Active Travel Tranche 2:
East Oxford LTNs Monitoring and Evaluation Full Report, October 2023

DOCUMENT HISTORY

Revisions – Amendments

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Executive Summary

1. This report provides an evaluation of the effects of the east Oxford low traffic neighbourhoods (LTNs) since their implementation on 20 May 2022. It supports the cabinet decision on whether to make the Traffic Regulation Order (TRO) permanent.

2. The following aspects are presented in this report:
    - Sensor-derived traffic volume changes by mode (car, pedestrian, cycle, LGV, HGV & motorcycle) for both within LTNs and along the boundary roads immediately surrounding them, using data from:
        - VivaCity sensors.
        - Automatic traffic count (ATC) surveys.
        - CCTV surveys.
        - Telraam sensors.
        - Automatic cycle counters (ACC).
    - Journey time analysis for the boundary roads and key feeder roads for vehicular traffic, including specific analysis for bus runtimes.
    - Air quality analysis from Oxford City Council in terms of Nitrogen Dioxide (NO2) both within the LTNs and on the boundary roads, including roads bordering the Cowley LTNs, to consider whether the east Oxford LTNs have had any influence on air quality on roads immediately surrounding the Cowley LTNs, given their proximity.
    - The impact on emergency services response times, based on South Central Ambulance Services (SCAS) modelled data using Optima Predict.
    - Safety data, based on collision statistics within and surrounding the LTN areas.

In-LTN Area

3. The report indicates that overall, vehicle traffic levels within the LTNs have decreased significantly, in line with the objective of the scheme. A notable exception within the LTNs is Jeune Street[1], a one-way road with no traffic filter, which has seen sizable percentage increases in vehicular traffic.

4. Cycling has seen mixed changes. Movements across St Mary's LTN between Iffley and Cowley Roads experienced large percentage increases, particularly on Magdalen Road. Movements through St Mary's LTN in- or out-bound from The Plain have decreased, suggesting that cyclists are not using the LTNs as a route to and from the city.

5. Pedestrian movement within the LTNs is also a mixed picture, with some streets showing decreases and others increases. The locations seeing increases are near potential trip attractors, which could be an explanation for this variation.

[1] Jeune Street has a no right turn restriction in place, precluding right turn onto St Clement's Street from this road. Anecdotally, neither this restriction nor the one-way restriction is being adhered to.

6. In general, the impact has not been consistent across all modes of transport, with some roads measured seeing greater increases or reductions respectively than others for each mode of transport.

7. In addition, motorcycle traffic has also generally increased within LTN roads. Since motorcycles are not physically precluded entry at LTN filter locations they can circumvent the restrictions.

Boundary Roads

8. In terms of the impact on the boundary roads immediately surrounding the LTNs, the picture is mixed. Some areas have experienced higher traffic levels post-implementation compared to immediately pre-implementation, whilst other areas have seen reductions in traffic. Overall, when volumes are aggregated across all sites measured, there is a small increase in traffic levels on the boundary roads (1.7% direct difference, moderated to 8.7% impact estimate when factoring for wider transport trends). Annual average daily traffic (AADT) in Oxford in 2023 is still some 16% below 2019 levels overall (see Annex L), but overall traffic levels across the city are quite similar between 2022 and 2023. This suggests some level of stabilisation of wider vehicular travel patterns to a lower traffic level in Oxford post COVID-19. Traffic levels in 2021 were still notably lower than they were in 2022 and 2023 however, indicating that an increase between 2021 and 2022/2023 is partially caused by an overall increase in traffic levels within the city. This supports the need for an impact estimate calculation to indicate the impact of the LTNs on traffic levels, rather than relying on the direct difference when 2021 levels are used within the baseline.

9. Morrell Avenue has seen a modest increase in traffic, whilst along the Cowley and Iffley Roads the impact on traffic volumes has been different at either end of each road. In both instances, prior to the introduction of the LTNs (during the period between November 2021 and May 2022) the sensors further away from the city centre recorded significantly higher traffic volumes than those closer to the city. After the introduction of the LTNs on 20 May 2022 the gap in volume has closed (completely in the case of Cowley Road and significantly for Iffley Road), due to large increases in traffic near The Plain roundabout, and sizeable decreases in traffic at locations further from the city centre. A possible explanation may be that people are re-routing and/or choosing alternative transport to gain access to the city from the direction of the ring-road. Once a driver reaches the areas covered by the sensors though (bounded by LTNs on both sides for Cowley Road, and on one side for Iffley Road), they have little alternative than to drive straight down the road. As a result, what would have been dispersed previously is all contained to the radial routes. The in-LTN analysis supports this theory, since the largest increase in volume is on the Cowley Road at The Plain. Previously, Divinity Road experienced high volumes of through-traffic between the Cowley Road and Warneford Lane roundabout.

10. Unlike the other key boundary roads on the approach to The Plain roundabout, at St Clement's Street where proxy data was available for in-bound traffic, the number of cars reduced. However, journey time analysis and bus 'runtime'

analysis indicated that the most significant delays experienced amongst any location in the vicinity are along this stretch of road, concentrated in the PM-peak (when many people leave work) and afternoon-peak (when many schools have pick-up) periods. Initially this seems counter-intuitive, but when considered in the context of The Plain roundabout, with its relatively low capacity but with huge amounts of activity (including large numbers of cyclists and pedestrians) and the increased volumes entering the roundabout from Cowley and Iffley roads, the likelihood is that the delays are being caused by difficulty entering the roundabout from St Clement's Street (i.e. there are insufficient gaps in traffic to enable vehicles to enter). The journey time and bus runtime delays are significantly greater in the in-bound direction. Whilst aggregated journey time reliability, in terms of the journey time delay compared to free-flowing traffic, decreased (worsened) by 71% towards The Plain, aggregated out-bound journey times experienced a small, 10%, improvement in reliability overall, measured by Planning Time Index[2]. However, St Clement's Street and some other locations still experience additional delays in journey times in the out-bound direction in some instances.

11. Where journey times have improved, it tends to be in locations away from The Plain, and in the mid-section of the route. Of all boundary roads, Iffley Road seems to have experienced the most journey time improvements along the section between Donnington Bridge Road and Church Cowley Road. However, in the in-bound direction, when journey times are aggregated along this road, there is still an overall delay, which is particularly marked in the AM-peak period, applying both to vehicular journey times and bus runtimes.

12. Bus runtimes tend to follow the same pattern as overall journey times, but with some differences. For example, in the out-bound direction, several stops along the Cowley Road, in the section between Howard Street and Between Towns Road, experience significant delays in the Afternoon-peak period not mirrored in the *Journey times (driving)* analysis. Otherwise, the pattern is very similar, with greatest bus runtime delays in the in-bound direction along St Clement's Street.

13. Generally, there has been a reduction in walking along boundary roads, with only one location (Iffley Road, near Donnington Bridge Road) experiencing increases after moderation to adjust for increasing walking at control sites. However, there is a generally positive picture with respect to cycling, with all boundary roads showing increases in uptake, in some cases significant percentage increases. Morrell Avenue shows the largest percentage (51% difference, moderated to 49% impact when increases in cycling at control sites are factored in) increase in cycling levels of the boundary roads.

[2] Planning Time index (PTI), which is typically used as a measure of reliability, represents the extra delay time that should be added to average travel time. PTI is the ratio of the 95th percentile to the free-flow travel time and shows the total time which is needed for on-time arrival in 95 percent of all trips.

Air Quality

14. The air quality analysis generally matches the traffic evaluation, with variable levels of improvement in air quality within the east Oxford LTNs alongside an increase in pollutant levels along the boundary roads immediately surrounding them. Only one location, on St Clement's Street, at The Plain roundabout, has exceeded the legal limit, having exceeded this limit in 2019, in excess of those readings for 2022. A further two locations in the immediate vicinity of the LTNs are at or above the local target for Nitrogen Dioxide (NO2) levels: St Clement's Street near the junction with Alma Lane, and Hollow Way Road. All locations showed lower NO2 levels in 2022 than in 2019, where data was available for comparison.

Emergency Services

15. The effect of the east Oxford LTN traffic restrictions on emergency services has been considered using response time delay modelling (simulation) from South Central Ambulance Service (SCAS), using their Optima Predict platform. This platform provides a simulation of impacts, not actual delays, and models response time delays from the east Oxford LTNs traffic restrictions compared to a baseline without them. The initial modelling assumed ambulances would re-route to avoid all east Oxford and Cowley LTN closure points. Subsequent modelling was undertaken to assess the mitigatory impact of replacing bollards in six locations within the two LTN areas with automatic numberplate recognition cameras (ANPR). Delay times were modelled against different response categories (categorised by level of urgency).

16. Initial modelling (without ANPR) indicated delays of 45 seconds within the east Oxford LTN area for the most urgent category 1 (life threatening) calls; this was mitigated down to a 7 second delay for this area and category when ANPR was introduced in the model. At the Oxfordshire-wide level, a 4 second delay without ANPR becomes a 1 second delay with ANPR in category 1. This simulated 1 second delay could be mitigated by the ambulance service providing one additional dual crew ambulance hour per day, at an annual cost of £40,000, based on modelling this controlled scenario and conditions. Hypothetical modelling was also undertaken to assess the impact of congestion on the response times, as the model does not otherwise account for any additional general traffic delays. When the surrounding roads had speeds reduced to 70% of historic speeds (based on data from 2019), the delay came back to a 5 second delay for category 1 across the Oxfordshire area. In reality, the journey times and speed impacts vary considerably depending on routes and times of day, with some locations and times experiencing improvements, so this 5 second delay is unlikely to be the reality of the situation.

Road Safety

17. Road safety analysis has been undertaken to assess changes in collision statistics. This shows little change between the baseline period and post-implementation. However, due to the low numbers of incidents, safety analysis is usually taken over a five-year period, to avoid skewing of the evaluation. For example, over five years there may be one fatal incident; should this fatal collision happen to fall in the single 'after' year but there be no further collisions beyond the first year of implementation, it would skew the results of the analysis compared to the five-year baseline averaging a single fatal collision over five years down to being 0.2 collisions per year. This analysis is therefore not statistically significant and only indicative.

Overall Findings

18. Overall, looking at the most significant findings, the effects of the east Oxford LTNs are mixed. There are some positive impacts such as reduced car use within the LTNs and on some sections of the boundary roads, with associated air quality improvements within the LTNs, plus increased cycling on the boundary routes. When aggregating the data between the boundary roads and LTNs, where data sources are compatible, there is a clear overall increase in cycling of over 20% and an overall reduction in car movements of more than 10%. However, there are also negative impacts such as bus journey time delays. Evaluation suggests that the negative results seem to stem from the funnelling of traffic along the Iffley and Cowley Roads and onto The Plain roundabout. This, in turn, puts additional pressure on The Plain, historically a congested area, which acts as a bottleneck adding to congestion on the approaches, particularly on St Clement's Street. Air pollution levels at The Plain are also worsened accordingly, in an area already problematic for air quality. As a result of the increased congestion, journey times increase in the direction towards the city centre (by up to 290%), reducing reliability and creating delays for bus services. However, analysis of March 2023 data shows an improving trend in bus runtimes on routes leading into St Clement's Street towards The Plain.

Conclusions

19. Should the LTNs remain in place to maintain the beneficial outcomes, the recommendation from this report would be that the challenges also outlined require mitigation. Over time, modal shift away from widespread, default reliance on motor vehicles, potentially through the implementation of the trial traffic filters scheme and other strategic plans such as extension of the Zero Emissions Zone (ZEZ) and introduction of a workplace parking levy, may lead to wider improvements. However, a short-term and joined-up solution should be investigated to mitigate the impact on bus services using St Clement's Street in particular. An acceleration of proposals already in place to tackle bus journey time delays in the area through the Bus Services Improvement Partnership (BSIP), could go some way towards achieving this mitigation, building on works already implemented in London Place and St Clement's Street. It should be noted that the bus journey time data analysis periods pre-date these works (the installation of an in-bound bus lane on Headington Hill, London Place and St

Clement's Street), and further monitoring should be undertaken to assess their efficacy in improving runtimes for buses. In addition, the use of ANPR for traffic restriction enforcement in place of hard closures at three locations in the east Oxford LTNs and three additional locations in the Cowley LTNs serves to mitigate the emergency service delays to a large degree and would therefore be recommended. This could also be beneficial for other groups of road users such as taxis. However, this does not overcome the key problem identified above in relation to The Plain roundabout: to address which ideally requires the volume of traffic entering The Plain to be reduced.

20. Additionally, further behavioural research should be undertaken to understand the reasons for the variation of active travel increase between different locations. The connection with trip attractors might indicate that further measures may be needed to achieve the policy objectives. Further research would also be beneficial looking into other impacts of the LTNs, including a fuller review of health and safety impacts once sufficient time has elapsed to allow these elements to be evaluated, plus consideration of wider social impacts.

21. In summary, against the three key objectives of LTNs: to reduce traffic in the LTNs, increase uptake of active travel and improve air quality in the area, evidence collected suggests that the east Oxford LTNs have:
    - Reduced car use within the LTNs themselves and facilitated an overall reduction in car traffic in the area of over 10% (based on aggregating data across compatible sensor types), but with the negative effect of increasing traffic in some locations elsewhere.
    - Increased uptake of cycling outside the LTN areas and across the LTN areas (e.g. between Iffley and Cowley Roads) but not through them (in the direction to or from The Plain roundabout), with an overall cycling increase of over 20% (based on aggregating data across compatible sensors); walking indicates little to no change overall.
    - Improved air quality within LTN streets, but with the negative effect of worsening air quality in the surrounding locations (although improved air quality from 2019 data).

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Introduction

22. To provide assurance, capture learnings and guide future decision making, Oxfordshire County Council set out an extensive evaluation framework of active travel interventions. This work was led by the Innovation Hub's (iHUB) Future of Mobility and Placemaking team, and was conducted in collaboration with leading universities, businesses, Oxford City Council and other county council teams. It has been reviewed by Oxford Brookes University, School of the Built Environment.

23. This evaluation framework was originally established for the Department for Transport (DfT) -funded Tranche 2 Emergency Active Travel Fund intervention. Due to the period during which the interventions took place, and the COVID-19 pandemic and cost of living crisis affecting the periods of interest, there are significant variations and complications in the data analysis, however. This report uses the metrics suggested in the original submission, along with ones raised in interactions with local stakeholders to address these challenges. One metric which was originally planned was a survey to assess changing perceptions about the LTNs over time. Unfortunately, it was not possible to undertake this dedicated user perception survey due to overlapping timeline requirements with the Experimental Traffic Regulations Order (ETRO) survey. A full analysis of the ETRO survey and subsequent TRO survey associated with this scheme have been undertaken separately and are appended to the cabinet report. These reports should be read in conjunction with this evaluation report, for a fuller picture of scheme implications and effects.

24. The methodology for east Oxford low traffic neighbourhoods (LTNs) was written up and published on Oxfordshire County Council's website[3], to provide transparency to the public on the way in which their evaluation would be undertaken. This methodology has been adapted, by removing Triple Difference (DiDiD)[4] in this final report, following advice received from academic and industry peer review, in order to simplify the evaluation approach and provide greater consistency across the analyses. Journey time analysis has been undertaken using a different dataset (Google API) from that referred to in the methodology (INRIX) to capture a greater and more representative proportion of vehicles within the dataset. Since publishing the methodology, a new data source (CitySwift) also became available for bus journey times, which has been applied in this report instead of the original source (Bus Open Data Service, BODS). Additional metrics have also been included in this report, which were not defined in the methodology statement.

25. The report covers a number of areas to assess a range of effects from the east Oxford LTNs, covering those both internal and external to the LTNs. An initial 'snapshot' evaluation of the east Oxford LTNs was undertaken and published in

[3] East Oxford low traffic neighbourhoods – air quality, traffic sensors and data analysis | Oxfordshire County Council

[4] DiDiD as used previously in the snapshot report, compares control and intervention sites to look at the difference in the differences between the immediate pre-intervention period and post-intervention period, as well as comparing the pre- and post- traffic volume data for both control and intervention sites against 2019 baseline volumes.

June 2023[5]. This report builds on the analysis and commentary undertaken in the snapshot, both in terms of encompassing additional data and granularity of analysis within the topics covered, and in providing additional metrics. During analysis for this report, some errors in data processing were identified in the Snapshot report relating to counts on Divinity Road, Morrell Avenue and Iffley Road north. These have all been corrected in this full report and where significant, flagged with footnotes.

26. It is worth noting that the period covered for this evaluation, which is approximately a year post implementation (due to time limitations associated with ETROs), is not sufficient to measure some of the aspects which may be impacted by the scheme. Notably this includes the influences on public health and on safety. Both are touched on in this report to provide some indicative information on the likely effects, but to fully understand how the LTNs have affected health and road safety, a minimum of a three- to five- year post implementation evaluation timeline would be necessary. Equally, behaviour change can take some time to take effect especially when habitual behaviours have been formed over many years.

27. The following sections outline background information, each analysis topic in turn, and conclusions.

[5] Active Travel Tranche 2: East Oxford LTN Evaluation Snapshot Report

Background

Benchmarking

28. Low Traffic Neighbourhoods (LTNs) have been implemented in the UK since 2018 but have been in existence for decades under other names. They aim to reduce traffic, increase uptake of active travel modes and improve air quality in residential areas. The evidence on the success or failure of LTNs is mixed, both in terms of outcomes and in the way the evidence has been gathered, analysed and reported.

29. Some studies have shown that LTNs can be effective in reducing traffic. For example, a 2023 study by Thomas and Aldred[i] found that LTNs in London reduced motor traffic levels by an average of 32.7% within their boundaries. Another study, by the Centre for London[ii], found that cycling increased by 31-172% and car traffic decreased by 22-76% in 10 LTNs in London. LTNs can also improve air quality. A study by King's College London[iii] found that LTNs in London led to a reduction in nitrogen dioxide (NO2) levels of up to 10%. LTNs can make residential areas more attractive and safer for walking and cycling. A study by the University of Westminster[iv] found that LTNs in London led to an increase in the number of people walking and cycling in the areas affected.

30. Whilst LTNs have been shown to have some successes in terms of meeting their objectives within the LTN areas themselves, some studies however have found that LTNs can lead to increased traffic on surrounding roads. For example, a 2022 study by The Times[v] found that traffic increased by up to 35% on some boundary roads in LTNs in London, though the degree of traffic increase varies significantly between areas depending on the context, so direct comparisons can't be made between disparate areas with different characteristics. In the evaluation undertaken for the Cowley LTNs in Oxford[vi], the overall traffic increase on the boundary roads was only 2.3% after COVID-19 adjustment and seemed to be decreasing over time. In addition, another study, by the RAC[vii], found that crime rates increased in some areas after LTNs were introduced, though a study into Waltham Forest LTNs[viii] showed a 10% decrease in total street crime following LTN introduction. LTNs have also proved to be a divisive topic, and whilst there are strong supporters of them, they also have a strong contingent of detractors. For example, a survey by the Local Government Association[ix] found that 40% of residents in areas with LTNs were opposed to them. A YouGov poll[x] in November 2022 found that 29% of people in Oxford were opposed compared to 56% in support.

31. When looking at the results of studies in a bit more detail, there are also significant variations between areas in the level of success and/or failure of the different schemes. This suggests that local factors and the implementation approach itself are of high importance in determining whether or not a given scheme is on balance positive or negative and to what degree. Table 1 below indicates this variation in the results.

Table 1 - Changes in traffic and cycling within LTNs

City	LTNs Implemented	Reduction in Traffic	Increase in Cycling	Period
London	100+	-32.7%	31-172%	2018 - 2023
Paris[xi]	50	-15%	20%	2020 - 2023
New York City[xii]	20	-10%	15%	2020 - 2023
San Francisco[xiii]	10	-20%	30%	2020 - 2023
Amsterdam[xiv]	100	-40%	50%	2020 - 2023
Copenhagen[xv]	50	-50%	75%	2020 - 2023
Oslo[xvi]	20	-60%	80%	2020 - 2023

32. As noted above, one of the reasons for the variation in results is likely due to the different ways in which LTNs are implemented. Some cities have implemented LTNs more comprehensively than others, with more physical barriers and traffic calming measures. Arguably, these cities are more likely to see larger reductions in traffic. Another reason for the variation in results is likely due to the different characteristics of the cities themselves. For example, cities have varying levels of traffic to start with, some cities have better public transportation systems than others or better infrastructure for active modes of travel, and social norms also vary between locations meaning what is more acceptable in one location may be less so in another. The very layout of the city itself may also impact on the effectiveness and level of impact, depending on how easy or difficult it is for vehicles to re-route around an LTN area, for example. These factors can also influence the effectiveness of LTNs.

33. Another aspect to consider is that variable results are also at least partially down to the differences in how the data has been collected and analysed, and some of the studies undertaken are considerably more robust in nature than others. The majority of studies undertaken have simply looked at straight change between pre- and post-implementation. This does not account for changes caused by underlying trends and wider disruption such as the pandemic and cost of living crisis. To address this challenge though, some studies have considered control sites. A variety of analytical techniques have then been applied to understand the impact of the LTNs, depending on data availability (e.g., ongoing or short, defined periods) and type (e.g., traffic volume or questionnaire etc). The implementation and baseline periods covered by the studies also varies. Some studies only looked at the short-term impact of LTNs, while others looked at the long-term impact. It is important to consider the length of the implementation and baseline periods when interpreting the results of the studies, as results usually change over time.

34. Overall, therefore, the results of LTNs implemented and evaluated around the world vary. There is generally an indication that traffic reduces within the LTN area and that cycling increases. At the same time, however, there is sufficient evidence that some locations have also experienced negative impacts such as displaced traffic. Further study is needed to be able to better compare the results

between locations and understand in more detail the different factors contributing to the level and kind of result.

Local Information

35. To help understand some of the wider likely impacts of the east Oxford LTNs, a range of geographic and economic background information has been reviewed. This covers mapping of key land-based information, as depicted in figure 3 below, such as retail and commercial locations, coloured in orange/salmon pink, and places of education. Areas of deprivation are also shown in figure 4 below, and the LTN areas are shown to encompass a range of deprivation levels, but neither of the extremes. In addition, two timelines are provided for context, the first of which (figure 1) shows key events in the lead up to and following implementation of the east Oxford LTNs. The second (figure 2) shows the baseline and post implementation data gathering undertaken for the analyses.

Figure 1 - Timeline of key events related to LTN interventions.

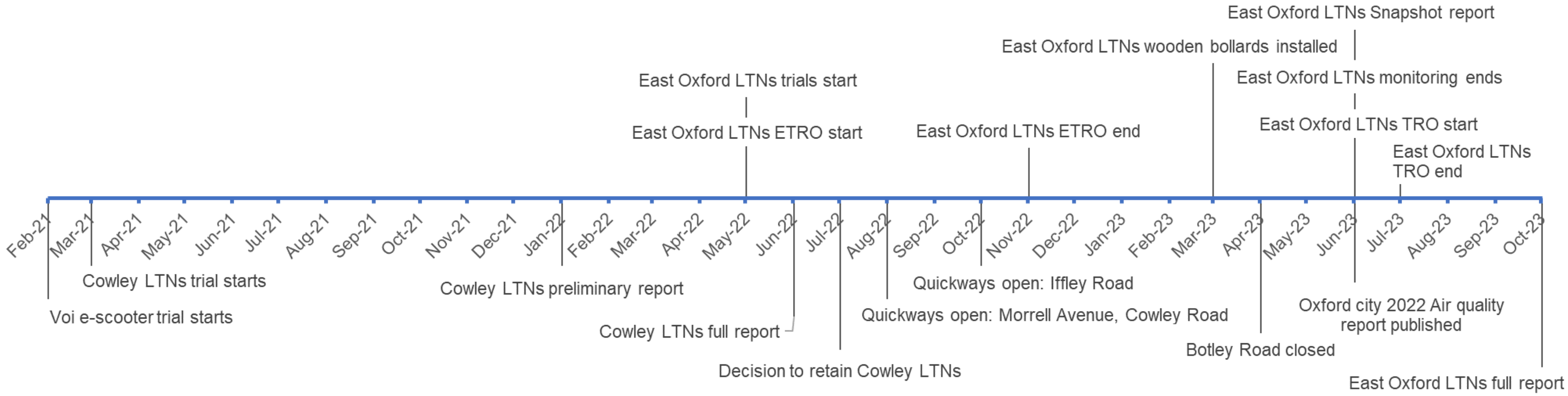
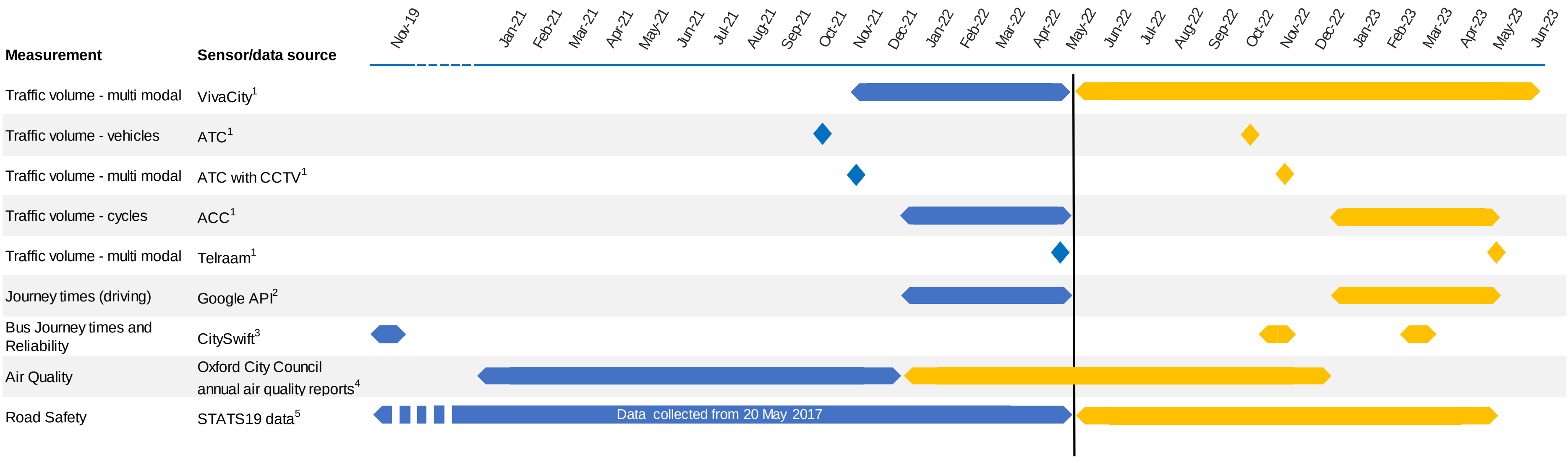


Figure 2 - Timeline of key data gathering undertaken for the analyses.



East Oxford LTNs trial commences 20 May 2022

Notes

1 - see *Methodology/Analysis* section for detail of dates and *Annex C* for sensor type descriptions

2 - see *Journey times (driving)/Analysis approach* section for detail of dates

3 - see *Bus Journey Time and Reliability/Analysis approach* section for detail of dates

4 - see *Air Quality/Analysis* section for detail of dates

5 - see *Road Safety/Analysis* section for detail of dates

Key

Baseline data gathering

Post implementation data gathering

36. The intervention itself was funded through the Department for Transport's Active Travel Tranche 2 programme. It encompassed the installation of bollards (traffic filters) in key locations which preclude the LTNs from being used to drive between one radial route and the next. Alongside the LTNs, Quickways have also been installed along the boundary roads, which provide improved cycling infrastructure, through the same tranche of funding.

Figure 3 - Map depicting areas of commercial activity and educational institutions in and around east Oxford LTNs

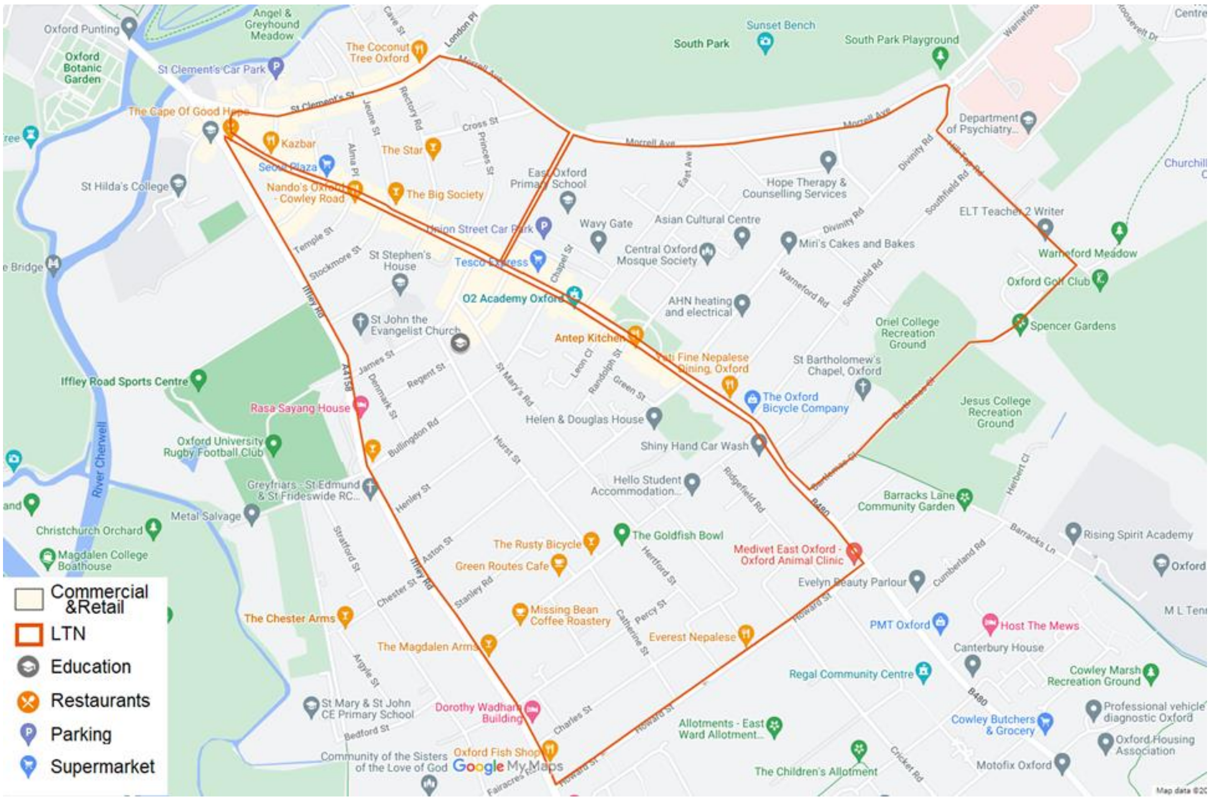
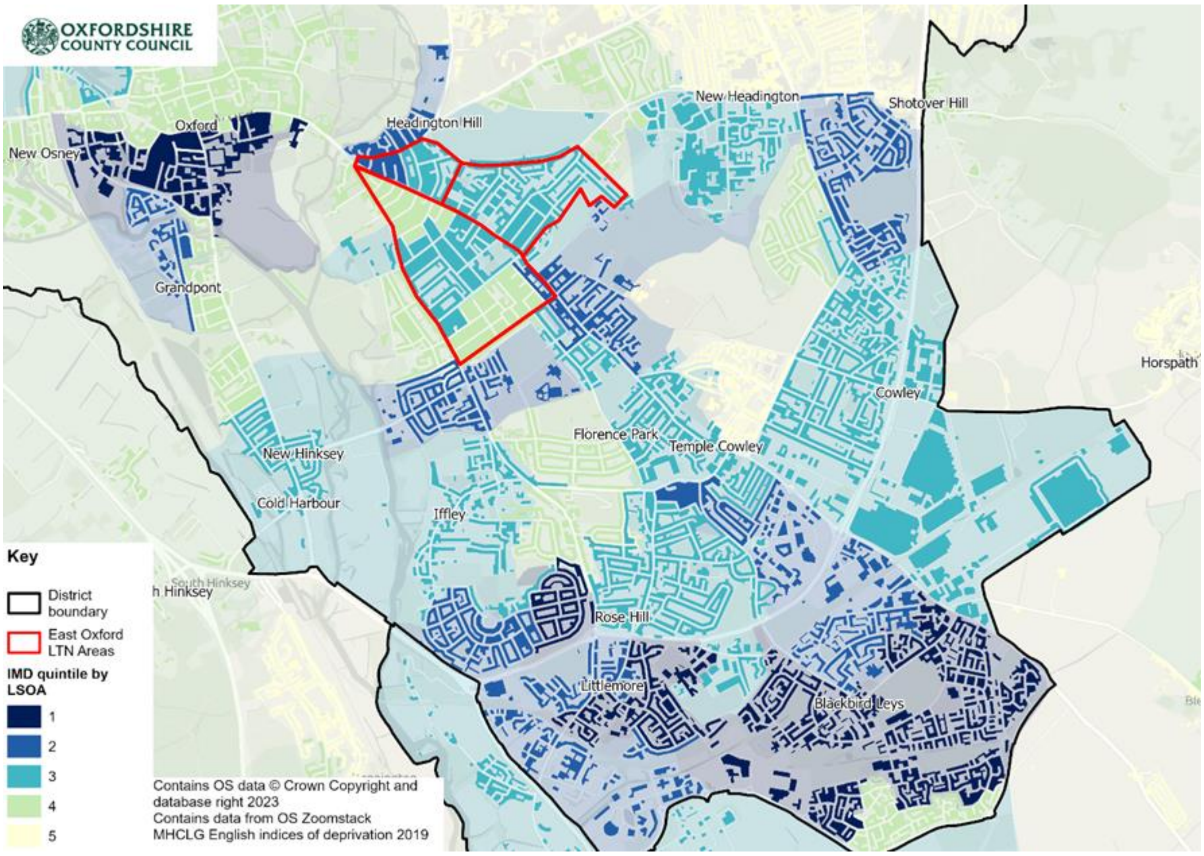


Figure 4 - Map depicting areas of deprivation in and around east Oxford LTNs. The 2019 English indices of deprivation rank each of England's 32,844 Lower-layer Super Output Areas (LSOA) by deprivation with the overall deprivation the Index of Multiple Deprivation (IMD). This map is coloured by which quintile (20% band) each area falls into with 1 being the most deprived 20% and 5 the least deprived 20% nationally[6].



37. In addition, information on the population of the area has been gathered to assess demographic makeup and health. Whilst it is not possible, as noted previously, to fully understand the impacts of the LTNs on health, an understanding of the local population can provide some insight into the likely implications of the changes for this population. Census data from 2021 was reviewed, alongside public health, hospital and life expectancy data from the Office for Health Improvement and Disparities and benefit claimant data from Department of Work and Pensions. More information can be found in Annex A - *East Oxford LTN area – Public Health data*.

38. The review of population data for the east Oxford LTN area[xvii] shows:

- The area has c.12,000 residents living in c.4,300 households (March 2021).
- Compared with Oxford city, the area has double the proportion of residents aged 20-24 years. There are lower than average numbers aged 0-19 years and aged >45 years.
- Residents were more likely than Oxford city to be from a White ethnic background.

[6] https://insight.oxfordshire.gov.uk/cms/deprivation-dashboard

- Households were significantly more likely to be private rented accommodation (52% compared with 32% for Oxford) and to have four or more people living in the household.
- Residents were more likely to have higher level qualifications (degree and above) and were more likely to be in professional occupations than the Oxford average. The proportion in elementary occupations[7] was also slightly higher than the Oxford average.
- Households in the area had lower car ownership levels than the average for Oxford and those in employment were more likely to work mainly from home. (Note that the Census 2021 survey was carried out in March 2021 when lockdown restrictions were in place). Comparing 2011 and 2021 Census findings for the east Central Oxford MSOA shows the proportion of households with at least one car declined slightly in the area, while in Oxford the percentage of households with car(s) increased slightly.
- Residents had a higher level of active travel use, either walking or cycling, when commuting to work than the Oxford average (by 7%) and a much lower level of driving to work (14% versus 23%).
- Residents of the area were more likely than average to be in very good health and to be "not disabled". This comparison is likely to be affected by the younger age profile of the local population.
- Rates of older people in poverty were above average, but all other categories of low income or claiming health-related benefits were below Oxford's average.

39. The review of Health data for the east Oxford LTN area[xviii] shows:

- Life expectancy data for 2016-20 for the area shows males in the area with a significantly lower life expectancy than the average for England (76.3 compared with 79.5 years). Life expectancy for females was better than average for England (85.5 compared with 83.2 years).
- Hospital admissions for alcohol attributable conditions for the area were significantly worse than the England average.
- Deaths from respiratory disease and hospital admissions for Chronic Obstructive Pulmonary Disease (COPD) were both similar to the national and Oxford average.
- Deaths from stroke, coronary heart disease and circulatory disease were all higher than the England average.
- Over a third of children in year 6 (aged 10-11 years) living in the area were measured as overweight/obese, which is slightly more than the Oxford average though below the England average.[8]

[7] Elementary occupations consist largely of simple and routine tasks which mainly require the use of hand-held tools and often some physical effort. Most occupations in this major group require skills at the first ISCO skill level (a primary education which generally begins at the age of 5, 6 or 7 and lasts about 5 years)

[8] Further information can be found at: https://insight.oxfordshire.gov.uk/cms/joint-strategic-needs-assessment

40. The following analyses refer back to relevant aspects within this local information, which is intended to provide some context around how the impacts may interact with and/or be influenced by pre-existing conditions in the area.

Traffic Volume Analysis

Methodology

41. A number of different data gathering approaches and metrics have been used to calculate the effects of the east Oxford LTN traffic filters on traffic volumes across different modes of transport. The methodology for the different approaches to traffic volume analysis are set out in the following sections, covering the approaches and the statistical analyses applied. For more information on the statistical approaches, see Annex B. For more information on the data gathering approaches, see Annex C.

Average Traffic Counts

42. The average daily count is calculated differently for different methods of data gathering. This is dependent on whether the method provides short-term data with an equivalent baseline period (e.g., November 2021 baseline compared to November 2022 post intervention), or longer-term data with a baseline period which is not equivalent to the intervention period (e.g., 20 November 2021 to 19 May 2022 baseline compared to 20 May 2022 to 19 June 2023 intervention).

43. For the short-term data, the effects of seasonality on the data are minimised by the before and after periods being at similar dates pre- and post- intervention. However, there is likely significant variation by day of the week, for example with commercial vehicles, commuting, and the school run, which with small samples, may skew an overall mean. To reduce the potential distortion caused by full weeks not being evenly covered, a day-of-week daily average approach is taken in these short-term data instances. First, the mean daily count by each individual day of the week is calculated. Then, the mean of the already averaged seven days is calculated to determine the overall daily average.

44. For the longer-term data collection, the median is used instead of the mean, as the mean is more sensitive to outliers. The median represents the middle value (daily count) of the distribution, making it well suited to minimising the effects of outliers/anomalies in the data (skewed to extreme value counts). For instance, outliers could be created in the data where there were factors other than the LTN filters affecting daily traffic volume, such as: roadworks, local and national events, as well as unforeseen power outages on street architecture on which sensors are located.

45. In both instances, the average value is used to compare the baseline (pre-intervention) period against the post-intervention data, to assess the changes between periods.

Simple Difference

46. Using the calculated average for the data collected, the first metric of 'difference' is a simplified output to understand the effects of LTN filters on traffic volumes by

comparing average daily counts by transport mode before and after the LTN filters were installed.

47. This method provides a simplified difference in traffic volume between two time periods but does not account for the wider trends in traffic volume across Oxford, for example wider changes due to the impact of the cost-of-living crisis, or changes in working arrangements and travel patterns post COVID-19, or seasonal effects such as festive periods. A difference-in-differences (DiD) statistical technique was adopted to derive an impact estimate metric, to distinguish the impact on traffic volume attributed to the LTN filters from what is happening more generally across Oxford, where data was available and suitable (see Annex B).

Impact Estimate

48. The impact estimate metric uses a DiD statistical technique to estimate the causal effect of the LTN filters by comparing changes in outcomes between the intervention and affected areas against a control area before and after the east Oxford LTNs were implemented. The change in outcomes between the location associated with the east Oxford LTNs and a set of equivalent control roads were then compared. The key idea behind DiD is to compare the difference in outcomes between the LTN area and the control before and after the LTN implementation, over time. This approach helps account for general trends that might affect traffic flows, such as those noted above.

49. When interpreting the results of the impact estimate, it is also important to consider some of the assumptions and limitations inherent in the DiD statistical technique:
    - There is an assumption that where there are external forces affecting traffic flows (such as cost of fuel, change in daily work patterns that affect flows following COVID-19, weather, holidays etc.), these forces affect both the in-LTN area/boundary roads and the control area/control boundary roads equally.
    - The LTN traffic filters are the only area-specific aspect that changed over time in LTN area/boundary roads and there is not anything else influencing the outcome variable (daily average traffic volume) that did not similarly impact the control areas.
    - The LTN area/boundary roads and the control area/control boundary roads are similar except for the LTN filters.

50. In consideration of the above assumptions and limitations of the DiD, the method was refined where possible to mitigate the potential skewing effects on the results. Regarding selection bias, the roads chosen for control purposes were constrained by sensor availability and data completeness over time. However, the roads that were selected (see map in Annex C) were chosen based on the following criteria:
    - Data availability.
    - Comparability in terms of flow context (e.g., similar levels of traffic and road classification type).

- Reasonable distance from the LTNs (i.e., minimising the likely impact of the intervention on the control sites).
- Choice of locations within Oxford city to minimise differences in overall patterns of travel due to aspects such as the seasonal large student population and tourist movements.
- Avoidance of known long-term disruption on the control route during the periods of interest (e.g., major roadworks or road closures).

Analysis

51. The analysis that was applied to each sensor used to gather data for the LTNs traffic volume evaluation is outlined below. Annex C provides more detailed descriptions of each type of sensor used.

52. The data collected for the volume analysis of boundary roads undertaken in this report are from permanent VivaCity Sensors. The data for these sensors compares the before period of 20 Nov 2021 – 19 May 2022, to the after period of 20 May 2022 – 19 June 2023. Ideally, the pre- and post- intervention periods would match dates to avoid seasonal differences between the baseline and interventions period, but data was not available in all locations during the corresponding time period. Controls were available for this sensor type, and as such both difference and impact estimate metrics could be calculated, where volumes were sufficiently high (lower volumes may show skewed values when calculating an impact estimate and the metric has therefore been omitted in these instances). Given sufficient data, the metrics have been applied across all major modes of transport, covering pedestrian, cycling, car, motorcycle, light goods vehicle (LGV) and heavy goods vehicle (HGV). Where an impact estimate has been applied, seasonal differences between pre- and post- intervention period should largely be negated, since controls are likely to experience similar effects. The effect of seasonality will be apparent in the difference metric, however.

53. VivaCity sensors were chosen for their ability to capture data across multiple modes of transport, including active travel modes which other sensor types often cannot capture. Oxfordshire County Council has a network of 103 VivaCity sensors across the county, with a large proportion in Oxford, some though not all of which have been in place capturing data since 2019[9]. This provides valuable baseline and pre-COVID-19 data, as well as control site data for comparison. Other permanent sensors are unable to capture all modes of transport of interest within this evaluation. It is worth noting, however, that VivaCity sensors can only capture data under sufficient lighting conditions. As they are mounted on streetlights, they can capture data during night-time periods, but it may be less comprehensive, particularly in less well-lit locations.

54. Whilst coverage of the major roads surrounding the LTNs were well monitored by the VivaCity sensors, there were not sufficient numbers in place within the LTNs to provide a comprehensive picture of the effects, owing to constraints such as

[9] Notable locations used in this evaluation without (usable) 2019 baseline data include Morrell Avenue, Cowley Road north, Divinity Road and St Clement's Street

suitable street architecture necessary to facilitate and power the VivaCity sensors. To overcome this coverage issue, additional data sources were also used to gather data inside the LTNs.

55. ATC surveys were conducted twice consecutively, one year apart (October 2021 and October 2022). The locations were identified as those likely to provide a clear demonstration of the vehicular traffic impact within the LTNs. This included roads which may be impacted by the placement of the restrictions, as well as roads where LTN restrictions had been applied. The specific timing and duration of these surveys can be seen in Annex E.

56. In addition, there were two sites with corresponding control locations (Annex E) surveyed independently, which alongside ATC surveys, included CCTV pedestrian and cycle counts. The surveys in these locations were carried out as per the specific timings shown in Annex E, also twice consecutively, one year apart (November 2021 and November 2022).

57. All periods for both ATC and ATC plus CCTV surveys covered at least a full continuous week, although the exact days monitored were inconsistent, with setup and removal on different days of the week and issues with the ATC sensors, including obstruction and damage. As such, the day of the week mean was applied to these datasets.

58. As well as the VivaCity data, ATC and ATC plus CCTV surveys which were undertaken and results reported in the June snapshot evaluation report[10] data has been gathered and reviewed from two additional datasets, previously not reported. The first of these is a permanent Automatic Cycle Counter (ACC), which has been in place on Magdalen Road on the Cowley Road side of the junction with St Mary's Road since 12/08/2021. ACCs are designed to count only cycles crossing loops cut into the carriageway; however, they do pick up some other vehicle movements, and may not count all cycles made from carbon fibre or aluminium. In this particular location, the loop is cut across the whole of Magdalen Road, but only across the sides of the road on St Mary's Road. As there was no suitable control for this ACC location, to account for seasonal variation and other factors, the period from 01/01/2022 to 19/05/2022 has been set as the baseline and compared to 01/01/2023 to 19/05/2023. However, it must be acknowledged that there will be limitations of using this data in isolation given other influencing factors. As for the VivaCity analysis, median values are used to avoid outliers exerting significant influence on the averages.

59. The second additional dataset is from a Telraam sensor, which has been located on Hurst Street since 06/05/2022. Telraam sensors are mounted in the 1st floor window of a building and are available to citizens and businesses alike to purchase and install, with data collected being openly available on the internet. Data has been fully reviewed from this sensor and an assessment of another Telraam sensor co-located with a VivaCity sensor undertaken to validate the sensor type's accuracy. Whilst citizens have installed Telraam sensors in several relevant locations for the east Oxford LTNs, only the Hurst Street location was in

[10] Active Travel Tranche 2: East Oxford LTN Evaluation Snapshot Report

place prior to the installation of the LTNs. It is therefore the only such device in the area capable of providing any before and after measurement of the impact of the LTNs on the area.

60. Due to the timeline for the installation of the Telraam device on Hurst Street and the lack of a suitable control site, the analysis is being undertaken using the same methodology as used for the ATC survey analysis. The period of 06/05/22 to 19/05/22 is compared to 06/05/23 to 19/05/23, using day of the week mean to account for the different spread of days over the two periods. It is worth noting that Telraam devices do not have night vision functionality and so can only count when there is sufficient external lighting and therefore are only likely to be counting during daylight hours, particularly in more residential areas with lower lighting levels, not 24-hour periods.

61. It is worth noting that without the availability and use of historic data from pre-COVID-19 and/or the use of control sites, the simple difference between the counts over the two years derived from Telraam, ATC, CCTV and ACC datasets cannot be attributed to the LTNs alone. Traffic patterns were still in flux in 2021/2022, following the pandemic, when surveys and count periods were undertaken. Additionally, as shown in Annex L, overall traffic levels in Oxford were lower in 2021 than in 2022. The cost-of-living crisis will also have influenced travel choices during the interim period. In all cases therefore, a simple before and after comparison can only be indicative to a greater or lesser degree depending on the comparison being made in each case.

62. The analysis of volume data is presented in the following sections, split into '*Boundary Roads'* and '*In-LTN Roads*' for pedestrians, cyclists, cars, Light Goods Vehicles (LGVs), Heavy Goods Vehicles (HGVs) and motorbikes. For each mode, the average daily counts are reported per location for the pre- and post-intervention periods (labelled as 'before' and 'after'). The percentage difference between the pre- and post- intervention counts is also given (labelled as 'difference') together with the impact estimate where this has been possible to calculate. Where available, 2019 average data is also provided for reference; this is calculated as the median, as it is only available for the longer-term datasets. Additionally, where sufficient data is available, the percentage difference is shown for modal traffic during weekdays and weekend days only.

63. For ease of reading, data has been colour-coded within the summary tables provided in the analysis sections of this report. The key for this is included below in Table 2.

Table 2 - key for percentages

Decrease					%	Increase				
> -100	-100 to -76	-75 to -51	-50 to -26	-25 to -10	-9 to +9	10 to 25	26 to 50	51 to 75	76 to 100	> 100

64. Some additional car volumes on roads elsewhere in Oxford have also been analysed to understand the patterns of traffic flow dispersal around the city and

to test particular theories put forward in this evaluation. The data for these additional roads is included in Annex F.

Granularity

65. To assess whether there are any differences in the changes by modal volumes depending on time of day, further analysis has also been undertaken to split out the data into time periods, where hourly data is available within a given dataset, and direction of travel. Direction of travel is covered for all locations but is of greater import for the boundary road data, where volumes are higher and peak flows can vary by direction quite significantly affecting times when congestion is caused. The time periods considered cover:
    - AM-peak: 7am to 9am
    - Day: 9am to 3pm
    - PM-peak: 3pm to 7pm.

66. For this more granular analysis, the use of control sites is not suitable, as the amounts of data involved become smaller and differences between control sites and intervention areas become magnified at this level of granularity, meaning their use could skew the results. For example, peak periods are likely to differ slightly across disparate locations, depending on key trip attractors and distances from them.

67. As outlined previously (see paragraph 48 above), the use of control data allowed the impact estimate to be applied to datasets with different periods covered by baseline and post-intervention timelines, adjusting for differences between the time periods. Since impact estimates cannot therefore be applied in the granular time-period analysis, it has been necessary to undertake it on different periods than were used for the aggregated datasets of this kind – namely the VivaCity sensor data. Data has therefore been taken from 1 January 2022 to 19 May 2022 for the baseline period and compared to data from 1 January 2023 to 19 May 2023 for the post-intervention period for the VivaCity data both in-LTN and for boundary roads.

68. Due to the difference in periods analysed for the VivaCity data and the fact that not all time periods are covered (i.e., the granular data excludes the time period from 7pm to 7am), the granular total counts do not add up to the totals provided in the aggregated data. It has also only been possible to provide the granular analysis for modes of transport which experienced sufficient movement volumes; other modes/locations with lower counts have been excluded from the granular analysis. Some data was also not available hourly, and so it has not been possible to apply the granular analysis in these instances. In particular, three VivaCity count lines were required to have their data re-cast, due to their host sensor being misaligned, and the data available subsequently did not go down to the hourly level.

69. Points of interest from the granular analysis are noted within the commentaries on the relevant aggregated data analysis. The focus is on locations and modes of transport which show larger, more significant differences, since even when

only applying this analysis to modes with higher volumes, some time periods and directions of travel have very small numbers. Where only small absolute numbers of movements occurred, a small change such as from 1 to 2, creates a misleadingly large percentage change (100% increase). The full granular data summary is provided in Annex D and Annex E.

Confounding Factors

70. In analysing the impact of the LTNs, it is worth noting a few confounding factors which will affect the data gathered. These include:
    - Significant levels of vandalism and subsequent non-compliance with LTN restrictions, particularly in the period when plastic bollards were in place, up until wooden bollards being installed week commencing 13 March 2023, causing areas which should be closed to through-traffic to be treated by some motor vehicles as effectively ‘open’ for some periods of time. Whilst levels of vandalism have dropped since new bollards have been installed, isolated acts of vandalism and theft are still occurring. There is also reportedly increased non-compliance with other traffic orders which pre-dated the LTNs, such as one-way streets and banned turns.
    - The Quickways (see Annex G) cycling routes were implemented during the evaluation period, meaning that roadworks and/or changes in infrastructure not directly related to the LTN occurred at the same time as the LTNs. Both roadworks and changes in the infrastructure available at any one time are likely to have had an impact on route choice as well as modal uptake along these routes.
    - The lack of availability of a full year of representative baseline data prior to the implementation of the LTNs owing to instability of travel patterns after COVID-19.
    - The closure of the Botley Road to vehicular traffic from 11 April 2023 will have influenced travel patterns in Oxford post this period, and some datasets include analysis covering this period.

71. Some additional, more specific, confounding factors have also been raised in the relevant sections of the report below.

72. The periods of vandalism or damage causing bollard outages has been compiled and can be found in Annex H and summarised in table 3 below.

Table 3 - Sum of bollard outage days by road

Street Name	Total approximate number of outage days per site
Divinity Road	79
Bullingdon Road	71
Leopold Street	69
Essex Street	56
Marston Street	52
Howard Street	44
Rectory Road	44
Princes Street	39
Magdalen Road	38
Southfield Road	38
Barnet Street	28
James Street	18
Temple Street	14
Stockmore Street	5

73. The data on outage periods has been compared against car trends along relevant boundary roads during these periods to assess whether they have had a significant impact on volumes of vehicles. Where ongoing data is available, the impact does not seem to be significant in overall traffic volume terms, though there is some evidence to suggest that where outages were highest on Divinity Road, traffic levels may have been more significantly influenced by permeability than the boundary routes. It has also been compared against the data collection periods for the short-term sources, to identify where an outage may have influenced the results of these datasets. Whilst there are some dates which coincide, in no cases was a bollard out on the same street as where short-term data was being collected. Where bollard outages coincided with data collection periods, this has been noted in the text discussing the results. The results of these comparisons are included in the relevant section of this report and in Annex H.

74. As a key intervention which went in place during the evaluation period, the timelines for installation of Quickways has also been reviewed to assess whether changes in travel patterns can be correlated with the timelines involved on the routes affected. There is some evidence to suggest (see *Boundary Roads - Cycles* section) that Quickways have had an influence on cycling levels separate from the LTNs. The timelines and locations where Quickways have been installed are included in Annex G.

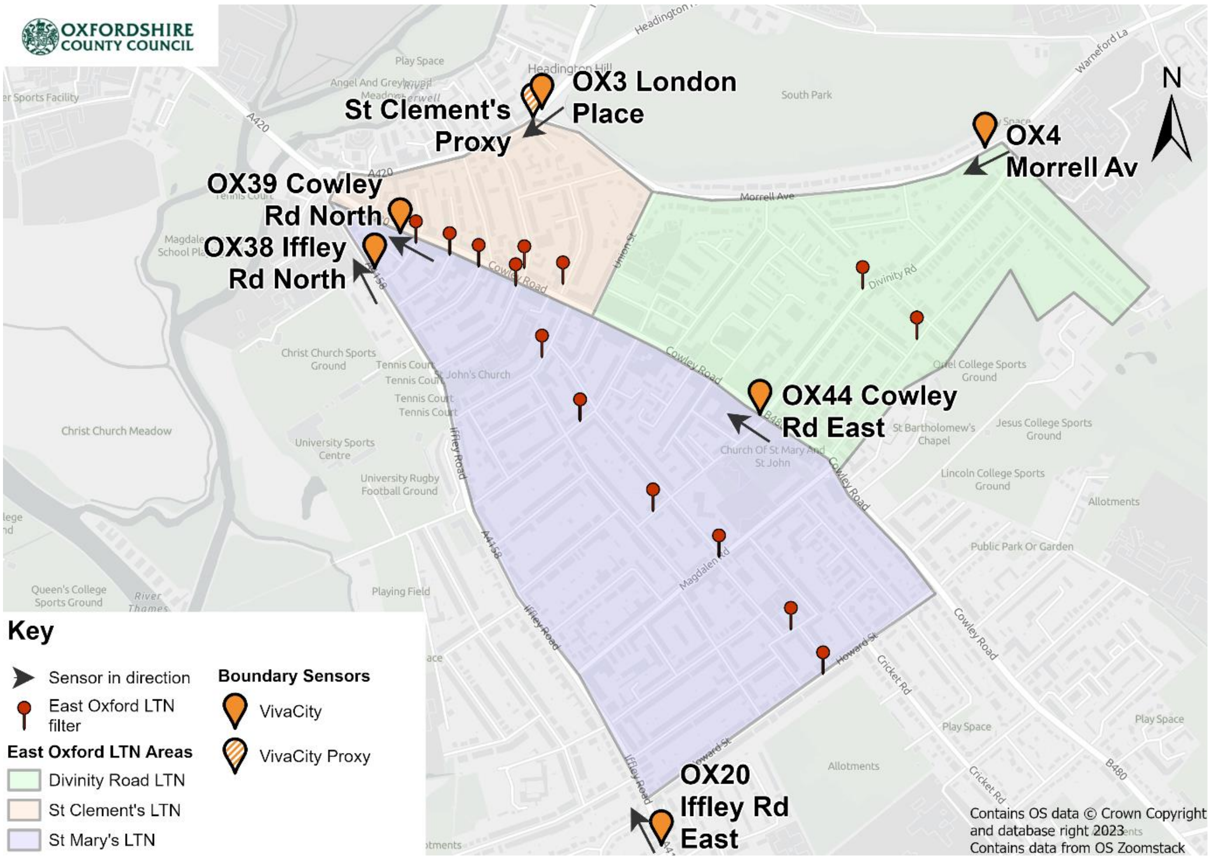
75. This evaluation uses techniques which are outlined in the methodology above and detailed further in Annex B with the aim of accounting for the instability in patterns of travel and the closure of the Botley Road where possible. Where this has not been possible, this has been caveated in the relevant section of the report.

Boundary Roads

Sensor Locations

76. The sensors, located on the boundary roads can be seen on figure 5 below and are listed below:
    - OX38 Iffley Road north
    - OX20 Iffley Road east
    - OX39 Cowley Road north
    - OX44 Cowley Road east[11]
    - OX4 Morrell Avenue
    - OX4 London Place.[12]

Figure 5 - Location of boundary road sensors and filters in east Oxford LTNs



77. Control road sensors, used to calculate the impact estimate and adjusted impact estimate for boundary roads can be seen in Annex C and are listed below:
    - OX11 Bayswater Road east
    - OX15 Headley Way south

[11] The data for this location was re-cast due to a sensor misalignment for part of the analysis period, meaning that it needed to be re-calibrated and run again. Data for this location and the two in-LTN locations were affected by this. Granular, hourly data, is not available for these sites, due to data processing restrictions.
[12] The London Place sensor has been used to create a proxy for St Clement's Street – see paragraph 78 for further explanation.

- OX31 Marston Ferry Road.
- OX49 Woodstock Road north.[13]

78. It has not been possible to use data from the sensor in St Clement's Street as part of the boundary road analysis due to consistency issues following the incorrect relocation of the sensor as part of roadworks during the monitoring period. As this is a significant location to assess the effects of the interventions on boundary roads, data from a traffic turning survey, performed on 4 May 2023 has been used to calculate the average weekday turning counts from London Place and Morrell Avenue into St Clement's Street and so to estimate traffic through St Clement's area. Due to the availability of data at the London Place sensor, this calculation can only be made for the in-bound direction (that is, towards The Plain roundabout), as shown on figure 5. The turning counts survey shows that the average daily turning counts from London Place to St. Clement's Street is 90% and from Morrell Avenue to St Clement's Street, 78%. This approximation works reasonably well for cars; there was a +/- 10% difference between the estimated and recorded counts for those times the St Clement's Street sensor was properly installed and reading correctly. However, this is not the case for other modes. This may be because these counts are much lower and taking average turning counts for a single day does not give good estimate of average turning counts. Therefore, only results for cars are reported.

Pedestrians

Table 4 - Pedestrian VivaCity analysis for boundary roads, In and Out direction, Weekday and Weekend

	Pedestrian, In + Out						
	Weekday + Weekend					**Weekday**	**Weekend**
Road	**2019**	**before**	**after**	**diff.**	**impact[14]**	**diff.**	**diff.**
Iffley Road north	1,689	2,588	2,570	-0.7%	-14.6%	-3.4%	+3.9%
Iffley Road east	424	477	567	+18.9%	+5.0%	+16.9%	+30.2%
Cowley Road north	4,589	5,999	5,699	-5.0%	-18.9%	-5.4%	-4.7%
Cowley Road east	*	6,606	6,490	-1.8%	-15.6%	-2.0%	+1.4%
Morrell Avenue	**	1,098	1,216	+10.7%	-3.7%	+1.8%	0.0%
Total		**16,768**	**16,542**	**-1.3%**	**-15.2%**		

Table 5 - Pedestrian VivaCity analysis for boundary roads, In direction, Weekday and Weekend

	Pedestrian, In						
	Weekday + Weekend					**Weekday**	**Weekend**
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	1,007	1,405	1,444	+2.8%	-6.3%	+1.7%	+5.4%
Iffley Road east	310	366	450	+23.0%	+13.9%	+21.0%	+26.5%
Cowley Road north	2,434	3,149	2,958	-6.1%	-15.1%	-6.8%	-6.5%
Cowley Road east	*	2,859	2,952	+3.3%	-15.9%	+1.1%	+10.1%
Morrell Avenue	**	515	592	+15.0%	-4.0%	+8.5%	-0.5%

[13] Note that control roads were altered following the publication of the east Oxford LTNs evaluation methodology, due to a data outage on Banbury Road, making the site unsuitable for inclusion.
[14] See explanation of 'impact' in *Methodology – Impact Estimate* and see Annex B for further detail

Table 6 - Pedestrian VivaCity analysis for boundary roads, Out direction, Weekday and Weekend

Road	Pedestrian, Out						
	Weekday + Weekend					Weekday	Weekend
	2019	before	after	diff.	impact	diff.	diff.
Iffley Road north	665	1,189	1,128	-5.1%	-24.2%	-8.1%	+2.6%
Iffley Road east	90	95	110	+15.8%	-2.6%	+9.2%	+42.2%
Cowley Road north	2,132	2,810	2,742	-2.4%	-21.4%	-3.7%	-1.7%
Cowley Road east	*	3,666	3,534	-3.6%	-13.0%	-4.9%	-5.2%
Morrell Avenue	**	574	597	+4.0%	-5.0%	-3.8%	-4.2%

**The sensor was upgraded during the intervention period and data is not comparable for 2019*
***Data is not available for this location in 2019*

79. Looking at the pedestrian counts in-bound and out-bound and weekday and weekends (table 4), they show a decrease in number after implementation along Iffley Road north[15], Iffley Road east and Cowley Road east (-0.7%, -5.0%, -1.8%). When compared to the control roads (where pedestrians increased on average), this decrease is more pronounced as shown by the impacts (-14.6%, -18.9%, -15.6% respectively). Iffley Road east and Morrell Avenue both show an increase in pedestrian flows (+18.9%, +10.7%[16]) although this is reduced when looking at the impact (+5.0%, -3.7%). Overall, pedestrian movements have fallen slightly across the boundary roads (-1.3%) and more significantly when considering comparison to controls (-15.2% impact).

80. Footfall is consistently either more positively or less negatively affected at weekends than during the weekdays, with Iffley Road east showing a marked percentage increase in pedestrian use at weekends (+30.2% at weekends compared to +16.9% for weekdays). The increased weekend levels may be due to locations near allotments and other green space, likely to be more visited during leisure times. Where data is available, pedestrian counts are significantly higher, both before and after implementation, than they were in 2019. It is worth noting that Voi e-scooters were made available in Oxford city from 18/02/2021, which may have impacted on pedestrian levels as the scheme has grown significantly over the 2022-2023 period post-implementation (142% year on year gain compared to the previous 2021-2022 period). Data from users identifying modal shift suggest that around 30% of e-scooter users would have walked their journey in the absence of an e-scooter.

81. When considering directional movements in towards The Plain roundabout and city versus out-bound from these locations (tables 5 and 6), there are significant differences in flows for some locations. Whilst Morrell Avenue is fairly consistent in both directions, Iffley Road in particular shows much greater flows of pedestrian movements in-bound than out-bound. Cowley Road has a more mixed picture, with the northern (near The Plain) location showing slightly lower

[15] Note that the pedestrian counts on Iffley Road north before and after intervention, are greater in this report than in the Snapshot report due to a data processing error which has been rectified in this report.
[16] Note that the increase in Morrell Avenue pedestrian counts is less pronounced than it was in the snapshot report due to a data processing error which has been rectified in this report.

flows out-bound than in-bound, but the reverse being true of the Cowley Road east sensor location. The patterns of in- and out-bound counts are consistent across time-periods, suggesting that it is not the LTNs which are affecting the difference between flows towards or away from the city, but something longer-standing which influences choice of route. It may be (partly) to do with the sensitivity of the sensors under different lighting levels and the timings of travel during daylight hours and in darkness when sensitivity of the sensors is lower.

Cycles

Table 7 - Cycle VivaCity analysis for boundary roads, In + Out, Weekday + Weekend

	Cycle, In + Out						
	Weekday + Weekend					Weekday	Weekend
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	2,452	2,684	2,806	+4.5%	+2.8%	+8.4%	+13.7%
Iffley Road east	660	690	795	+15.2%	+13.4%	+23.5%	+16.3%
Cowley Road north	2,622	2,110	2,850	+35.1%	+33.3%	+34.9%	+34.5%
Cowley Road east	*	2,349	2,952	+25.7%	+23.9%	+25.1%	+35.9%
Morrell Avenue	**	644	970	+50.6%	+48.8%	+40.6%	+36.8%
Total		**8,477**	**10,373**	**+22.4%**	**+20.6%**		

Table 8 - Cycle VivaCity analysis for boundary roads, In, Weekday + Weekend

	Cycle, In						
	Weekday + Weekend					Weekday	Weekend
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	1,385	1,355	1,383	+2.1%	+2.0%	+8.2%	+7.4%
Iffley Road east	470	481	537	+11.6%	+11.5%	+16.1%	+21.1%
Cowley Road north	1,155	939	1,072	+14.2%	+14.1%	+16.2%	+20.1%
Cowley Road east	*	1,189	1,482	+24.6%	+22.6%	+25.6%	+44.2%
Morrell Avenue	**	347	527	+51.9%	+49.7%	+45.5%	+29.6%

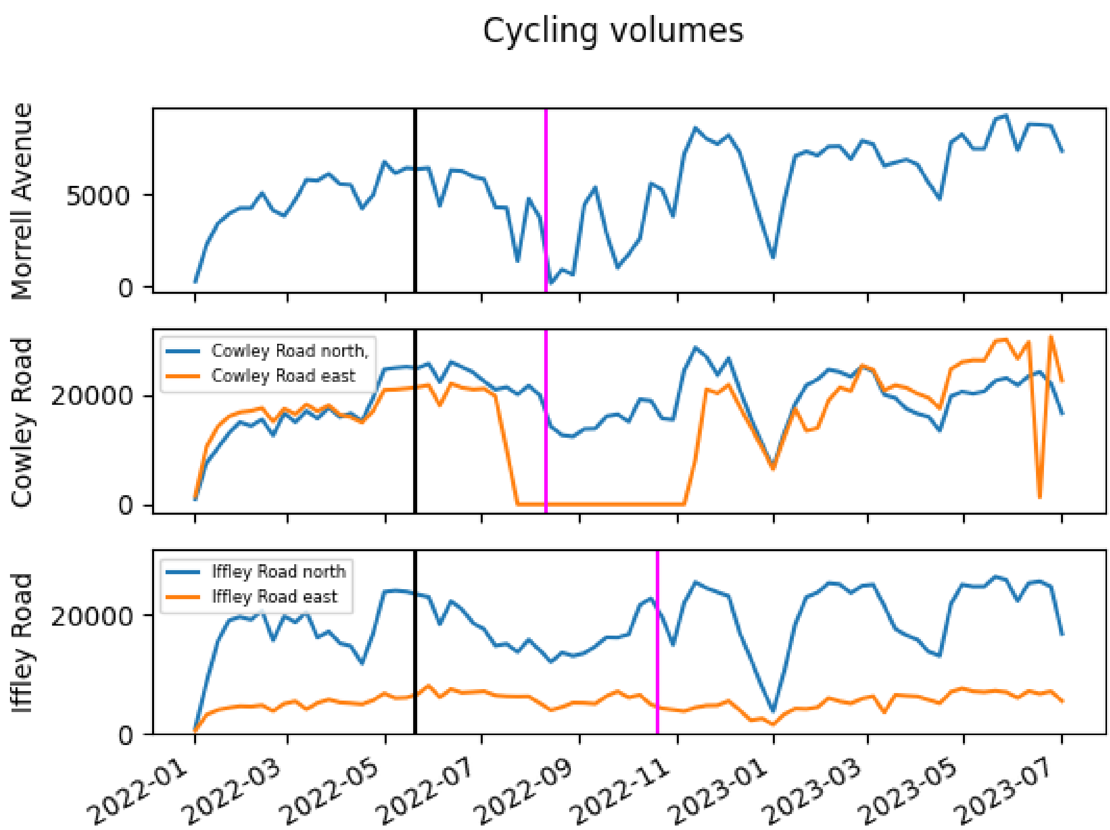
Table 9 - Cycle VivaCity analysis for boundary roads, Out, Weekday + Weekend

	Cycle, Out						
	Weekday + Weekend					Weekday	Weekend
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	1,073	1,305	1,431	+9.7%	+7.6%	+12.2%	+17.4%
Iffley Road east	169	206	257	+24.8%	+22.7%	+28.0%	+15.9%
Cowley Road north	1,377	1,212	1,770	+46.0%	+44.0%	+40.1%	+40.5%
Cowley Road east	*	1,145	1,439	+25.7%	+25.5%	+27.5%	+32.6%
Morrell Avenue	**	298	451	+51.3%	+51.5%	+33.6%	+46.4%

82. Cyclist counts have consistently increased across all boundary roads with similar changes in flows and impact percentages, meaning it is likely that the effect of the LTNs and other local changes are driving the increase rather than changes in travel patterns more generally. Looking at table 7, the highest percentage increases are found on Morrell Avenue (+50.6% difference, +48.8% impact), Cowley Road north (+35.1% difference, +33.3% impact) and Cowley Road east (+25.7% difference, +23.9% impact). A local factor that could have contributed to

this increase in cycling is the opening of the Quickways on Warneford Lane/Morrell Avenue, Cowley Road (both on 11/08/2022) and Iffley Road (on 20/10/2022). The difference in impact between these roads could be attributed to the type of provision – more segregation is afforded on Warneford Lane so offers more protection to cyclists. See Annex G for photographs of infrastructure provision outlining these differences. Figure 6 below shows an increase in cycling after the completion of the Quickways, taking into account usual seasonal trends, particularly on Morrell Avenue. It may also be that cycling is becoming a more attractive option as cyclists can filter through traffic (see also *Journey times (driving)* analysis). Overall, across the boundary roads there has been a 22.4% increase in flows, tempered slightly to an impact of 20.6% when taking increases in cycling at control sites into account. Also, cycling counts are up after LTN implementation compared to 2019, where data is available.

Figure 6 - Cycling flows over time along boundary roads including Quickways completion times (weekly aggregated counts)



The LTN implementation date is marked in black and Quickways completion date is marked in pink.

83. Unlike for pedestrians, there is a more mixed picture for the differences between weekdays and weekends for cyclists (table 7), with some locations showing higher increases in cycling in the week and others during the weekend. This is likely due to the patterns of routes used for travel to work versus those used for leisure travel. It should also be noted that delivery cycles will be recognised by the VivaCity cameras and it is not possible to distinguish the proportion of the cycles which are for personal trips versus those being used for delivery purposes.

84. When in-bound are separated from out-bound cycle counts (tables 8 and 9), as for pedestrians, there are more in-bound than out-bound cyclists on the Iffley Road at both sensor locations. The difference is greater at the eastern location (further out). The Cowley Road again, is a more mixed picture, with the more central location showing higher out-bound counts than in-bound, whilst the more peripheral sensor shows little difference between in- and out-bound flow. There could be a whole range of factors driving this behaviour and without residential or user surveys it would be difficult to say, with any certainty, why this is happening. However, this could indicate that cyclists able to use alternative routes for their journeys may favour the Iffley Road for trips into the city and shift to using the Cowley Road, or other routes such as St Clement's or off-road routes, for those out-bound single or linked trips away from the city. Alternatively, it may be (partly) due to the timing of journeys during lighter/darker times, when sensors are more/less sensitive to picking up movements.

85. Morrell Avenue sees a greater overall number of cyclists in the in-bound direction than out-bound, perhaps due to the steep incline along this route, which is down-hill in the in-bound direction. However, it has seen a slightly higher increase in counts for the out- than in-bound direction. As for pedestrians, the patterns of varying in- and out- bound counts existed prior to the LTNs. Therefore, it is not only the LTNs which are affecting the difference between flows towards or away from the city, but something longer standing which influences choice of route or timing of journeys. Since, however, the increases are generally higher in the out-bound direction across all locations, this does indicate a recent disparate influence on flows.

86. Looking at the more detailed, granular analysis of the data (see Annex D and explanation of the approach taken in the section on *Granularity*), Cowley Road north experiences the greatest level of change (+35%) in the PM-peak period, in the out-bound direction, whilst other periods remain relatively consistent with pre-implementation levels. Iffley Road north also shows the greatest change in the PM-peak in the out-bound direction (+23%), but also experiences reasonable increases in the opposite direction in the AM-peak and 'day' period between peaks (+16% AM-peak; +12% day).

Cars

Table 10 - Car VivaCity analysis for boundary roads, In + Out, Weekday + Weekend

	Car, In + Out						
	Weekday + Weekend					**Weekday**	**Weekend**
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	8,818	7,764	9,835	+26.7%	+33.6%	+27.1%	+24.8%
Iffley Road east	15,750	16,016	13,377	-16.5%	-9.6%	-15.6%	-15.2%
Cowley Road north	5,787	5,361	8,411	+56.9%	+63.8%	+57.5%	+51.7%
Cowley Road east	12,648	10,561	8,548	-19.1%	-12.1%	-20.7%	-11.8%
Morrell Avenue	**	3,148	3,425	+8.8%	+15.7%	+7.0%	+12.1%
Total		**42,850**	**43,596**	**+1.7%**	**+8.7%**		

Table 11 - Car VivaCity analysis for boundary roads, In, Weekday + Weekend

Road	Car, In						
	Weekday + Weekend					Weekday	Weekend
	2019	before	after	diff.	impact	diff.	diff.
Iffley Road north	4,610	3,980	4,981	+25.2%	+33.9%	+26.0%	+24.2%
Iffley Road east	7,832	8,052	6,971	-13.4%	-4.7%	-12.9%	-10.8%
Cowley Road north	2,996	2,721	4,089	+50.3%	+59.0%	+52.9%	+50.8%
Cowley Road east	6,436	5,346	4,351	-18.6%	-13.8%	-19.8%	-13.2%
Morrell Avenue	**	1,449	1,653	+14.1%	+18.8%	+12.7%	+19.2%
St Clement's proxy	**	6,230	5,216	-16.3%	-11.5%	-16.8%	***

Table 12 - Car VivaCity analysis for boundary roads, Out, Weekday + Weekend

Road	Car, Out						
	Weekday + Weekend					Weekday	Weekend
	2019	before	after	diff.	impact	diff.	diff.
Iffley Road north	4,171	3,790	4,834	+27.5%	+32.3%	+30.1%	+25.2%
Iffley Road east	7,374	7,882	6,387	-19.0%	-15.3%	-20.6%	-19.6%
Cowley Road north	2,769	2,655	4,308	+62.3%	+67.0%	+62.0%	+53.4%
Cowley Road east	6,211	5,188	4,170	-19.6%	-10.9%	-21.7%	-10.5%
Morrell Avenue	**	1,688	1,791	+6.1%	+14.8%	+3.7%	+6.2%

87. From table 10 there has been a significant increase in car traffic flows on Iffley Road north and Cowley Road north, closer to city centre (+26.7% and +56.9%), which is similarly reflected in the impact (+33.6%, +63.8%). Away from the city centre, there has been a (less pronounced) decrease in flows along Iffley Road east and Cowley Road east (-16.5% and -19.1%), moderated in the impact figures (-9.6%, -12.1%). Morrell Avenue shows a small increase in flows and impact (+8.8%, +15.7%). The lack of option to use Divinity Road will likely have affected use of Morrell Avenue for those based in the vicinity travelling by car. In total, car journeys along boundary roads have increased by 1.7% in volume, with an 8.7% impact when taking control site decreases into account. Overall, except for Morrell Avenue, weekend flows are slightly less pronounced than weekdays.

88. Interestingly, there is a distinct difference in pre-existing (prior to the implementation of the east Oxford LTNs) volumes on Iffley Road and Cowley Road between the more central and peripheral locations, respectively – lower volumes near the city centre and higher at the outer sensors. These same sets of sensors also generally see an increase in traffic post LTN implementation where the volume was lower, and a decrease in traffic where the volume was higher. The analysis of in-LTN car movements (see following section) indicates that prior to LTNs going in place, a large proportion of traffic would have diverted off these two roads between the sensor locations; now that movements are constrained, it is no longer possible to divert and so a flattening (consistent level of traffic) of the overall car volume along each road can be seen. Analysis of the movements on Divinity Road shows an average reduction of around 6,000 daily car movements (see table 25 in the *in-LTN Roads* analysis section), which previously would have used this as a through-route.

89. The reduction in traffic at the outer sensors could point to people re-routing and/or choosing alternative transport to gain access to the city. Given the consistently higher levels of cycling along all boundary roads, there is some evidence supporting a degree of modal shift, though without full coverage of all potential routes it is not possible to say definitively that this is due to modal shift. However, once a driver reaches the inner sensor locations, they have little alternative than to continue on that road, so what would have been dispersed previously is all contained to the radial routes. The reduction in volume between Iffley Road east and Iffley Road north can be explained by some diversion along Donnington Bridge Road, whereas Cowley Road has no side road options to divert along.

90. To assess the degree to which re-routing versus modal shift or avoiding travelling may be occurring, a number of additional sensor locations were considered to determine whether car volumes might have gone up in other areas of the network in response. The locations and results are included in Annex F. Locations considered are not fully comprehensive and are based on possible re-routing options amongst locations where sensors were in place and collecting comprehensive data. Interestingly, of all the locations considered, the Banbury Road sensor (in Summertown, north Oxford) is the only one with increases in volumes of car movement post LTN implementation, with an overall 15.2% increase. This indicates that the reductions in flow identified are only being partially displaced within the city, but this does not exclude the possibility of increased use of routes not assessed, including the ring road. The reductions at The Plain sensor – which is on the Magdalen Bridge side of the roundabout – indicates slightly reduced numbers accessing the city centre from the eastern side of the city, which supports the picture of some car journeys from further out either re-routing or switching modes.

91. The volume over time has also been assessed and compared against bollard outages (periods during which a bollard has been removed - see Annex H). There is no obvious correlation between when bollards have not been in place and changes in traffic volume along the boundary roads, indicating that the majority of drivers are following the traffic restrictions of the LTNs even when bollards are not in place. Trends over time do suggest that in the locations which have experienced increases in car traffic volume, this is reducing slightly over time as the LTNs bed in. This is more apparent on the Cowley Road approaching The Plain roundabout (see figure 7 below), where the trend line is down by 12.5% over the period 20 May 2022 to 18 June 2023. Iffley Road north (see figure 8) shows a more flat, though very slightly declining trajectory overall (down 1.9% over the same period), but there is an increase post-January 2023, with particularly high figures in May 2023, so further data would be needed to assess the trend on this road more thoroughly.

Figure 7 - Car traffic post LTN-implementation at Cowley Road north

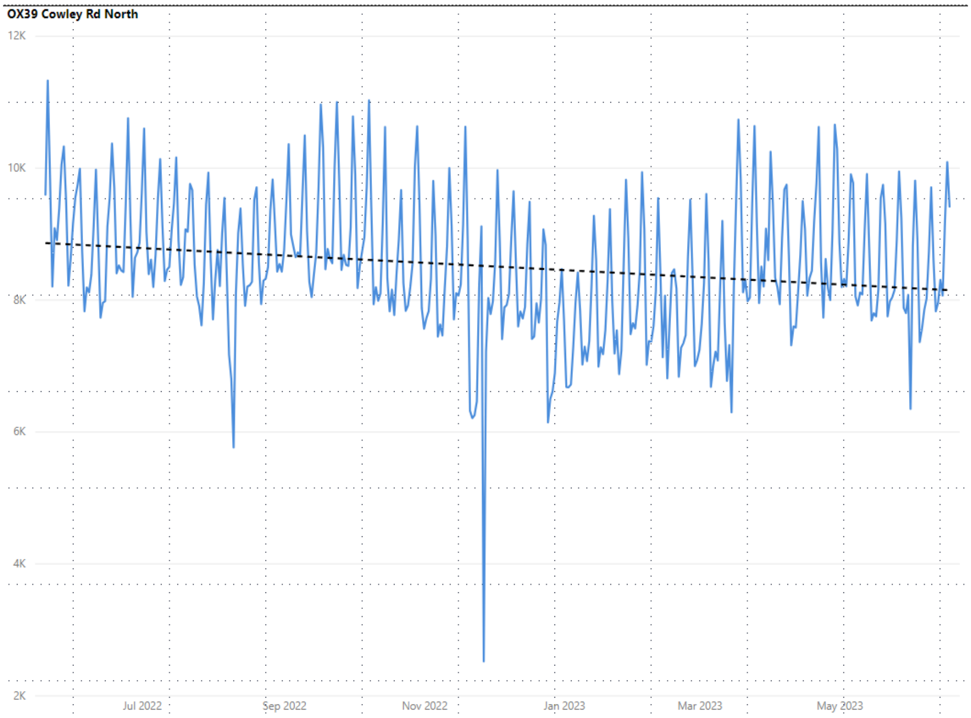
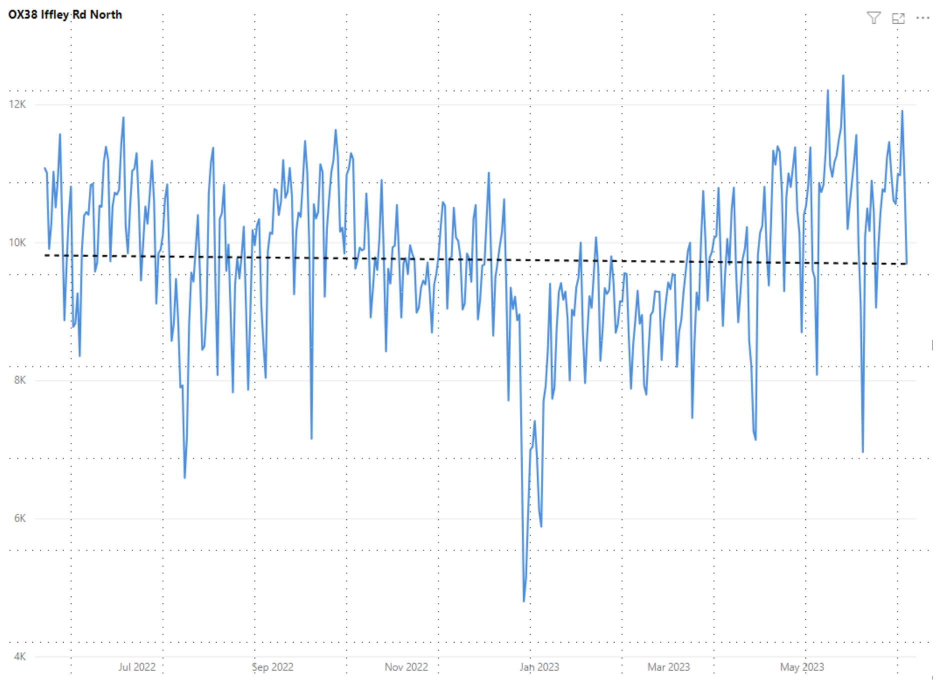


Figure 8 - Car traffic post LTN-implementation at Iffley Road north



92. When considering in-bound versus out-bound counts for cars (tables 11 and 12), there are smaller proportional differences than were apparent for cyclists and pedestrians. However, there is a greater volume of traffic using the Iffley Road at both sensor location in the in-bound than the out-bound direction. The same is true for the Cowley Road east (peripheral) location, but the opposite is true for the Cowley Road north (more central) location.

93. For in-bound counts, proxy data for St Clement’s Street (described in paragraph 78), shows volume has decreased between the pre- and post- implementation period (-16.3% difference and -11.5% impact). This decrease on St Clement’s Street is different from the respective increases seen along both Iffley and Cowley Road segments approaching The Plain roundabout. It may be that some drivers heading to the northern side of the city are diverting across the city using the Marston Ferry Road/The Slade/Hollow Way or ring road, rather than driving through the city centre to avoid journey time delays being experienced on St Clement’s Street (refer to *Journey Time* analysis, paragraph 148). The increase in traffic levels on the Banbury Road noted above in paragraph 90 supports this theory. It is worth noting that since the data for St Clement’s Street is based on proxy data, it is less accurate than direct sensor data with a higher error margin. As described in paragraph 78, comparison suggested the data was within +/-10% of direct sensor data which was available. There are also fewer car movements on the Marston Road post-implementation, particularly in the in-bound direction, supporting the reduction in the proxy St Clement’s Street data and indicating that drivers from the Marston area are re-routing via Banbury Road to access the city centre area or Headley Way/The Slade/Hollow Way if heading to the south of the city. Slightly smaller volumes of car traffic on the Headington Road also supports the same picture (see Annex F).

94. Review of the more granular data (see Annex D) identified that the changes are generally fairly consistent across daily time periods, with perhaps a slightly greater change in the AM-peak for most locations than for other times of day. St Clement’s Street, however, indicated that the reduction in traffic volume is most significant in the PM-peak, when it reduced by 33% in volume. Again, though, caution should be taken when interpreting the St Clement’s Street results.

Motorbikes

Table 13 - Motorbike VivaCity analysis for boundary roads, In + Out, Weekday + Weekend

	Motorbike, In + Out						
	Weekday + Weekend					**Weekday**	**Weekend**
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	142	278	277	-0.4%	+9.4%	+1.0%	-6.0%
Iffley Road east	248	455	462	+1.5%	+11.4%	+0.4%	+8.0%
Cowley Road north	256	438	502	+14.6%	+24.5%	+12.3%	+20.4%
Cowley Road east	238	576	671	+16.5%	+26.2%	+13.9%	+25.7%
Morrell Avenue	**	182	203	+11.5%	+21.3%	+13.8%	+30.9%
Total		**1,929**	**2,115**	**+9.6%**	**+19.4%**		

Table 14 - Motorbike VivaCity analysis for boundary roads, In, Weekday + Weekend

	Motorbike, In						
	Weekday + Weekend					**Weekday**	**Weekend**
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	79	110	134	+21.8%	+26.8%	+21.7%	+14.3%
Iffley Road east	149	265	279	+5.3%	+10.2%	+4.7%	+8.3%
Cowley Road north	115	266	282	+6.0%	+11.2%	+6.6%	+12.7%
Cowley Road east	79	311	365	+17.4%	+30.0%	+15.1%	+25.4%
Morrell Avenue	**	87	92	+5.7%	+19.0%	+3.0%	+11.9%

Table 15 - Motorbike VivaCity analysis for boundary roads, Out, Weekday + Weekend

	Motorbike, Out						
	Weekday + Weekend					**Weekday**	**Weekend**
Road	**2019**	**before**	**after**	**diff.**	**impact**	**diff.**	**diff.**
Iffley Road north	64	160	140	-12.5%	+0.4%	-12.1%	-10.1%
Iffley Road east	91	189	181	-4.2%	+8.4%	-7.1%	+4.1%
Cowley Road north	136	167	214	+28.1%	+40.8%	+24.6%	+30.2%
Cowley Road east	157	269	307	+14.1%	+19.1%	+11.2%	+24.0%
Morrell Avenue	**	90	111	+23.3%	+28.3%	+19.6%	+35.6%

95. Table 13 shows there has been an increase in the volumes and impact in the number of motorbikes, particularly on Cowley Road north (+14.6%, +24.5%) and east (+16.5%, +26.2%) and a substantial increase across all roads compared to 2019. It is likely that these increases reflect the growth of takeaway food deliveries by motorbike, motor scooter or moped, which would explain why Cowley Road with its many restaurants and takeaways sees the greater increase, compared to Iffley Road. There is also approximately a doubling in the difference counts at the weekend, except on Iffley Road north, where the weekend volume change is negative. Morrell Avenue has also experienced a significant increase (+23.3% difference and +28.3% impact). The reason for this may be the removal of parking along this route making it a more attractive option for motorcyclists, particularly as bus movements would be more predictable without their need to wait for oncoming traffic to pass.

96. When in-bound versus out-bound motorcycle counts are considered, similar to cycles, there are differences for some sensor locations but not others. There are more in-bound than out-bound motorcyclists on the Iffley Road at the eastern location (further out), but not a significant difference at the northern sensor point. The Cowley Road has higher in-bound counts at both sensor locations, unlike other modes of transport. It is worth noting that the overall number of motorcycles is lower than other modes of transport analysed in this way, so smaller changes seem more significant.

LGVs

Table 16 - LGV VivaCity analysis for boundary roads, In + Out, Weekday + Weekend

Road	LGV, In + Out						
	Weekday + Weekend					Weekday	Weekend
	2019	before	after	diff.	impact	diff.	diff.
Iffley Road north	1,154	1,077	1,359	+26.2%	+26.1%	+31.6%	+35.4%
Iffley Road east	1,829	1,762	1,540	-12.6%	-12.7%	-11.0%	-5.2%
Cowley Road north	717	730	1,121	+53.6%	+54.0%	+54.2%	+49.3%
Cowley Road east	1,314	1,014	774	-23.7%	-24.0%	-10.2%	-1.3%
Morrell Avenue	**	347	424	+22.2%	+77.0%	+24.9%	+21.7%
Total		**4,930**	**5,218**	**+5.8%**	**+5.7%**		

97. LGV counts are broadly consistent with cars, showing the same overall trends, apart from a significantly greater increase in impact (+77%) than was seen for cars (+15.7%) on Morrell Avenue. Overall numbers are, however, relatively low at this sensor site for LGVs in comparison to other boundary roads, so relatively small changes show greater percentage increases.

HGVs

Table 17 - HGV VivaCity analysis for boundary roads, In + Out, Weekday + Weekend

Road	HGV, In + Out						
	Weekday + Weekend					Weekday	Weekend
	2019	before	after	diff.	impact	diff.	diff.
Iffley Road north	47	35	35	0.0%	+8.3%	0.0%	-12.5%
Iffley Road east	70	46	53	+15.2%	+24.4%	+11.3%	+11.3%
Cowley Road north	46	55	40	-27.3%	-18.3%	-23.3%	-23.3%
Cowley Road east	46	45	43	-4.4%	+5.6%	+2.1%	+2.1%
Morrell Avenue	**	11	10	-9.1%	-8.4%	-14.3%	-33.3%
Total		**192**	**181**	**-5.7%**	**3.3%**		

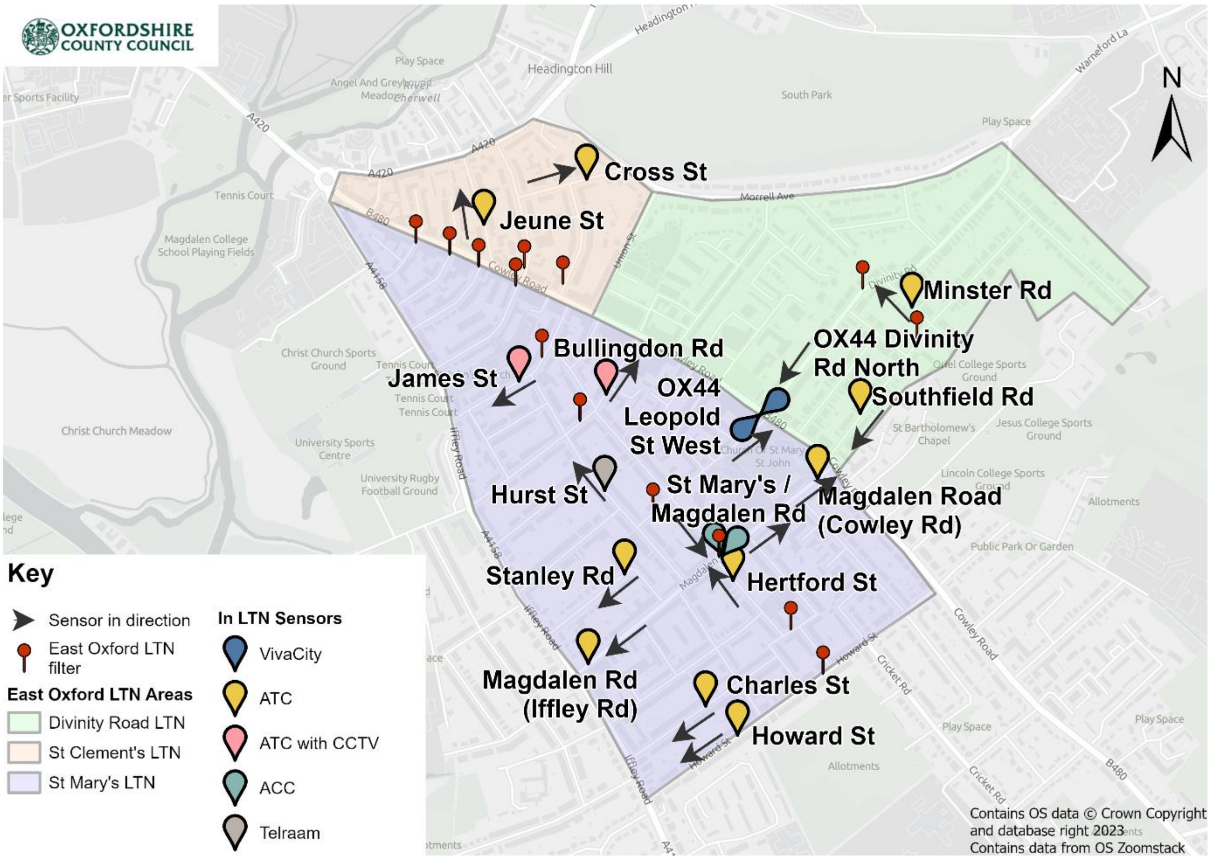
98. The count numbers for HGVs are too low for firm conclusions to be drawn. However, it is interesting to note that in all locations, the counts are lower post-LTN implementation than in 2019.

In-LTN Roads

Sensor Locations

99. Only two VivaCity sensor count lines were available to monitor the In-LTN area. They can be seen in figure 9 and are listed below:
    - OX44 Leopold Street west
    - OX44 Divinity Road north

Figure 9 - Location of In-LTN sensors and filters in east Oxford LTNs



100. Control road VivaCity sensors for the In-LTN area can be seen in Annex C and have the following locations:
    - OX27 Minns Business Park
    - OX13 B4494 south[17]

101. Only two VivaCity count lines were available to monitor traffic modes in the in-LTN areas. Previously, as outlined in the published Methodology statement noted in the *Introduction*, Divinity Road was made up of 3 separate count lines, covering pavements and roadway separately, but, for simplicity, these were combined to a single count line (covering exactly the same area). For Divinity Road north, data from 2019 was not available, as the count line was not set up

[17] Two locations (Ashurst Way and Moreton Road) required to be similarly excluded because of data issues.

until after this period. For Leopold Street west the sensor was upgraded in February 2023. Data was re-calibrated to allow comparison across the baseline and intervention period but was not applied to 2019 data. Whilst larger-vehicle volumes are relatively similar between versions of the sensor, the version 2 sensors are much more sensitive to other modes such as bicycles and walkers. Comparisons therefore can only be made back to 2019 for cars, LGVs and HGVs in this location. As two locations are not sufficient to understand traffic flow patterns within the LTN area, ATC data was also analysed, using sensors located as shown on figure 9.

Pedestrians

Table 18 - Pedestrians VivaCity analysis for in-LTN roads, In + Out, Weekday + Weekend

	Pedestrian, In + Out, Weekday + Weekend				
Road	**2019**	**before**	**after**	**diff.**	**impact**
Divinity Road north	**	3,847	3,667	-4.7%	-6.8%
Leopold Street west	1,196	1,409	1,479	+5.0%	+2.9%
Total		**5,256**	**5,146**	**-2.1%**	**-2.1%**

*** Data not available/not comparable at this location for 2019. See paragraph 101*

102. Table 18 indicates minor changes in pedestrian counts, the greater being a fall in flows and impact on Divinity Road north[18] (-4.7%, -6.8%). As noted in the previous section (*Boundary Road/Pedestrians*), use of e-scooters could be impacting on these reduced pedestrian figures to some degree, given growth of the scheme during the evaluation period.

Table 19 - Pedestrians ATC with CCTV analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

	Pedestrian, In + Out				
	Weekday + Weekend				Weekday
Road	**before**	**after**	**diff.**	**impact**	**diff.**
James Steet	745	686	-8%	-3%	-5%
Bullingdon Road	1,038	1,706	+64%	+70%	+66%
Total	**1,783**	**2,392**	**+34%**	**+39%**	

103. The daily average pedestrian count varied between the two locations of James Street and Bullingdon Road. James Street experienced a decrease in flows of 8% (Table 19) and a smaller negative impact estimate of -3% (Table 19) when comparing to the control areas (which had a 5% decrease in flows). Conversely, Bullingdon Road saw a large increase of 64% and an impact estimate of 70% increase in pedestrians (Table 19). These roads run parallel to each other with several joining roads: the James Street camera is closer to the Iffley Road side and the Bullingdon Road camera to the Cowley Road side.

[18] Note that the pedestrian counts before and after intervention are greater in this report than in the Snapshot report due to a data processing error which has been rectified in this report.

104. When looking at the more granular detail of the data (see Annex E), the main reduction in pedestrian movements on James Street was during the weekend, with a larger reduction in flows in the direction towards the Iffley Road (defined as in-bound to the city), which showed a 28% reduction in flows. Bullingdon Road, by contrast, shows increases across all times of day, with the most significant increase in pedestrian counts occurring in the weekday PM-peak towards Iffley Road of 78% (defined as out-bound from the city) and 74% in the opposite direction.

Table 20 - Pedestrians Telraam analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

	Pedestrian, In + Out			
	Weekday + Weekend			**Weekday**
Road	**before**	**after**	**diff.**	**diff.**
Hurst Street	380	440	+16%	+12%

105. Pedestrian use of Hurst Street has increased in by 16%, with more of the increase occurring during weekends than weekdays, as weekdays alone saw a smaller increase of 12%. When considering all data-sources and looking at the variations in levels of pedestrian use within the LTNs, with some locations increasing and others decreasing, the pattern of change may be reflective of desire lines. The likelihood is that pedestrians will tend to walk to where there are amenities, rather than into predominantly residential streets with fewer commercial destinations. Hurst Street, for example, provides a link to several shops and eateries on Magdalen Road (see *Background* section, figure 3 map of the area indicating areas of commercial interest). The Bullingdon Road, which saw significant pedestrian increases in the ATC + CCTV data, provides convenient access from the St Mary's LTN area and the general direction of the Iffley Road, to the largest local supermarket on Cowley Road, as well as the O2 Academy (see figure 3). Both locations monitored showing increases, therefore, may fall on specific walking desire lines to access these amenities. Conversely, James Street, which saw decreases in footfall, has few local amenities on the Iffley Road side, where the counter was situated. Divinity Road and Leopold Street both saw only slight changes in footfall. Neither provide an obvious route to local amenities, but there are potential destinations which can be reached via both routes. However, more comprehensive data for all locations within the LTNs would be required to confirm this theory.

Cycles

Table 21 - Cycle VivaCity analysis for in-LTN roads, In + Out, Weekday + Weekend

	Cycle, In + Out, Weekday + Weekend				
Road	**2019**	**before**	**after**	**diff.**	**impact**
Divinity Road north	**	781	974	+24.7%	-3.1%
Leopold Street west	128	220	204	-7.3%	-35.2%
Total		**1,001**	**1,178**	**+17.7%**	**-10.2%**

*** Data not available/not comparable at this location for 2019. See paragraph 101*

106. There have been mixed impacts on cycling levels – an increase of 24.7% in flows on Divinity Road north[19] and a decrease of 7.3% on Leopold Street west. However, when compared with control roads, Divinity Road north has a small decrease in impact, but there is a substantial decrease in impact on Leopold Street. Overall, there is an increase in volume of 17.7% between the two sites, but when control sites are factored in, there is a 10.2% reduction in impact.

Table 22 - Cycle ATC with CCTV analysis for in-LTN roads, In + Out, Weekday + Weekend

	Cycle, In + Out				
	Weekday + Weekend				**Weekday**
Road	**before**	**after**	**diff.**	**impact**	**diff.**
James Street	316	341	+8%	+10%	+9%
Bullingdon Road	384	523	+36%	+39%	+35%
Total	**701**	**864**	**+23%**	**+26%**	

107. The daily average cycle volumes increased for both James Street and Bullingdon Road, but as with pedestrians there was a larger increase on Bullingdon Road. As seen in Table 22, there was a 36% increase in flows compared to an 8% increase on James Street. The impact estimate also shows a similar finding to the difference metric; an impact estimate of 39% increase on Bullingdon Road compared to a 10% increase on James Street.

108. More granular analysis of the ATC + CCTV cycling data (see Annex E) identifies that the increases on James Street are experienced during weekdays, with the weekend seeing a reduction in flows of 29% towards Iffley Road and 5% towards Cowley Road. The largest % change increases in flows are during the weekday AM-peak in this location. Overall numbers of cyclists are small and small changes in absolute numbers can result in significant percentage changes. Drawing definitive conclusions for this location is therefore not possible based on the numbers in the analysis.

Table 23 - Cycle ACC analysis for in-LTN roads, In + Out, Weekday + Weekend

	Cycle, In + Out			
	Weekday + Weekend			**Weekday**
Road	**before**	**after**	**diff.**	**diff.**
Magdalen Road	321	548	+71%	+66%
St Mary's Road	74	62	-16%	-17%
Total	**272**	**367**	**+34.9%**	

109. The ACC data, similar to the VivaCity in-LTN data, shows a mixed impact on cycling levels, with Magdalen Road seeing a significant increase in flows of 71%,

[19] Note that the cycle counts before and after intervention are greater in this report than in the Snapshot report due to a data processing error which has been rectified in this report.

whilst St Mary's Road has a decrease in flows of 16%. The decrease on St Mary's Road (which forms part of one of two obvious cycling routes in- or out-bound of the city centre away from main roads – the other option being Hurst Street (see paragraph 111 below)) is suggestive that cyclists are not using the LTNs as a route to avoid traffic on the boundary roads, since the overall cycling levels have consistently increased along Iffley and Cowley Roads. When considering the higher figures on the Magdalen Road, it is worth noting that there is an electric bicycle shop located on the road, from which, prospective buyers can take bikes for test rides, potentially affecting the counts along this route.

110. When considering the direction of travel (see Annex E), prior to the LTNs, most of the cycle movement was from Iffley Road towards Cowley Road (c.80% of cycle movements were in this direction). Following LTN implementation, the volumes in each direction have equalised to a degree (around 57% of counts are in the Iffley to Cowley Road direction), with the Iffley to Cowley Road direction increasing by 26%, whilst flows in the opposite direction have gone up by 270%. This could be connected with the change of status from Magdalen Road having previously been a one-way route; whilst cyclists were not required to use the route only in one direction, users may have been more inclined to follow the same direction as the vehicular traffic. Whilst the entrance to Magdalen Road from Cowley Road noted "no through route to Iffley Road *except cycles*", the side roads previously had one-way arrows opposite them, which did not note that cycles were excluded from the one-way system, so many cyclists may have believed they were required to follow the same direction as the vehicular traffic.

Table 24 - Cycle Telraam analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

	Two-wheeler, In + Out			
	Weekday + Weekend			**Weekday**
Road	**before**	**after**	**diff.**	**diff.**
Hurst St	784	719	-8%	-8%

111. 'Two-wheeler' (cycles and motorbikes, see Annex C for a description of Telraam sensors) use of Hurst Street has decreased in flow by 8%, evenly between weekdays and weekends. Whilst this data includes both motorcycles and bicycles and it is therefore not possible to draw firm conclusions on cyclist movements, the reduction at this location is in line with the reductions also seen on St Mary's Road, supporting the assertion above that cyclists are not generally choosing the LTNs as a route to and from the direction of the city centre.

Cars

Table 25 - Car VivaCity analysis for in-LTN roads, In + Out, Weekday + Weekend

	Car, In + Out, Weekday + Weekend				
Road	**2019**	**before**	**after**	**diff.**	**impact**
Divinity Road north	**	7,336	1,147	-84.4%	-86.5%
Leopold Street west	1,593	1,289	923	-28.4%	-30.5%
Total		**8,625**	**2,070**	**-76.0%**	**-78.1%**

112. Overall, there are significant decreases in car volume (-75%, -78.1%), encompassing Divinity Road north[20] (-84.4%, -86.5%) and Leopold Street west (-28.4%, -30%). The reduction on Divinity Road north is to be expected as there is a traffic filter near the count sensor. The lesser reduction for Leopold Street west may be explained by the presence of a filter on this road some distance away; Leopold Street has always been more of an access into the area whereas Divinity Road was always more of a through route. Divinity Road was previously a major route between east Oxford and Headington, including for access to the hospitals and Oxford Brookes University main campus. Car traffic on Leopold Street reduced by more than 40% since 2019, having already reduced by about 20% between 2019 and 2021/2022.

113. It is worth noting that Divinity Road is the location with the most days of bollard outages of all LTN locations, and yet still has very high car movement reductions. The data does, however, show a marked and sharp decrease in car movements on Divinity Road post wooden bollard installation on 13/03/2023, having previously been showing an upwards trend in usage to that point (see Annex H). There is therefore reasonable evidence that bollard outages have increased traffic along Divinity Road.

Table 26 - Car ATC analysis for in-LTN roads, In + Out, Weekday/ Weekend comparison

	Car, In + Out			
	Weekday + Weekend			**Weekday**
Road	**before**	**after**	**diff.**	**diff.**
Jeune Street	341	493	+44%	+46%
Cross Street	1,887	750	-60%	-59%
Minster Road	174	174	0%	-4%
Southfield Road	1,505	267	-82%	-83%
Stanley Road	240	214	-11%	-13%
Magdalen Road (Iffley Road)	2,063	487	-76%	-77%
Magdalen Road (Cowley Road)	2,326	1,106	-52%	-54%
Hertford Street	370	229	-38%	-40%
Charles Street	619	506	-18%	-25%
Howard Street	2,189	344	-84%	-85%
Average	**1,171**	**457**	**-61%**	**-62%**
Total	**12,885**	**5,025**	**-61%**	

114. The daily average car count saw a general decrease across most ATCs with a total average decrease in volumes of 61%. The five ATCs recording the highest car flows in 2021, both ends of Magdalen Road, Howard Street, Cross Street, and Southfield Road, all saw significant decreases in volumes of at least 50%. The ATCs with lower before counts mostly experienced smaller decreases in

[20] Note that the car counts before and after intervention are greater in this report than in the Snapshot report due to a data processing error which has been rectified in this report.

flows, although Minster Road saw no change, having previously already experienced very low traffic volumes, and Jeune Street had an increase in volume of 44%.

115. Jeune Street is one-way from Cowley Road to St Clement's Street and this road does not currently include a traffic filter. An additional proposed filter at this location to address the increased traffic on this route was consulted on in June, and a decision on its implementation will be made in October 2023 if the LTNs are made permanent at this point. There have also been reports, anecdotally, that traffic has been using this route in the wrong direction, which the ATC will not have recorded – as such, the real (bi-directional) increase may be higher than that recorded here. When looking at the more granular detail within the data (see tables in Annex E), the greatest increase on Jeune Street was during the weekday AM-peak period, where the increase in volume was 80%. Weekday PM-peak also experienced a 63% increase in volume.

116. Prior to the LTNs being installed, Magdalen Road was one-way between the Iffley Road and the junction with Ridgefield Road, with just the small section between Ridgefield Road and Cowley Road being two-way. Following LTN installation, the segments on either side of filter are now both two-way to facilitate access and egress. Counts for the baseline period were therefore in one direction only, whilst implementation period counts were for both directions.

117. More granular analysis of the directions of flow show that, whilst most locations experienced a decrease in overall car volumes, in many locations there is a small increase of volume in one direction, which is counterbalanced by a greater decrease in the opposite direction. This is particularly true for Charles Street, Hertford Street and the Cowley Road side of Magdalen Road. Each of these locations show increased volumes in the direction towards the LTNs (classed as out-bound from the city), which is counterbalanced by greater reductions away from the LTNs (in-bound to the city). There is generally not a clear pattern of when the greatest changes are across the roads, with some seeing more significant changes during the AM-peak and others during the PM-peak. Others still experienced very consistent changes across all times of day, such as Southfield Road, which had reductions in volumes of between 77% and 90% in both directions across all times periods.

118. None of the bollards located on the roads included in the ATC surveys were out at the time of the 2022 survey. However, there were some locations missing during the period of surveying, which may have skewed some of the results. For example, Bullingdon Road bollard was missing during part of the survey period. This may have affected the traffic flows elsewhere in the St Mary's LTN area accordingly.

Table 27 – Car/LGV ATC with CCTV analysis for in-LTN roads, In + Out, Weekday/ Weekend comparison

	Car/LGV, In + Out				
	Weekday + Weekend				**Weekday**
Road	**before**	**after**	**diff.**	**impact**	**diff.**

James Street	1,519	343	-77%	-67%	-78%
Bullingdon Road	648	401	-38%	-27%	-42%
Total	**2,167**	**744**	**-66%**	**-55%**	

119. The decrease in cars and LGVs followed a similar overall trend to the data recorded at the 10 ATCs. Across both James Street and Bullingdon Road (as seen in table 27) there was an average decrease in difference of 66%, as well as an impact estimate decrease of 55% when compared to the control area locations (which experienced a smaller decrease of 11% as seen in table 27). However, when looking at the roads individually, there was a significantly higher impact estimate decrease on James Street (-67%) when compared to the 27% decrease on Bullingdon Road (as seen in table 27).

120. In reviewing the more detailed breakdown (see Annex E), for both James Street and Bullingdon Road, the counts for the 'in' direction, which denotes the direction towards the radial (boundary) routes and away from the LTN area, are generally negligible, with 13 being the highest count in this direction for a given time period across both roads. On James Street this is a generally sizable reduction, whilst on Bullingdon Road it is small absolute increases but because numbers are low, the percentage changes are very large. In the 'out' direction away from the city and into the LTNs, Bullingdon Road has experienced a rough halving of vehicle numbers across most time periods, whilst James Street has seen much greater decreases in difference of 81 to 85%.

121. Neither of the bollards on the relevant streets were missing during the data collection for the ATC element of the ATC plus CCTV survey. However, the Howard Street bollard was not in place during the survey period, so this may have affected movements during the period of the survey.

Table 28 - Car Telraam analysis for in-LTN roads, In + Out, Weekday/ Weekend comparison

	Car, In + Out			
	Weekday + Weekend			**Weekday**
Road	**before**	**after**	**diff.**	**diff.**
Hurst Street	493	270	-45%	-45%

122. In line with other in-LTN locations, car usage has dropped significantly, with an even 45% reduction in difference across weekdays and weekends on Hurst Street. There is little variation in the pattern of the change by time of day or week.

123. Only the Marston Street bollard was out during the period of analysis for Hurst Street. This location is unlikely to have affected flows on Hurst Street, as the two are not connected, but may have caused some small changes in vehicle flows in the period of analysis.

Motorbikes

Table 29 - Motorbike VivaCity analysis for in-LTN roads, In + Out, Weekday + Weekend

Road	Motorbike, In + Out, Weekday + Weekend				
	2019	**before**	**after**	**diff.**	**impact**
Divinity Road north	**	200	192	-4.0%	-24.7%
Leopold Street west	27	37	35	-5.4%	-26.3%
Total		**237**	**227**	**-4.2%**	**-25.1%**

124. Motorbike counts have decreased very slightly, but the change is not statistically significant. The impact is more pronounced when compared to the set of control roads, however, as motorcycle use has generally increased. This slight reduction for the two count locations is unexpected. However, the ATC counts show increases where data is available (see table 30).

Table 30 - Motorbike ATC analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

Road	Motorcycle, In + Out			
	Weekday + Weekend			**Weekday**
	before	**after**	**diff.**	**diff.**
Jeune Street	48	63	+32%	+31%
Cross Street	63	89	+42%	+56%
Minster Road	13	16	+24%	+25%
Southfield Road	89	136	+54%	+57%
Stanley Road	10	13	+32%	+25%
Magdalen Road (Iffley Road)	*	*	*	*
Magdalen Road (Cowley Road)	279	351	+26%	+28%
Hertford Street	*	*	*	*
Charles Street	21	30	+42%	+31%
Howard Street	*	*	*	*
Average	**75**	**100**	**+34%**	**+36%**
Total	**596**	**798**	**+34%**	

**Some motorcycle counts excluded with one of the surveys showing strong anomalous counts in these locations*

125. The daily average motorcycle counts generally showed an increase in volumes between 24% and 54% across all locations, and an average increase of 34%. The traffic restrictions do not physically prevent motorcyclists travelling through. Therefore, it is likely that the combination of the reduced levels of car traffic within the LTNs, alongside the general increases in traffic on the boundary roads nearing The Plain on Cowley and Iffley Roads would make these routes more attractive to motorcyclists. Whilst it is worth noting that increases in delivery of food by motorcycle post COVID-19 have increased, this is unlikely to account for the changes between 2021 and 2022, since the majority of increase in delivery services occurred prior to 2022. Some sources suggest that the market share of delivery services actually decreased in 2022 compared to 2021, as consumers favoured click and collect options to save on delivery costs[xix].

LGVs

Table 31 - LGV VivaCity analysis for in-LTN roads, In + Out, Weekday + Weekend

	LGV, In + Out, Weekday + Weekend				
Road	**2019**	**before**	**after**	**diff.**	**impact**
Divinity Road north	**	550	110	-80.0%	-77.9%
Leopold Street west	151	101	80	-20.8%	-18.3%
Total		**651**	**190**	**-70.8%**	**-68.8%**

Table 32 - LGV ATC analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

	LGV, In + Out			
	Weekday + Weekend			Weekday
Road	**before**	**after**	**diff.**	**diff.**
Jeune Street	25	90	+265%	+256%
Cross Street	223	55	-75%	-75%
Minster Road	32	34	+7%	-1%
Southfield Road	95	44	-53%	-51%
Stanley Road	41	33	-19%	-23%
Magdalen Road (Iffley Road)	311	199	-36%	-39%
Magdalen Road (Cowley Road)	427	75	-83%	-83%
Hertford Street	34	33	-3%	0%
Charles Street	72	78	+8%	-2%
Howard Street	205	20	-90%	-92%
Average	**146**	**66**	**-55%**	**-56%**
Total	**1,611**	**727**	**-55%**	

126. LGVs follow a similar trend to cars, with an overall decrease in volumes of 55%. The five ATCs recording highest flows in 2021 saw significant decreases of between 36% to 90%. Jeune Street saw a large increase of 265% from being the ATC site with the lowest flows to the second highest. The other four ATC sites measured small decreases in volume of between 8% to 19%.

Table 33 - LGV and HGV (heavy vehicles) Telraam analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

	Heavy vehicles, In + Out			
	Weekday + Weekend			Weekday
Road	**before**	**after**	**diff.**	**diff.**
Hurst St	95	76	-20%	-25%

127. Heavy vehicle movements, which cover both LGV and HGV types within this dataset (table 33), have also reduced on Hurst Street, with a reduction in volume of 20%. The reduction over weekdays is slightly greater than during the weekend, showing a 25% volume decrease.

HGVs

Table 34 - HGV VivaCity analysis for in-LTN roads, In + Out, Weekday + Weekend

Road	HGV, In + Out, Weekday + Weekend			
	2019	before	after	diff.
Divinity Road north	**	4	4	0.0%
Leopold Street west	3	2	2	0.0%
Total		**6**	**6**	**0.0%**

128. The count numbers for HGVs have not changed between baseline and implementation periods in the locations monitored by VivaCity sensors but are too low to be statistically significant and for conclusions to be drawn.

Table 35 - HGV ATC analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

Road	HGV, In + Out			
	Weekday + Weekend			Weekday
	before	after	diff.	diff.
Jeune Street	6	14	+139%	+184%
Cross Street	44	15	-66%	-68%
Minster Road	8	11	+29%	+34%
Southfield Road	32	22	-32%	-33%
Stanley Road	7	8	+19%	+14%
Magdalen Road (Iffley Road)	61	50	-18%	-17%
Magdalen Road (Cowley Road)	120	48	-60%	-64%
Hertford Street	7	12	+87%	+75%
Charles Street	15	18	+24%	+15%
Howard Street	56	37	-35%	-45%
Average	**36**	**23**	**-34%**	**-37%**
Total	**391**	**258**	**-34%**	

129. HGV flows followed similar trends to car and LGV flows, with some exceptions (table 35). The five ATCs with highest 2021 counts saw significant decreases of between 18% to 66% in volume, whilst the findings also showed an average overall decrease of 34% in volume. The other five ATCs all saw increases in HGV volumes from 19% to the highest of 139% on Jeune Street, although the volume of HGVs is much lower than other vehicles, so small absolute changes show high percentage changes.

Table 36 - HGV ATC with CCTV analysis for in-LTN roads, In + Out, Weekday/Weekend comparison

Road	HGV, In + Out				
	Weekday + Weekend				Weekday
	before	after	diff.	impact	diff.
James Street	139	54	-61%	-37%	-62%
Bullingdon Road	99	45	-55%	-31%	-54%
Total	**237**	**99**	**-58%**	**-34%**	

130. HGVs also followed a decreasing trend, although reductions were more similar than for cars and LGVs across the two roads. James Street and Bullingdon Road HGV flows decreased by 61% and 55% respectively, with impact estimates of -37% and -31% when taking into account the control decrease of 24%.

Traffic Volume Analysis Summary

131. Whilst it is not possible to aggregate the results from all the different data sources together into a single metric to look at overall increases or decreases, it is possible to combine the data from compatible sensors. As such, to provide a high-level indication of the overall changes across both boundary roads and in-LTN, the VivaCity data for the three major modes of transport covered above: car, cycle and pedestrian, are aggregated together (see table 37).

Table 37- Summary of VivaCity counts, boundary roads and in-LTN by mode of transport

	All roads, In + Out, Weekday + Weekend		
Mode	**before**	**after**	**diff.**
Pedestrian	22,024	21,688	-1.5%
Cycle	9,478	11,551	+21.9%
Car*	51,475	45,666	-11.3%

**Note that proxy data for St. Clement's Street is not included within this summary*

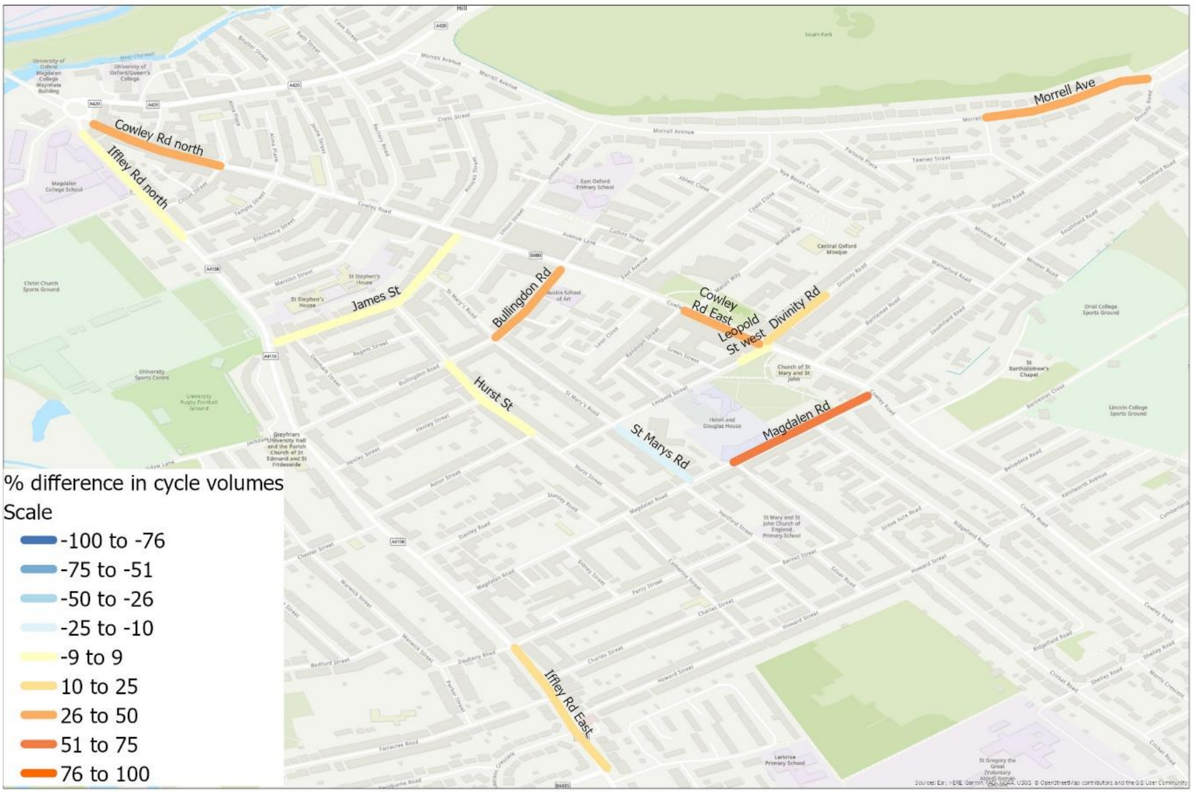
132. It should be stressed that this metric is only an indication, as not all locations are covered. As outlined above, some of the more significant changes for some modes of transport were experienced in locations with non-compatible data sources, such as Bullingdon Road and Magdalen Road, and there are of course also locations where no data is available. The overall changes are therefore likely to be different from those outlined above. However, it can provide an indication of the likely overall impact, which is generally positive. Cycling has seen an overall increase of 21.9% across the VivaCity sensor locations, whilst car use has decreased by 11.3%. Overall pedestrian change is the only small negative, with a slight decrease of 1.5%, though given the locations which experienced more significant increases in pedestrian movements are not included here, the likelihood is that overall change is more towards 0%.

133. The overall figures outlined in table 37 suggest that there is a moderate level of vehicular traffic evaporation; noting that the locations not covered within this summary table include several within the LTNs which have generally experienced decreases in traffic levels, the evaporation may be more significant in reality. Without a network-wide evaluation, however, it is not possible to assess to what degree it is caused by the combination of modal shift, re-routing or total avoidance of travel.

134. Figure 10 provides an overview of the car changes across the boundary roads and in-LTN area for all data sources covered in the previous sections. And figure 11 provides an overview of the cycle changes across the boundary roads and in-LTN area for all data sources covered in the previous sections.

Figure 10 - Overview of car volume changes across east Oxford LTN from all available data sources

Figure 11 - Overview of cycle volume changes across east Oxford LTN from all available data sources



Active Travel impact on Health

135. Whilst it has not been possible to measure changes in health outcomes from the LTNs due to the timeline involved in this evaluation, since a minimum of three years would be needed to make any meaningful analysis of health outcomes and a ten-year timeline would really be needed for greater confidence in any outcomes at a population level, it is widely accepted that active travel is positive for health, both physical and mental. As such, health agencies generally recommend 30 minutes or more of moderate-intensity physical activity on most days of the week for good health[xx]. These recommendations correspond to weekly energy expenditures of about 750 kcal, over basal (maintenance) levels, and are associated with around 30% reductions in mortality from any cause, cardiovascular disease and type 2 diabetes[xxi].

136. Active travel has also been shown to have beneficial outcomes for different age groups. As was noted in the *Local Information* section of this report, paragraph 39, childhood obesity levels in the intervention area are relatively high. Regular active travel can help to lower children's BMI. A study tracked over 8,000 school children for several years and found that those who switched to walking and cycling to school between the ages of 7 and 14 had healthier body weights (BMI) than those who continued to travel by car[xxii]. At the other end of the age spectrum, being physically active in old age is associated with numerous positive health outcomes, such as lower incidence of cognitive impairment, depression, dementia, coronary heart disease, some types of cancers, diabetes, stroke and hypertension[xxiii]. As noted previously, cycling levels have increased generally in the area, indicating that other populations are impacted by the various changes associated with active travel.

137. Schemes which support increased uptake of active travel can therefore be beneficial to longer term health outcomes. When considering the results of the LTNs in terms of impact on active travel, there is a mixed picture. Whilst there are increases in cycling along boundary roads, within the LTNs some areas have experienced increases and others decreases. Overall, however, the changes in cycling have been positive, with around a 20% increase (based on aggregating data across compatible sensors). Whilst the LTNs do seem to have effected change, due to other interventions (e.g., Quickways) implemented in the area at the same time, it is difficult to say which intervention is responsible for the positive increases in cycling, and to what degree.

138. For pedestrians, the picture is less positive. Whilst some locations have seen increases – notably Bullingdon Road – some have experience little or no change and others have seen slight reductions in footfall. There are some possible indications that where there are potential trip attractors nearby, footfall has gone up within the LTNs and in some boundary road locations, but it is not clear cut. In total though, when aggregating the data across compatible sensors, pedestrian use has experienced little to no change. It is worth noting that walking has increased at control sites both for the boundary roads and in-LTN locations, indicating that comparatively pedestrian uptake has likely fallen slightly.

139. Overall, therefore, it is reasonable to conclude that there should be some positive impacts on health from the changes in active travel brought about by the LTNs, but the extent is likely to be only moderate based on the evidence available.

140. The above does not, however, take into account the fact that behaviour change can take a significant amount of time to occur. There is some indication of the increases in cycling continuing over time – the uptake in cycling is consistently higher in percentage difference in the evaluation undertaken for the boundary roads in this report than it was in the previous snapshot evaluation, which took a shorter period post-intervention than the current analysis. However, this should be taken in the context of the additional data falling after the Botley Road closure, which will have also impacted on choice of transport. As such, the impact estimate should be used in this context (bringing in comparison with control sites), which indicates that further increases in cycling have been achieved in some, but not all, locations measured.

141. Changes in travel behaviour, whilst supported by improvements to infrastructure, have a greater impact at points of change within a person's life – for example, a change in job, home, education, caring, or period of major transport disruption[xxiv]. The LTNs accompanied by the Quickways can be argued to fulfil the disruption element for some types of journey and the improved infrastructure, thus providing the ingredients required to support modal shift. However, studies suggest that a more comprehensive approach to behavioural change is needed – to achieve modal shift to active travel, interventions are needed at multiple levels: society, city, neighbourhood and individual.[xxv] As wider interventions are put in place across these different levels, they should interact together to enable greater uptake of active travel schemes; as such, and as the population experiences further life changes over time, further increases may be seen over time.

Journey times (driving)

Analysis approach

142. Evaluation of journey times was undertaken for selected boundary road segments in east Oxford between 01 January 2022 to19 May 2022 (baseline pre-LTN) and 01 January 2023 to 19 May 2023 (post-LTN intervention period). St Clement's Street and Morrell Avenue had shorter periods for comparison owing to data availability of earliest google API query: 20 April 2022 to 19 May 2022 (baseline pre-LTN) and 20 April 2023 to 19 May 2023 (post-LTN intervention period). Please note that during this time – from 11 April 2023 – the Botley Road was closed to traffic (related to the redevelopment of Oxford railway station and replacement of the rail bridge over the Botley Road). The following weekday daily time-periods were used to query Google Maps API to estimate the duration for each road segment in both directions:
    - AM-peak (7:45am)
    - Afternoon-peak (3pm)
    - PM-peak (4:45pm)
    - Evening off-peak (7:45pm).

143. Difference is shown as a percentage based on the comparative evaluation periods as stated. Where speed is referenced, this is an indicative metric based on the median journey time and distance of the road segment and should not be used as an indication of speeding.

144. Control sites were not included in the evaluation as an increase/decrease in journey times in one location would not be expected to be comparable with journey times at another location. This is because of the complexity of factors (some examples below) that influence journey times which are relative to each road and their influence is variable depending on time of day as well as direction:
    - The east side of the city is a major area of employment compared to the west side of the city – including three major NHS hospital sites plus additional private and smaller sites, Oxford Brookes University main campus, Oxford Business Park (south), Unipart, and the BMW Mini Plant.
    - Other attractors such as school sites with different drop-off and pick-up times.
    - The node of The Plain roundabout has a significant impact, as it acts as a bottleneck between west and east sides of the city.
    - Areas with greater/lesser numbers and types of amenities causing greater or lesser need to travel.
    - Differences in the provision of public transport, both in terms of frequencies of services and routes covered.

145. The lack of control data influenced the time periods used for pre- and post-implementation periods, choosing equivalent periods to minimise background variation caused by seasonality and data from after the beginning of 2022 to minimise influence from the aftermath of the COVID-19 pandemic. However, it is not possible to assign all changes in journey times to the implementation of the

LTNs – other changes (both local and global) between the baseline and intervention periods will also have impacted on the journey times.

146. To estimate duration, Google Maps combines its database of historical traffic patterns for roads over time with live traffic conditions, using machine learning to then generate predictions of journey times based on both sets of data. The data outputs from the Google API can be seen in the following maps with a full breakdown of all the selected roads in Annex I.

Towards The Plain

Journey time analysis

147. Table 38 below is to be used to interpret the map outputs for the boundary roads segments in the direction towards The Plain roundabout (as seen in figure 12). The multiplier roads (direction east to west) are also included to understand the estimated cumulative impact of both Cowley and east Oxford LTNs.

Table 38 - Road segments used in journey time analysis

map_id	Boundary road segments (towards The Plain)	
EO.1r	St Clement's Str	Top of Morrell Av to The Plain Roundabout
EO.2r	Morrell Av	Roundabout Warneford L up to St Clement's Str
4	Cowley Rd	Magdalen Rd to The Plain
6	Cowley/Oxford Rd	Hollow Way to Magdalen Rd
8	Garsington Rd (B480)	Eastern Bypass to Hollow Way
12	Iffley Rd	Donnington Bridge Rd to The Plain
14	Iffley/Henley Av	Church Cowley Rd to Donnington Bridge Rd
16	Henley Av/Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd
	Multiplier roads (east to west)	
18	Between Towns Rd	Cowley Rd to Iffley Rd
20	Hollow Way	Horspath Driftway to Cowley Rd
22	Donnington Bridge Rd	Iffley Rd to Abingdon Rd

Figure 12 - Percentage difference in Journey time by time of day for each boundary road segment - towards 'The Plain roundabout' direction

148. The percentage difference in journey time across all peak times, as shown in Figure 12 for in-bound roads (towards The Plain roundabout), was significantly higher in St Clement's Street compared to the other road segments. The Afternoon-peak shows an increase of 290% (an additional 3 mins 29 secs to the pre-LTN journey time of 1 min 12 secs) and PM-peak an increase of 242% (an

additional 5 mins 34 secs to the pre LTN journey time of 2 min 18 secs). This was also reflected in a reduction in median journey speed from 12mph to 6mph at AM-peak, 12mph to 3mph at Afternoon-peak, and 6mph to 2mph at PM-peak.

149. In terms of other boundary road segments with significant increases, Iffley Road – Donnington Bridge Road to The Plain – with a 61% increase at AM-peak (an additional 2 mins 33 secs to the pre-LTN journey time of 4 min 12 secs), and Cowley Road (B480) – Magdalen Road to The Plain – with a 63% increase at PM-peak (an additional 2 mins 39 secs to the pre-LTN journey time of 4 min 11 secs). Conversely, there were moderate percentage decreases in IffleyRoad/Henley Avenue – Church Cowley Road to Donnington Bridge Road – at AM-peak (-26%, a decrease of 41 secs from the pre-LTN journey time of 2 min 36 secs), and at PM-peak (-17%, a decrease of 22 secs to the pre-LTN journey time of 2 min 13 secs). This is in line with the findings of reduced traffic volumes along this stretch of road, as outlined in the *Boundary Road/Cars* analysis section.

150. On the multiplier roads (from east to west direction), there were slight increases at AM-peak and Afternoon-peak across all multiplier road segments. The highest % increase was seen at Hollow Way – Horspath Driftway to Cowley Road – of 62% at PM-peak (an additional 2 mins 50 secs to the pre-LTN journey time of 4 min 34 secs). This was also reflected in a decrease in median journey speed from 11mph to 7mph at PM-peak.

Reliability using Planning Time Index scores

151. Planning Time index (PTI), which is typically used as a measure of reliability, represents the extra delay time that should be added to average travel time. PTI is the ratio of the 95th percentile to the free-flow travel time and shows the total time which is needed for on-time arrival in 95% of all trips. A PTI value of 2.0 for a given period suggests that travellers should spend twice as much time traveling as the free-flow travel time to reach their destination on-time 95% of the time. In this evaluation PTI was applied to the journey time data at both pre- and post-intervention evaluation periods, in order to provide a baseline indication of reliability before the LTNs were implemented. The free flow time used in the PTI calculation was the median evening journey time.

Table 39 - Planning Time Index (PTI) with reliability ranges and colour key for pre-PTI and post-PTI table values

Unreliable		>1.7
Moderately unreliable		1.31 to 1.7
Reliable		1.0 to 1.3

Table 40 - Planning Time Index for Journey time by time of day and for each boundary road segment – towards 'The Plain roundabout' direction.

Boundary road segments (towards 'The Plain roundabout')		AM-peak		
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
St Clements Str	The top of Morrell Av to The Plain roundabout	2.46	3.97	+61.3%
Morrell Av	Roundabout on Warneford L up to St Clements Str	1.32	1.64	+24.5%
Cowley Rd	Magdalen Rd to The Plain	1.73	2.32	+34.1%
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	1.98	2.10	+5.8%
Garsington Rd (B480)	Eastern Bypass to Hollow Way	3.91	3.69	-5.7%
Iffley Rd	Donnington Bridge Rd to The Plain	3.28	4.26	+30.1%
Iffley/Henley Av	Church Cowley Road to Donnington Bridge Rd	4.57	1.82	-60.3%
Henley Av/Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	2.00	2.74	+37.2%

Boundary road segments (towards 'The Plain roundabout')		Afternoon-peak		
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
St Clements Str	The top of Morrell Av to The Plain roundabout	1.57	5.29	+236.3%
Morrell Av	Roundabout on Warneford L up to St Clements Str	1.15	1.44	24.3%
Cowley Rd	Magdalen Rd to The Plain	1.39	2.97	+113.7%
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	1.56	1.44	-7.5%
Garsington Rd (B480)	Eastern Bypass to Hollow Way	1.58	1.73	+10.1%
Iffley Rd	Donnington Bridge Road to The Plain	1.36	1.53	+13.0%
Iffley/Henley Av	Church Cowley Road to Donnington Bridge Rd	1.84	1.51	-18.0%
Henley Av/Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	1.72	3.37	+96.5%

Boundary road segments (towards 'The Plain roundabout')		PM-peak		
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
St Clements Str	The top of Morrell Av to The Plain roundabout	5.03	8.25	+64.0%
Morrell Av	Roundabout on Warneford L up to St Clements Str	1.50	3.71	+147.7%
Cowley Rd	Magdalen Rd to The Plain	1.71	3.60	+110.6%
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	1.58	1.55	-2.3%
Garsington Rd (B480)	Eastern Bypass to Hollow Way	2.15	3.48	+61.8%
Iffley Rd	Donnington Bridge Road to The Plain	1.73	1.62	-6.1%
Iffley/Henley Av	Church Cowley Road to Donnington Bridge Rd	2.30	1.64	-28.7%
Henley Av/Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	2.37	2.99	+26.2%

152. As seen in the tables above, when comparing the PTI scores pre- and post- for the boundary road segments, in direct contrast with the out-bound roads, there was an overall 71% decline in reliability across all times of day. The most significant AM-peak decline in reliability was seen in St Clement's Street – from the top of Morrell Avenue to The Plain roundabout - up to 3.97 times the evening off-peak journey time from 2.46. However, in terms of pre- and post- LTN reliability range, St Clement's Street's PTI remained unchanged within the 'unreliable' range (>1.7). The 'unreliable' range does, however, encompass all

PTI values over 1.7, and therefore a wide range of reliability scores, whilst other ranges are smaller and discrete. For Afternoon-peak, St Clement's Street, Cowley Road from Magdalen Road to The Plain and Eastern Bypass to Hollow Way, saw a decline from pre-LTN reliability, 'moderately unreliable' to 'unreliable'. The most significant increase in difference was seen in St Clement's Street (1.57 to 5.29) followed by Cowley Road (B480) - from Magdalen Road to The Plain (1.39 to 2.97).

153. Henley Avenue/Rose Hill/Oxford Road - Eastern Bypass to Church Cowley Road – also saw a significant increase in its PTI score (1.72 to 3.37), however, the pre-LTN reliability range was unchanged from its previous range of 'unreliable'. For PM-peak, despite an increase in the PTI scores for St Clement's Street, Cowley and Garsington Road, the pre-LTN reliability range was unchanged for those road segments from its previous range of 'unreliable'. The most significant change in reliability was seen in Morrell Avenue (roundabout on Warneford Lane up to St Clement's Street), where the PTI reliability range declined from 'moderately unreliable' to 'unreliable' (1.5 to 3.71).

154. In terms of road segments that showed an improvement in reliability, Iffley/Henley Avenue – Church Cowley Road to Donnington Bridge Road – showed a positive change across all time periods, in line with the reduced vehicle movements along this segment. The highest difference in PTI was seen at AM-peak (4.57 to 1.82), whereas the Afternoon-peak saw an improved change in PTI reliability range; from 'unreliable' to 'moderately unreliable' (1.84 to 1.51).

Table 41 - Planning Time Index for Journey time by time of day and for each multiplier boundary road segment – direction (east to west)

Boundary Road Segments (east to west)		AM-peak		
Road	Road Segment direction	Pre PTI	Post PTI	PTI Diff
Between Towns Rd	Cowley Rd to Iffley Rd	1.91	3.26	+70.5%
Hollow Way	Horspath Driftway to Cowley Rd	3.11	3.26	+4.7%
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	2.05	2.80	+36.3%

Boundary Road Segments (east to west)		Afternoon-peak		
Road	Road Segment direction	Pre PTI	Post PTI	PTI Diff
Between Towns Rd	Cowley Rd to Iffley Rd	1.57	1.85	+18.1%
Hollow Way	Horspath Driftway to Cowley Rd	2.05	2.53	+23.5%
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	1.55	1.36	-12.1%

Boundary Road Segments (east to west)		PM-peak		
Road	Road Segment direction	Pre PTI	Post PTI	PTI Diff
Between Towns Rd	Cowley Rd to Iffley Rd	2.57	3.42	+33.3%
Hollow Way	Horspath Driftway to Cowley Rd	3.65	4.26	+16.7%
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	4.95	4.33	-12.4%

155. On the multiplier roads (running from east to west direction), apart from Between Towns Road – Cowley Road to Iffley Road – which saw a decline in reliability range (1.57 to 1.85), most roads were unchanged in terms of the pre-LTN PTI reliability range. The largest negative difference in PTI score was seen in Between Towns Road – Cowley Road to Iffley Road – (1.91 to 3.26) at AM-peak. There were also small improvements seen in Donnington Bridge Road - Iffley Road to Abingdon Road – at both Afternoon-peak (1.55 to 1.36) and PM-peak (4.95 to 4.33).

156. From the *Journey time analysis*, road segments with highest increase in journey time were located closest to and towards The Plain roundabout. The increases in journey times approaching The Plain on the Cowley and Iffley Roads may be expected, given the previously reported increased traffic volumes along these segments of road. However, the proxy data for St Clement's Street indicated a reduced in-bound volume at this location, which initially seems counter-intuitive, since this is the location experiencing the most significant journey time delays. Note that the effect of higher traffic volumes on Cowley and Iffley Roads has the impact of affecting the flows of traffic around The Plain roundabout. One aspect of note is that the turn from Cowley Road into Iffley Road is banned, and drivers must drive all the way around the roundabout to access Iffley Road from Cowley Road. Users travelling down Iffley Road wishing to access Cowley Road must also now use The Plain, since it is no longer possible to drive between Cowley and Iffley Roads using the 'ladder' roads. As such, road users exiting from St Clement's Street must give way to all other traffic from other arms of the roundabout, meaning few gaps to exit from St Clement's Street.

157. *

Away from The Plain

Journey time analysis

158. Table 42 below is to be used to interpret the map outputs for the boundary roads segments in the direction away from The Plain roundabout (as seen in figure 13). To understand the estimated cumulative impact of both Cowley and east Oxford LTNs, three multiplier roads (direction west to east) were also included:

Table 42 - Road segments used in journey time analysis

Map id	Boundary road segments (away from The Plain)	
EO.1	St Clement's Str	The Plain roundabout to the top of Morrell Av
EO.2	Morrell Av	St Clements Str, down to Warneford L. roundabout
3	Cowley Rd	The Plain to Magdalen Rd
5	Cowley/Oxford Rd	Magdalen Rd to Hollow Way
7	Garsington Rd (B480)	Hollow Way to Eastern Bypass
11	Iffley Rd	The Plain to Donnington Bridge Rd
13	Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd
15	Henley Av/Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass
	Multiplier roads (west to east)	
17	Between Towns Road	Iffley Rd to Cowley Rd
19	Hollow Way	Cowley Rd to Horspath Driftway
21	Donnington Bridge Rd	Abingdon Rd to Iffley Rd

These additional multiplier roads are included in the evaluation to help understand the combined and cumulative impact of the Cowley and east Oxford LTNs, as well as provide insight into some of the major feeder roads to the east Oxford LTN boundary roads.

Figure 13 - Percentage difference in Journey time by time of day for each boundary road segment – away from ‘The Plain roundabout’ direction

159. As seen in figure 13, overall, for the out-bound boundary road segments (<u>away</u> from The Plain roundabout), there was no significant difference in journey time. St Clement’s Street had the highest median percentage increase of 34% (an additional 26 secs to the pre LTN journey time of 1 min 15 secs), which was in the Afternoon-peak period. This was also reflected in a reduction in median

journey speed from 13mph to 9mph. Conversely, Morrell Avenue – from St Clement's Street towards the roundabout at Warneford Lane – showed a consistent small percentage decrease in journey times across all selected times of day, with AM-peak (-12%) and PM-peak (-10%) displaying the highest decreases. The road segment with the highest percentage decrease was Iffley Road – from The Plain to Donnington Bridge Road – with an 18% decrease (52 secs quicker than the pre-LTN journey time of 4 mins and 44 secs) at PM-peak. The median journey speed was also found to increase at this time from 11mph to 14mph. This may be due to the freeing up of capacity further along the Iffley Road, between Donnington Bridge Road and Between Towns Road, as indicated by the reduction in traffic volumes covered previously.

160. In terms of multiplier roads (from west to east direction), there was a slight percentage increase with a minimum of 8% to a maximum of 19% across both Between Towns Road and Hollow Way across all times of day. The highest increase was seen in Hollow Way Road – from Cowley Road to Horspath Driftway – with a 19% increase in journey time at AM-peak (an additional 43 secs to the pre-LTN journey time of 3min 45sec), and a reduction in median speed from 13mph to 11mph. Donnington Bridge Road – Abingdon Road to Iffley Road – experienced the only decrease in journey time, with a 22% decrease (45 secs quicker than the pre-LTN journey time of 3 mins 27 secs) and an increase in median journey speed from 13mph to 16mph at AM-peak.

Reliability using Planning Time Index scores

Table 43 - Planning Time Index for journey time by time of day and for each boundary road segment – away from 'The Plain roundabout' direction.

Boundary road segments (away from 'The Plain roundabout')		AM-peak		
Road	**Road segment/ direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
St Clements Str	The Plain roundabout to the top of Morrell Av	1.50	1.68	+12.4%
Morrell Av	St Clements Str, down to Warneford L. roundabout	1.24	1.16	-6.4%
Cowley Rd	The Plain to Magdalen Rd	1.11	1.10	-0.6%
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	2.87	3.05	+6.3%
Garsington Rd (B480)	Hollow Way to Eastern Bypass	1.36	1.29	-5.4%
Iffley Rd	The Plain to Donnington Bridge Rd	3.63	1.77	-51.3%
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	1.52	1.34	-11.8%
Henley Av/Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	2.01	1.49	-25.6%

Boundary road segments (away from 'The Plain roundabout')		Afternoon-peak		
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
St Clements Str	The Plain roundabout to the top of Morrell Av	1.42	1.91	+34.8%
Morrell Av	St Clements Str, down to Warneford L. roundabout	1.16	1.15	-0.4%
Cowley Rd	The Plain to Magdalen Rd	1.35	1.54	+14.2%
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	2.83	3.59	+27.1%
Garsington Rd (B480)	Hollow Way to Eastern Bypass	1.29	1.20	-6.8%
Iffley Rd	The Plain to Donnington Bridge Rd	1.65	1.32	-20.3%
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	1.50	1.37	-9.0%

Henley Av/Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	1.86	1.29	-30.8%

Boundary road segments (away from 'The Plain roundabout')		PM-peak		
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff
St Clements Str	The Plain roundabout to the top of Morrell Av	1.72	1.95	+13.5%
Morrell Av	St Clements Str, down to Warneford L. roundabout	1.23	1.22	-0.9%
Cowley Rd	The Plain to Magdalen Rd	1.61	1.56	-3.4%
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	3.07	2.60	-15.2%
Garsington Rd (B480)	Hollow Way to Eastern Bypass	1.63	2.85	+75.1%
Iffley Rd	The Plain to Donnington Bridge Rd	5.35	1.75	-67.2%
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	2.48	1.78	-28.1%
Henley Av/Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	3.13	1.44	-54.0%

161. As seen in the tables above, when comparing the PTI scores, pre- and post-LTN implementation for the out-bound Boundary Road Segments (away from The Plain roundabout), there was an overall 10% improvement across all times of day. The most significant AM-peak improvements were seen on Iffley Road – The Plain to Donnington Bridge Road – from 3.63 down to 1.77 times the Evening off-peak journey time. At Afternoon-peak, the most significant improvement was seen in Henley Avenue/ Rose Hill/Oxford Rd - Church Cowley Road to Eastern Bypass, where the PTI moved into the 'reliable' range of 1 to 1.3 (1.29). For PM-peak, there were improvements across all sections of Iffley Road/Henley Avenue. Whilst the highest improvement was seen at The Plain to Donnington Bridge Road segment (5.3 to 1.75).

162. In terms of road segments, with a decline in reliability, St Clement's Street – The Plain roundabout to the top of Morrell Avenue – showed a negative change across all time periods. However, apart from the Afternoon-peak PTI (1.42 to 1.91), all other time periods had the same reliability range (moderately unreliable, 1.31 to 1.7; unreliable, > 1.7) after the east Oxford LTNs were implemented.

Table 44 - Planning Time Index for journey time by time of day and for each multiplier boundary road segment – direction (west to east)

Boundary Road Segments (west to east)		AM-peak		
Road	Road Segment direction	Pre PTI	Post PTI	PTI Diff
Between Towns Rd	Iffley Rd to Cowley Rd	2.00	1.89	-5.4%
Hollow Way	Cowley Rd to Horspath Driftway	2.09	2.26	+8.1%
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	4.75	1.54	-67.5%

Boundary road segments (west to east)		Afternoon-peak		
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
Between Towns Road	Iffley Rd to Cowley Rd	1.88	2.07	+10.2%
Hollow Way	Cowley Rd to Horspath Driftway	1.52	1.49	-2.0%
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	1.57	1.26	-19.5%

Boundary road segments (west to east)		PM-peak		
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**
Between Towns Road	Iffley Rd to Cowley Rd	1.87	1.88	+0.6%
Hollow Way	Cowley Rd to Horspath Driftway	1.54	1.49	-3.0%
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	2.30	1.50	-34.7%

163. On the multiplier roads (running from a west to east direction), the Donnington Bridge Road - Abingdon Road to Iffley Road – showed the most consistent improvement across all times of day. Whilst the AM-period had the highest percentage difference (-67%), the Afternoon-peak PTI moved into the reliable range (from 1.57 to 1.26). There was a slight decrease in PTI score in Hollow Way Road, but this had no impact on the reliability range prior to the implementation of the east Oxford LTNs.

Journey Time full road overview

Table 45 - Difference in journey time (secs) for road segments and along entire in-bound road length

Boundary roads/ segments (towards 'The Plain roundabout')	Weekday difference in duration -/+ secs			
Road segment/Road name	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
From Morrell Avenue to The Plain roundabout	+83	+209	+334	+18
St Clements Str total	**+83**	**+209**	**+334**	**+18**
From roundabout Warneford Lane up to St Clements St	-4	+1	+59	-9
Morrell Av total	**-4**	**+1**	**+59**	**-9**
Magdalen Rd. to The Plain	+54	+73	+159	+15
Hollow Way to Magdalen Rd	+25	+13	+19	+15
Eastern Bypass to Hollow Way	+5	+2	+49	+1
Cowley to Garsington Rd (B480) total	**+83**	**+88**	**+226**	**+31**
Donnington Bridge Rd to The Plain	+153	+23	+2	+11
Church Cowley Rd to Donnington Bridge Rd	-41	-4	-22	+8
Eastern Bypass to Church Cowley Rd	+36	+46	+27	+5
Iffley to Oxford Rd total	**+148**	**+65**	**+7**	**+24**

164. As seen in the table above, when considering the total road length in the direction towards The Plain, St Clement's Street and Cowley Road experienced the highest increase in journey times. In St Clement's Street, the highest increases were seen at Afternoon-peak and PM-peak; a median average of an additional 3min 29secs added to the pre-LTN journey time of 1min 12secs at Afternoon-peak, and a median average of an additional 5min 34secs added to

pre-LTN journey time of 2min 17 secs at PM-peak. Increases were also found along Cowley Road at PM-peak and Iffley Road at AM-peak.

165. The difference in impact at different times of day between routes is likely to be affected by patterns of use of other roads. For instance, The Plain has limited capacity, and any concentrated movements at this time are likely to affect delays both around The Plain and its feeder roads. Concentrated movements in this context could be attributed to large numbers of staff and students accessing universities and schools. This could partially explain AM-peak delays on Iffley Road which is particularly concentrated at this time of day. However, as the pick-up times are more dispersed (staggered due to after school/university activities etc), the impact at PM-peak is likely to be less of a contributary factor.

Bus Journey Time and Reliability

Analysis approach

166. Evaluation of the impact on bus times was undertaken for selected boundary road segments in east Oxford between 01 November 2019 to 30 November 2019 (baseline pre-LTN) and 01 November 2022 to 30 November 2022 (post-LTN intervention period). 2019 was chosen as the baseline year, owing to the impact of COVID-19 on comparable transport usage. According to DFT[xxvi], motor vehicle usage from May 2022 to September 2023 had returned to 2019 (pre-COVID levels), although as noted in Annex L, traffic in Oxford is still lower in 2023 than it was in 2019. Bus patronage levels also increased, but at the last reported publishing period (August 2023) were still lower than pre-COVID baseline period (74% August 2023). However, a continual increase in bus patronage over the LTN evaluation period will affect bus service frequencies; for example, impacting on journey times since more buses, whilst contributing to reduced car movements, can cause an increase in general traffic and congestion levels in some contexts. In addition, there were fewer buses per hour running along the routes of interest in 2022 than there were in 2019, this ensures that any journey time increases are not being caused by increased bus frequencies causing congestion. The St Clement's Street route is used by multiple bus services and is therefore more sensitive to changes in frequency and patronage affecting traffic delays. This may be attributed to more passengers getting on and off buses along St Clement's Street – as there was not a bus lane in this location during the period of this analysis, this can also lead to traffic delays for all vehicle types. It is also worth noting that a bus lane has been implemented in the in-bound direction in this location post the data analysis period of this report. The effects of this new bus lane have not been considered as part of this evaluation.

167. November was chosen as the period for analysis as it provides a likely 'worst case scenario' for the bus journey times. November is a time of year when vehicular travel is generally high in Oxford, as students are in residence and poorer weather discourages active travel. The analysis is focused on weekdays and was taken for the following daily time-periods in both directions: AM-peak (7am to 9am), Afternoon-peak (3pm to 3:30pm), PM-peak (4pm to 7pm); Evening off-peak (7pm to 11:59pm).

168. The data source used in the analysis was taken from CitySwift's runtime analysis dashboard for the Oxford SmartZone[21] area, a product designed in collaboration with Oxfordshire County Council, Stagecoach Oxfordshire and the Oxford Bus Company.

169. As with the previous *Journey times (driving)* analysis, controls sites were not used as part of this evaluation, for the reasons previously discussed. In addition, numerous changes have occurred since 2019 that have added to the complexity of being able to untangle and make robust comparisons using controls. For example, service route and frequency changes following the pandemic. It should

[21] The Smartzone area covers all the Oxford Bus Company, Stagecoach, Thames Travel or Arriva bus routes operating in and around Oxford City, a map is available here.

be noted that due to the changes between 2019 and 2022, it is not possible to assign all bus journey time and reliability changes outlined in the analyses below to the introduction of the LTNs. Several services included within the datasets ran from one side of the city to the other prior to COVID-19. During the pandemic, most cross-city services were stopped and half the route re-numbered starting from the City Centre. One such example is the 4A service, which used to run from the west side of the city via the Botley Road, through the city and along St Clement's Street out to Wood Farm via Morrell Avenue. This service became the 15 from the city centre to Wood Farm when the route was split. It remains split in 2022, which may affect journey times between the two periods covered. The use of runtime as the metric is defined as the average time it takes to move from one stop to the next but excludes dwell time.

Change in stop-to-stop runtime metric

170. The main metric used in this evaluation to analyse bus times was taken from the CitySwift's dashboard – 'Change in Stop-to-Stop Runtime', which shows the averaged change in runtime recorded since the previous stop (departure to arrival) and the percentage change in average stop-to-stop runtimes across two periods (baseline and post-LTN implementation). The stop-to-stop runtime calculation includes all the services that visit each stop-pair, and accounts for the increase/decrease of services across two periods along a particular corridor/road. A full break-down of all stop pairs by road can be seen in Annex J.

171. Stops which did not have times in both comparative time-periods were not included in the analysis. The results of the analysis are shown as a percentage difference in time taken between stops pairs and in both directions from the following roads shown in table 46:

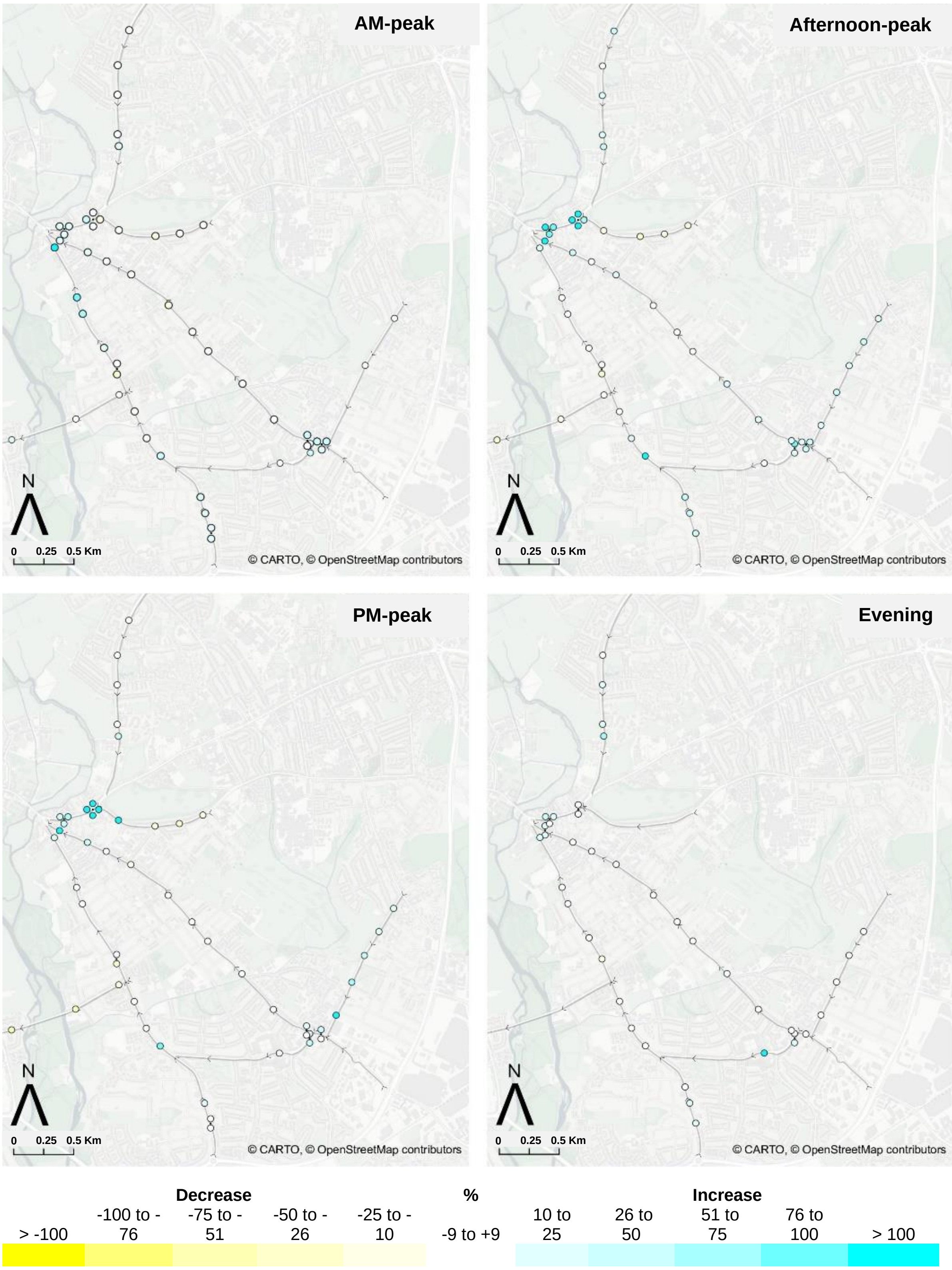
Table 46 - Road segments used in bus time analysis

Boundary roads		Multiplier roads
Cowley Rd: Cowley/Oxford/ Garsington Rd (B480)		Between Towns Rd
Iffley Rd: Iffley/Henley Avenue/Rose Hill/Oxford Rd		Donnington Bridge Rd
Marston Rd		Hollow Way
Morrell Avenue		
St Clements Str		

172. Where there are multiple previous stops going to the same stop, this is indicated on the following runtime maps as clusters around a point, as well as reflected in the breakdown tables in Annex J.

Towards The Plain

Figure 14 - Percentage difference in stop-to-stop runtime: In-bound and multiplier roads (east to west)



173. Overall, as seen in figure 14 (and in Annex J), for the stops in an inward direction towards The Plain, on roads closest to The Plain roundabout and

towards the ring road (e.g., close to Hollow Way/Between Towns Road) experienced the highest increases in runtime difference. Stops nearest to The Plain roundabout experienced the highest of these percentage increases; The Plain stop on Cowley Road (previous stop Stockmore Street) increased by 167% (an additional average 1min 19secs compared to 48secs in 2019) at Afternoon-peak, and 146% (an additional average of 1min 23 secs compared to 57secs in 2019) at PM-peak. The Plain stop on Iffley Road (Previous stop James Street) had an increase of 149% (an additional average of 2mins 33secs compared to 1min 43secs in 2019) at AM-peak. The difference in speed also aligned with these findings, as average speeds of 10mph in 2019 for the stops mentioned, dropped to an average of 4mph for the post-LTN period.

174. The road with the highest percentage increases as well as high levels of percentage increases across all stops at both Afternoon-peak and PM-peak times was St Clement's Street. The runtime data showed Glebe Street stop to have percentage increases between 61% and 258% during Afternoon-peak and PM-peak times respectively. The highest percentage increase in runtime was at PM-peak, with a 258% increase in duration from the previous stop of Brookes University Stop. This meant an average additional 7mins 9secs compared to 2mins 45secs in 2019. This finding also aligned with the change in speed which showed an average decrease from 13mph in 2019 to 4mph in 2022.

175. The data showed small to moderate decreases in the middle sections of Cowley Road and Iffley Road stops (-2% to -33%) during peak times, as well as decreases on Morrell Avenue stops, with an average 20% decrease at Afternoon-peak across all stops. Improvements in runtime along Morrell Avenue may be partly due to the removal of parking spaces along its length. The on-street parking previously required buses to wait for oncoming traffic to pass before they could pull out, creating delays to journeys at busier times.

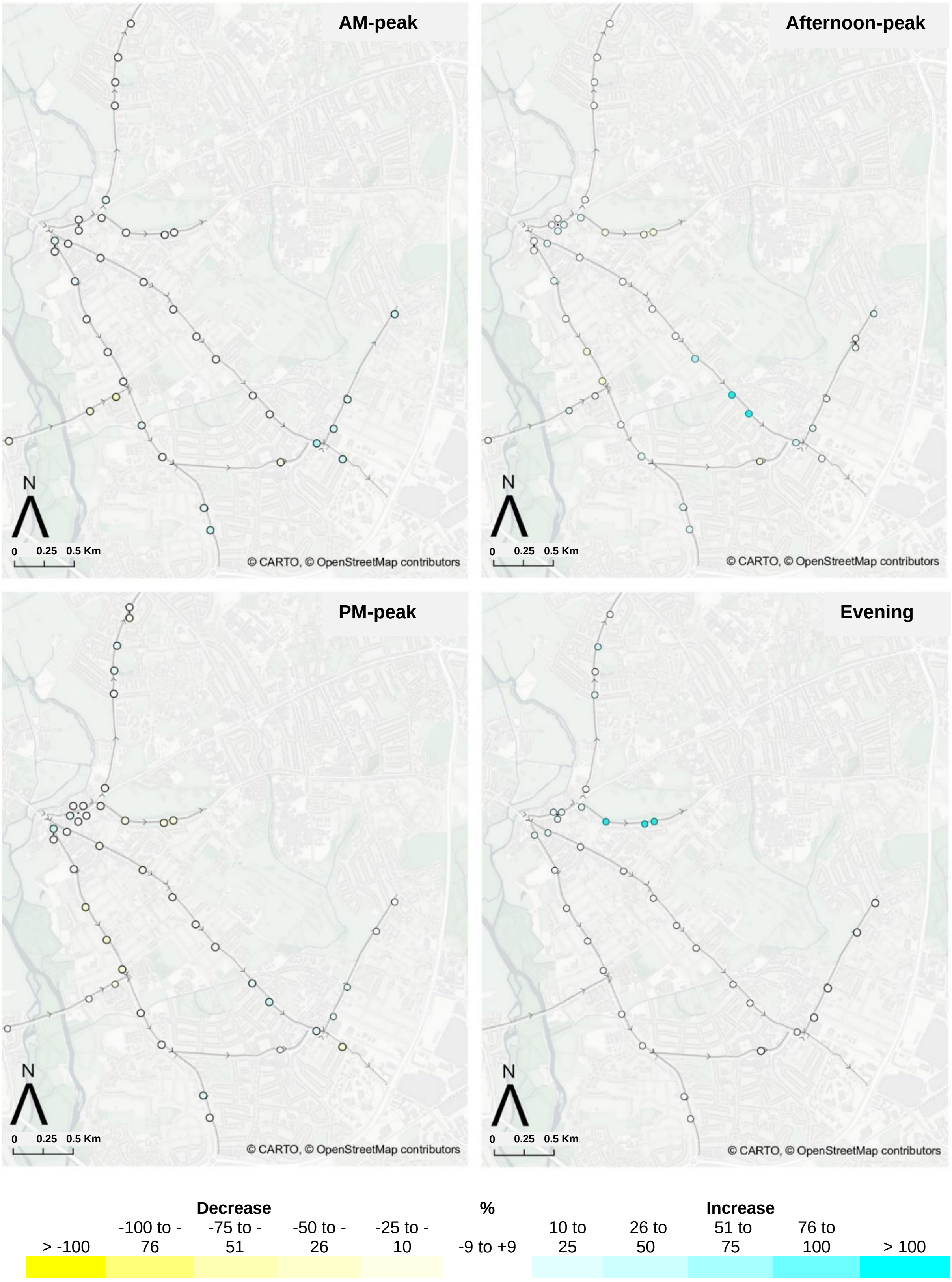
176. On multiplier roads (from east to west direction), overall moderate to large percentage increases in runtimes were seen across all stops on Between Towns Road, (an average min of 19% to max 72% increase was seen across all time periods), and across all stops on Hollow Way Road, mainly at Afternoon-peak and PM-peak (an average min of 21% to max 67% increase). The highest off-peak time individual stop increase was seen on Templars Square (previous stop The Original Swan) in the evening, with a 201% average increase in runtime (an additional average of 1min 52secs to the 37secs runtime in 2019). In terms of peak times, Fernhill Road stop (previous stop Crescent Hall) on Hollow Way at PM-peak had the highest increase of 177% (an additional average of 2min 6secs to the 1min 11secs runtime in 2019). Whilst the average speed for Templars Square on Between Towns Road was shown to be similar to 2019 levels (12.9mph in 2019 and 13.5mph), findings for Fernhill Road stop on Hollow Way showed a significant reduction in average speed; 9.2mph down to 3.4 mph.

177. The main percentage decreases were seen on stops along Donnington Bridge Road at Afternoon-peak (an average -19% across all stops) and PM-peak (an average -42% across all stops). The highest individual stop percentage decreases were seen at PM-peak on the Donnington Bridge stop (-52%) and Weirs Lane stop (-55%). These decreases in runtime resulted in an average

reduction of 58secs from 1min 51secs in 2019 on Donnington Bridge stop, and an average reduction of 1min 47secs from 3min 17secs in 2019 on the Weirs Lane stop. At PM-peak, Donnington Bridge stop (10mph in 2019 up to 20mph) and Weirs Lane stop (9mph in 2019 up to 17mph) also experienced significant increases in average speed between their respective previous stops.

Away from The Plain

Figure 15 - Percentage difference in stop-to-stop runtime: Out-bound and multiplier roads (west to east)



178. As seen in figure 14 (and in Annex J), for the stops in an <u>outward</u> direction away from The Plain, the roads with the highest increase in runtime were Cowley

Road and Morrell Avenue. Cowley Road had 3 stops with an increase over 70%: Marsh Road, Clive Road and Shelley Road at Afternoon-peak. Marsh Road stop (previous stop Shelley Road) had the highest increase of 167%, with an average additional 2mins 12secs to the previous 1min 19sec average runtime in 2019. This was also reflected in the average speeds recorded (not including dwell time), which significantly reduced from 12mph in 2019 to 4mph.

179. In the evening, stops on Morrell Avenue also showed significant increases in runtime: East Avenue (previous stop Union Street) had the highest increase of 143% with an additional 1min 6 secs to the previous runtime of 46secs in 2019. The data also showed a reduction in speed from 18mph down to 7mph for the East Avenue stop and a similar finding for the Stone Street stop (15mph to 7mph).

180. There were also moderate to high increases on Iffley Road, with an increase of 27% at Rose Hill Parade stop (previous stop Westbury Crescent) at AM-peak, and a 32% increase at The Plain stop (previous stop St Cross road) at PM-peak.

181. When comparing runtime change for stops with the same previous stop – Queens Lane – located beyond The Plain roundabout on the High Street, all stops were found to have moderate increases in the evening: The Plain stop on Cowley Road (17%), The Plain stop on Iffley Road stop (17%) and St Clement's Street stop (22%). The impact is worse in the evening period.

182. In terms of other boundary roads with stops away from The Plain, on Morrell Avenue (apart from South Park stop, with a 9% increase) and in contrast with the Evening period described above, there were decreases of between 11% and 38% in runtimes across all other out-bound stops at Afternoon-peak and PM-peak, compared to 2019. For East Avenue stop this meant an average of 17 secs less in runtime at PM-peak from 56secs in 2019, and 11 secs less in runtime at PM-peak for Stone Street stop from 38secs in 2019. Stone Street stop (previous stop East Avenue) had the highest decrease of 38% in runtime at Afternoon-peak, resulting in an average reduction of 13secs from the 33secs runtime in 2019 and increase in average speed from 13mph to 20mph.

183. The largest percentage decreases in runtime were seen on Iffley Road: at Magdalen Road stop (-32% Afternoon-peak, -42% PM-peak), Howard Street (-31% Afternoon-peak, -38% PM-peak) and Henley Street stop (-4% Afternoon-peak, -33% PM-peak). The average decrease in runtime was between 26 and 42 secs. Smaller percentage decreases were also found on Cowley Road, on stops after The Plain stop down to Howard Street. Overall, the majority of stops that showed percentage decreases in runtime were in the middle of the boundary roads. However, the closer in proximity to The Plain as well as towards the ring road (e.g., near to Between Towns Road/Hollow Way Road), the opposite trend was found (percentage increase in runtime).

184. On multiplier roads (from west to east direction), overall, only Hollow Way showed small to moderate increases, with the highest increase found across all stops at AM-peak (10% to 33.37%). Fern Hill Road stop (previous stop The

Original Swan) showed consistent increases across all peak time periods, with AM-peak the highest: 33% increase in runtime change (an average additional 15 secs to the previous runtime of 46 secs in 2019). The data also showed a small reduction in average speed from 11mph down to 9mph. Delays on Hollow Way stops, and in particular Fern Hill Road stop, might be partly explained by the percentage increase in runtime shown at The Original Swan stop on Cowley/Garsington Road (B480) (60% AM-peak, 49% Afternoon-peak and 19% at PM-peak).

185. In terms of decreases, overall stops on both Between Towns Road and Donnington Bridge Road showed small to moderate decreases across all stops and across all times of day. The findings also showed higher levels of decreases across all stops on Donnington Bridge Road at AM-peak. Townsend Square stop showed the highest percentage decrease of 60% when compared to 2019: an average reduction of 55secs to the previous runtime of 1min 36secs in 2019. The data also showed a significant increase in average speed, from 8mph up to 18mph.

Bus times full road overview

186. The following tables show the cumulative percentage increase/decrease of stop-to-stop runtimes along an entire boundary road. Please note road length comparison of runtimes does not include dwell times, and therefore does not reflect the full journey time for buses along the route.

Table 47 - Cumulative impact of % -/+ of runtimes along boundary roads in an in-bound direction

Boundary roads / segments (towards 'The Plain roundabout')	Weekday difference in duration -/+ secs			
Road name	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
Marston Rd Avg.	+8	+43	+13	+23
St Clements Str Avg.*	+1	+236	+396	+12
Cowley Rd Avg.* (Cowley/Oxford/ Garsington Rd (B480)	+12	+151	+84	-9
Iffley Rd Avg.* (Iffley/Henley Avenue/Rose Hill/Oxford Rd)	+246	+101	+51	+14
Morrell Ave Avg.	-13	-36	+80	

** Where roads have duplicate stops, a mean average has been applied to the runtime value*

187. As seen in the table above, when considering the total road length in the direction towards The Plain roundabout, St Clement's Street and Iffley Road experienced the highest increases in runtimes. The journey times for St Clement's Street had the highest increases at Afternoon-peak and PM-peak: an average of an additional 3min 56secs added to the pre-LTN runtime of 3min 36secs at Afternoon-peak, and an average of an additional 6min 36secs added to the pre-LTN runtime of 5min 30secs at PM-peak. Iffley Road also experienced

an increased overall runtime at AM-peak; an average of an additional 4min 6secs to the pre-LTN runtime of 10min 40secs.

188. On St Clement's Street, Glebe Street stop has previous stops from three different roads: Headington Road, Marston Road and Morrell Avenue. The following table shows how difference in runtimes may vary based on these different routes into Glebe Street stop and cumulative runtimes on St Clement's Street.

Table 48 - Cumulative impact of % -/+ of runtimes along boundary roads in an in-bound direction, examining three different road routes leading to St Clement's Street stop.

Boundary roads / segments (towards 'The Plain roundabout')		Weekday difference in duration -/+ secs			
Previous road/stop	**Destination road**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
Headington Rd: Brookes University	St Clement's Str Avg.	-2	+242	+464	+9
Marston Road: Kings Mill Lane	St Clement's Str Avg.	-34	+184	+276	+17
Morrell Avenue: Union Street	St Clement's Str Avg.	42	+275	+380	

189. As seen in table 48, all three routes into St Clement's Street experienced large increases in runtimes at Afternoon-peak and PM-peak. The largest was from Headington Road direction with an average of an additional 7min 44secs to the pre-LTN runtime of 5min 27secs.

190. Tables 49 to 51 below show a comparison of runtimes by time of day looking at three data periods for the three routes (Headington Road, Marston Road and Morrell Avenue) into St Clement's Street: November 2019 (pre-LTN), November 2022 and more recently March 2023. Both latter data periods provide an insight at different post-implementation periods: around 6-months (November 2022) and 10-months (March 2023). The first table in each route pair shows the average weekday runtime in seconds by time of day. The second table examines the percentage difference when the March 2023 runtimes are compared firstly to the pre-LTN baseline of 2019, and then against the post-implementation period of November 2022 in order to see how the impact may have changed over the evaluation period. Please note while there may be some local seasonal variances in travel behaviours, based on the findings from the National Travel Survey[xxvii] examining 'The average number of trips by month and main mode (trips per person per month)' for England, there are minimal differences between trip rates between March and November. However, findings should be interpreted as an indication only.

Table 49 - Comparison with March 2023 and the cumulative impact of runtimes along boundary roads in an in-bound direction: Headington Road (Brookes University stop) leading to St Clements Street stop.

Headington Rd: Brookes University (towards 'The Plain roundabout')		Weekday duration (secs)			
Data period	**Destination Road**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
November 2019	St Clement's Str Avg.	212	231	327	98
November 2022	St Clement's Str Avg.	210	473	791	110
March 2023	St Clement's Str Avg.	226	376	428	166

Headington Rd: Brookes University (towards 'The Plain roundabout')		Weekday % difference in duration March 2023			
Comparison data period	**Destination Road**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
November 2019	St Clement's Str Avg.	+6.6%	+62.77%	+30.89%	+69.42%
November 2022	St Clement's Str Avg.	+7.62%	-20.51%	-45.89%	+50.91%

191. As seen in table 49, whilst there were significant increases in runtimes – from Brookes University stop on Headington Road to St Clement's Street – between November 2019 and November 2022, the overall trend from November 2022 to March 2023 showed a significant improvement in runtimes, although still higher than in 2019. The largest increase in percentage difference between November 2019 and March 2023 was seen at Afternoon-peak (an average additional 2mins 25secs to the 3mins 51secs duration in 2019) and Evening time periods (an average additional 1mins 8secs to the 1mins 38secs duration in 2019). When compared to 2022, Evening runtimes were also found to be increasing over time, with an average 51% increase (an average additional 56secs in 2023 to the 1min 50secs duration in 2022). However, at Afternoon-peak and PM-peak time periods average 2023 runtimes showed significant decreases when compared to November 2022, the largest being a 46% decrease at PM-peak (an average reduction of 6mins 3secs from the 13mins 11secs duration in 2022). This may indicate that some people previously travelling by vehicle earlier in the day started to delay their journeys to avoid the peak traffic times, reducing the congestion and associated runtimes.

Table 50 - Comparison with March 2023 and the cumulative impact of runtimes along boundary roads in an in-bound direction: examining Marston Road (Kings Mill Lane stop) leading to St Clement's Street stop.

Marston Rd: Kings Mill L (towards 'The Plain roundabout')		Weekday duration (secs)			
Data period	**Destination road**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
November 2019	St Clement's Str Avg.	253	236	374	145
November 2022	St Clement's Str Avg.	219	420	650	163
March 2023	St Clement's Str Avg.	214	330	430	147

Marston Rd: Kings Mill L (towards 'The Plain roundabout')		Weekday % difference in duration March 2023			

Comparison data period	Destination road	AM-peak	Afternoon-peak	PM-peak	Evening
November 2019	St Clement's Str Avg.	-15.42%	+39.83%	+14.97%	+1.38%
November 2022	St Clement's Str Avg.	-2.28%	-21.43%	-33.85%	-9.82%

192. When comparing March 2023 runtimes from Kings Mill Lane stop on Marston Road to St Clement's Street with 2019 (as seen in table 50), the main increase was seen at Afternoon-peak (40%); an average additional 1mins 34secs to the 3mins 56secs duration in 2019). There was also a moderate reduction of 15% at AM-peak which meant an average reduction of 39secs from the 4mins 13secs duration in 2019. However, when comparing March 2023 with November 2022, there was consistent reduction in average runtimes across all times of day, with the highest decrease in difference of 34% at PM-peak; an average reduction of 3mins 40secs from the 10mins 50secs duration in 2022.

Table 51 - Comparison with March 2023 and the cumulative impact of runtimes along boundary roads in an in-bound direction: examining Morrell Avenue (Union Street stop) leading to St Clements Street stop.

Morrell Av: Union Str (towards 'The Plain roundabout')		Weekday duration (secs)			
Data period	Destination road	AM-peak	Afternoon-peak	PM-peak	Evening
November 2019	St Clement's Str Avg.	138	168	293	
November 2022	St Clement's Str Avg.	180	443	672	
March 2023	St Clement's Str Avg.	147	327	414	

Morrell Av: Union Str (towards 'The Plain roundabout')		Weekday % difference in duration March 2023			
Comparison data period	Destination road	AM-peak	Afternoon-peak	PM-peak	Evening
November 2019	St Clement's Str Avg.	+6.52%	+94.64%	+41.3%	
November 2022	St Clement's Str Avg.	-18.33%	-26.19%	-38.39%	

193. For Kings Union Street stop on Morrell Avenue to St Clement's, compared to 2019, runtimes in March 2023 showed small to large increases across all time periods. The largest increase in percentage difference was seen at Afternoon-peak: an average additional 2mins 39secs to the 2mins 48secs duration in 2019. As with the previous routes from Headington Road and Marston Road, when comparing March 2023 runtimes with November 2022, there was a consistent decrease in average runtimes across all times of day. The largest decrease was found at PM-peak: an average reduction of 4mins 18secs from the 11mins 12secs duration in 2022.

194. Overall, runtimes towards St Clement's Street from the 3 different routes toward The Plain roundabout have shown a decreasing trend. This was evident across all times of day between the 6-month post-implementation period and around the 10-month post-implementation period in March 2023.

Emergency Services Response Times

Methodology

195. To understand the impact of the east Oxford LTNs on the emergency services, South Central Ambulance Service (SCAS) included the east Oxford LTN traffic filters as road closures in the Optima Predict event simulation platform. Oxfordshire County Council are grateful for SCAS's collaboration in this report. The Optima Predict platform models the impact on response time of introducing LTN filters against a baseline of the prevailing response times for the period selected. Note this includes the Cowley LTNs as business as usual (BAU). **As a simulation, the model does not provide actual emergency response times.**

196. Two different over-arching scenarios were simulated to understand the impacts of the east Oxford LTNs. The first simulated the effects of the LTNs assuming full road closures at all locations with a bollard or planter in place. The second simulated the impact of replacing certain barriers with Automatic Number Plate Recognition (ANPR) cameras.

197. Both simulations assume that ambulances will route or divert against known factors, such as the road closures associated with the LTNs and calculate the additional journey time using average road speed data from 2019.

198. The simulation reports on the impact on NHS England ambulance response categories described in table 52 below.

Table 52 – NHS England emergency response categories

Category	Example injuries/illness	Response target
Category 1: Life-threatening	Cardiac arrest Severe allergic reaction	7 minutes on average, and 90% of calls in 15 minutes
Category 2: Emergency	Stroke Severe burns	18 minutes on average, and 90% of calls in 40 minutes
Category 3: Urgent	Late stages of labour Non-severe burns	90% of calls in 120 minutes

Source: NHS England, 'Ambulance response programme'
Note - first responder time (e.g. paramedic on motorbike) is included in all categories.

199. The first of the simulation reports used historical incident and response data from 01 May 2022 to 13 November 2022 and was reported in the east Oxford LTN Snapshot report[22].

[22] Active Travel Tranche 2: East Oxford LTN Evaluation Snapshot Report

200. The second simulation undertaken used response data from 01 January 2023 to 30 June 2023. The simulation differs from the first by assuming that the physical barriers currently in place are replaced by ANPR cameras at the following locations:

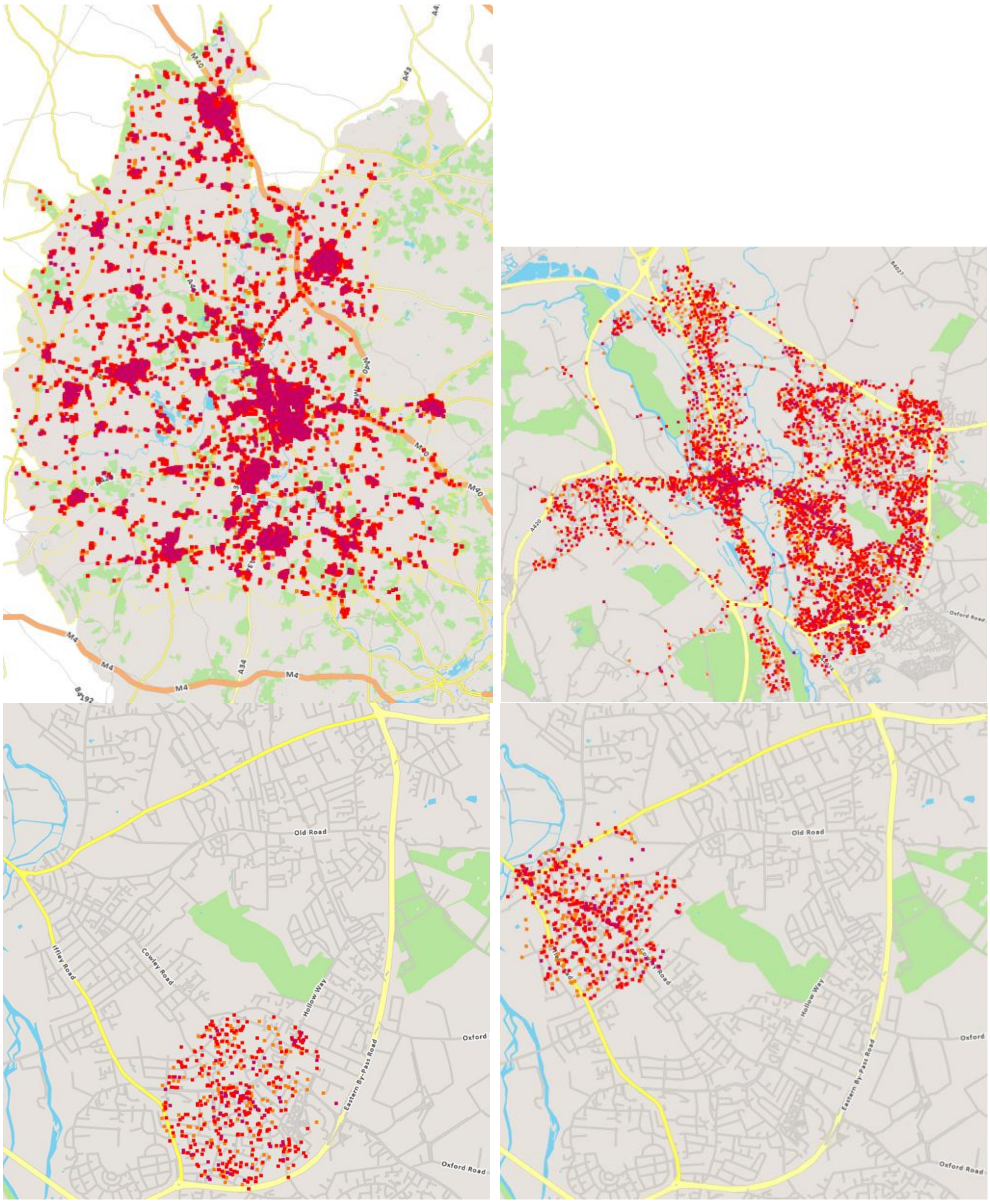
- Divinity Road (east Oxford, Divinity Road LTN)
- James Street (east Oxford, St Mary’s LTN)
- Magdalen Road (east Oxford, St Mary’s LTN)
- Crescent Road (Cowley, Temple Cowley LTN)
- Littlehay Road (Cowley, Florence Park LTN)
- Littlemore Road (Cowley, Church Cowley LTN)

201. The first three locations listed above have been consulted on, and the decision on their implementation will be decided as part of the decision on whether or not the east Oxford LTNs are made permanent. The latter three locations were consulted on and approved. Their implementation is scheduled to be undertaken during the first half of 2024. All other physical LTN barriers remain in the second simulation model.

202. To replicate the remaining physical barriers within the simulation, the road network was ‘edited’ in the simulation and corresponding sections removed. In the original modelling, road speeds were adjusted to simulate delays. The new methodology should be more accurate in simulating the filters. The methodology used for the more recent simulation also differs from that used in the first, using a customised version of the Optima SCAS model, incorporating just Oxfordshire operations, in order to speed up the model. This latter difference should have no effect on the accuracy.

203. A number of different geographical areas were considered separately within the simulation, as depicted in the following figure:

Figure 16 - Geographical areas of analysis used in second SCAS simulation model. Top left to bottom right: Oxfordshire, Oxford, Cowley LTNs, east Oxford LTNs



Results of the simulation including ANPR locations

204. The table below shows the simulated average response time difference between the baseline and scenario for the different geographical areas.

Table 53 - Results of simulation on impact of east Oxford LTNs including ANPR locations on response times by category and geography

Area	CAT1	CAT2	CAT3
NEOCW	+1 sec	+4 secs	+23 secs
Oxford	+1 sec	+7 secs	+23 secs
Cowley LTN	+7 secs	+6 secs	+32 secs
East Oxford LTN	+7 secs	+14 secs	+40 secs

205. The simulation incorporating the mitigation of ANPR at the six locations identified shows a significant lessening of impact compared to the original simulation previously reported on, particularly for the east Oxford LTNs area, where the simulated delay for CAT1 previously reported was 45 seconds. The impact at an Oxfordshire level is also greatly reduced: a simulated 4 second delay in CAT1 is now a 1 second delay (see Table 54).

Table 54 - Results of simulation on impact of east Oxford LTNs on local response times, by category, physical bollards in place at all sites (no ANPR)

Area	CAT1	CAT2	CAT2
NEOCW	+4 secs	+26 secs	+72 secs
Cowley LTN	+8 secs	+1 secs	+12 secs
East Oxford LTN	+45 secs	+45 secs	+35 secs

206. To understand what action would be needed to mitigate the delay times shown in this scenario, additional scenarios were subsequently run to assess the number of additional dual crew ambulance (DCA) hours needed to off-set the delays. The table below shows the simulated delays at the Oxfordshire-wide level between the baseline, LTNs scenario and potential mitigations for the area.

Table 55 - Results of simulations for Oxfordshire area with potential mitigation actions

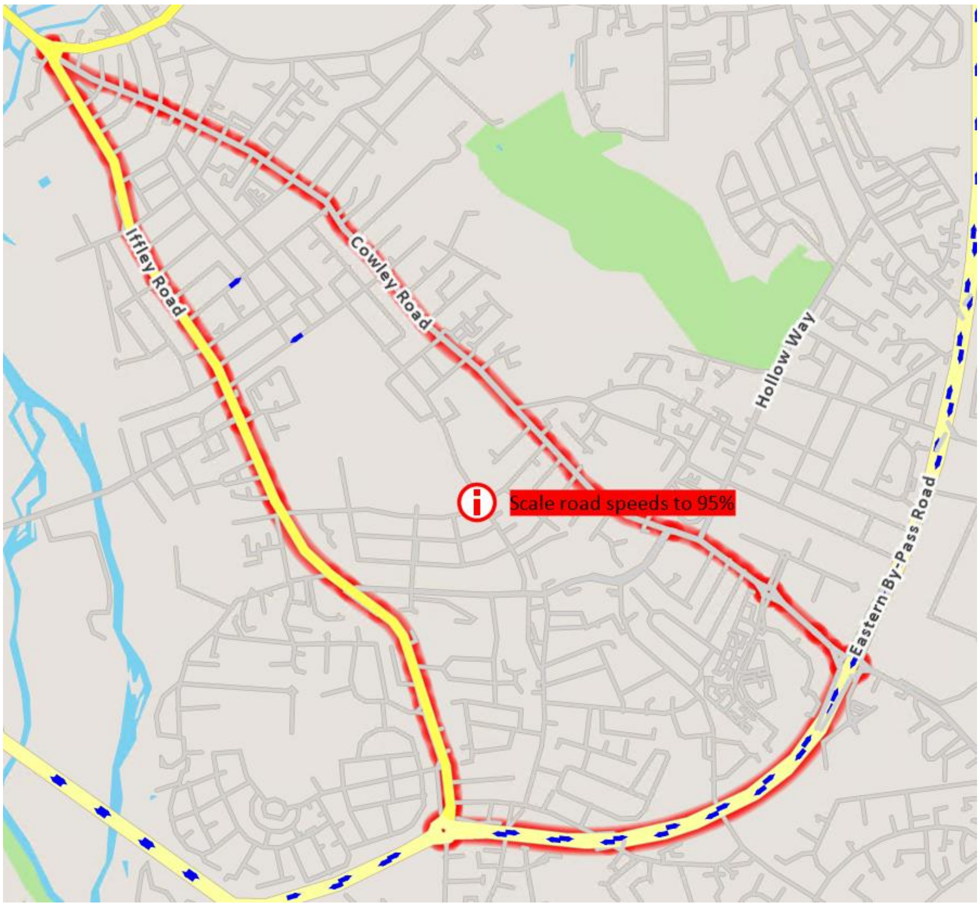
Scenario	CAT1	CAT2	CAT3
Baseline	-	-	-
LTNs	+1 sec	+4 secs	+23 secs
+1 Hour DCA	-1 sec	-8 secs	-29 secs
+2 Hours DCA	-2 secs	-20 secs	-1 min

207. Table 55 shows that just 1 additional DCA hour would be required to off-set the delays shown. The current number of unit hours in the area averages at 565,

meaning that less than 0.02% additional resource would be required, at an annual cost of £40,000. Given other variations in the way in which the ambulance service models and plans, this is not considered to be statistically significant and other factors will have a much more significant role in emergency response times.

208. One aspect which is not considered within the simulation however, is the potential for the LTNs to cause congestion on surrounding routes. The above simulations assume no change in prevailing traffic speeds between the baseline scenario and LTNs scenario. However, as outlined in the above *Journey times (driving)* analysis, there is evidence that journey times have increased and speeds reduced in some areas surrounding the LTNs, although there are also some areas which have seen improvements in journey times. Therefore, to assess the impact of increased congestion to ambulance response times, additional scenarios were modelled to assess the potential impact of reduced speeds along the roads immediately surrounding the east Oxford and Cowley LTNs. Figure 17 below shows the roads to which speed changes were applied in the further scenarios undertaken.

Figure 17 - Road speed scaling on roads surrounding the LTNs



209. Three further scenarios were run, scaling the speed to different levels on these roads to simulate congestion to a greater or lesser degree. The results of these

scenarios against response times for the Oxfordshire area are outlined in table 56 below.

Table 56 - Simulated average response time differences between baseline, LTNs scenario and sensitivity analysis for different road speeds

Scenario	CAT1	CAT2	CAT3
Baseline	-	-	-
LTNs	+1 sec	+4 secs	+23 secs
90% Scaled Road Speeds	+1 sec	+11 secs	+51 secs
80% Scaled Road Speeds	+3 secs	+25 secs	+1 min
70% Scaled Road Speeds	+5 secs	+37 secs	+2 mins

210. Road segments are affected by changes in speed due to increased congestion to different degrees, and some segments show generalised improvements. In addition, both direction and time of day significantly alter speed patterns. There are also road segments which are affected by speed changes which are not covered in the scenarios, notably St Clement's Street, which has experienced the most marked journey time impacts of all segments analysed in the journey time analysis. On the other hand, journey speeds along the routes with ANPR will likely be significantly faster than they were in 2019. As such, applying a scaling across the board will not give a reliable picture of the impact of the LTNs, but it does give an indication of the degree to which changes in speed will impact emergency response times.

211. Overall, the impact on emergency services response times can be seen to be significantly mitigated by the introduction of ANPR cameras in the six locations outlined and is minimal as long as congestion does not slow down surrounding main roads to a great degree. The impact is greater at the local level, however, and response times are likely to be slower in the LTN areas, with congestion caused on surrounding roads likely having a greater impact here than to overall Oxfordshire response times.

Air Quality

Air Quality Sampling

212. Evaluation of air quality (AQ) within the east Oxford LTNs was undertaken using the existing air quality monitoring network managed by Oxford City Council, the air quality authority for Oxford. This network was supplemented with 16 additional sensors in 2021 to provide greater coverage in the east Oxford and Cowley LTN areas. Oxfordshire County Council are grateful for the City Council's collaboration in this work.

213. Diffusive samplers, as described in the Department for Environment Food and Rural Affairs (DEFRA)'s Technical Guidance LAQM.TG22 paragraphs 7.197 – 7.234, are widely used for indicative monitoring of ambient nitrogen dioxide (NO2) in the context of regular review and assessment of local air quality levels by Local Authorities. This monitoring technique is particularly useful to give an indication of longer-term average NO2 concentrations and for highlighting areas of high NO2 (particularly when assessing NO2 sources such as traffic emissions, which do not change much from day to day). Diffusion tubes take samples over approximately a one-month period, hence a monthly mean value of NO2 can be derived.

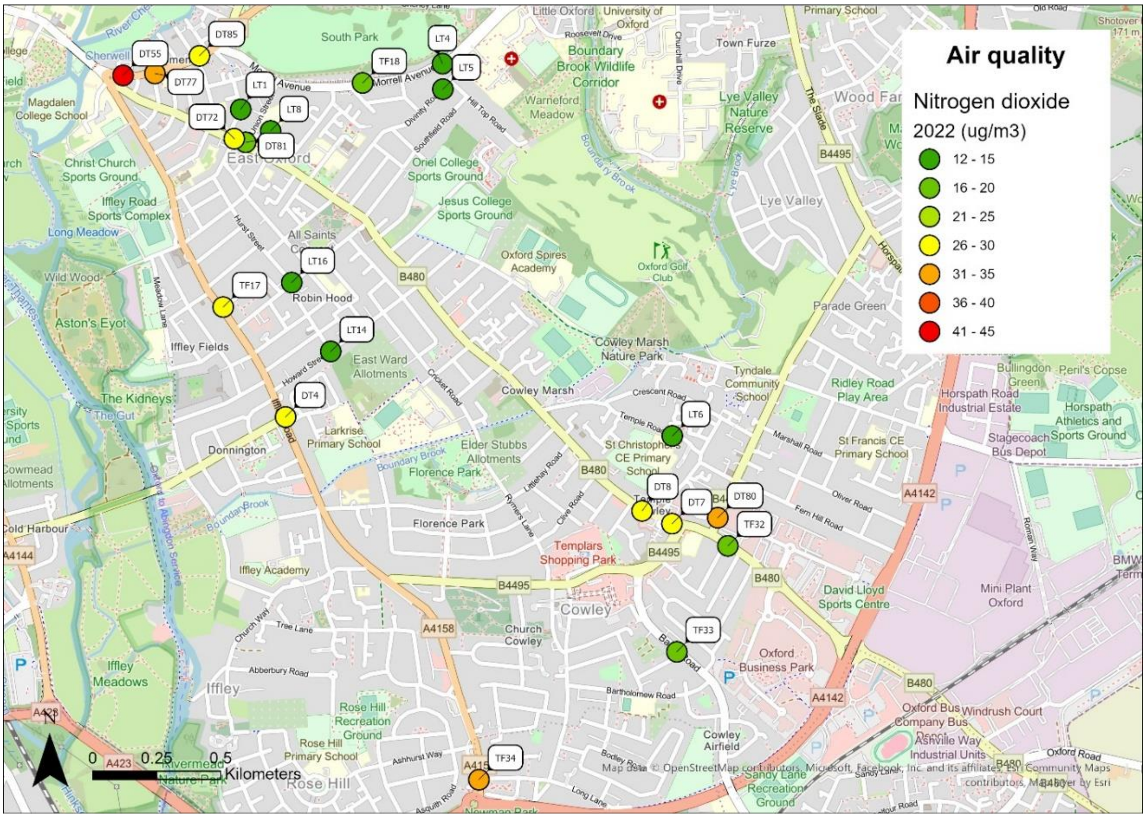
214. The diffusion tubes used for the purpose of assessing the impacts of LTNs were supplied and analysed by accredited laboratories. In 2021 they were analysed by South Yorkshire Air Quality Samplers and in 2022 by SOCOTEC, both using the 50% TEA in Acetone method. All accredited laboratories processing diffusion tubes are subject to quality assurance testing as part of their accreditation. This involves an independent comparison to other laboratories, under the independent AIR-PT scheme. The results of these inter-comparisons are publicly available.

215. All the diffusion tube results that are used in this LTN analysis have been fully corrected and adjusted according to the specific Defra guidelines that local authorities are required to follow and which are available here.

Air Quality Analysis

216. The location of the sampling tubes used in this analysis are shown in the map below.

Figure 18 - Location of air quality diffusion tube sensors used in the analysis



217. As outlined below, there are multiple factors which can influence NO2 levels. To control for these factors, it is important to understand how air quality has changed more widely across the city. An assessment has therefore been conducted to analyse overall 2022 air quality levels across all the City of Oxford monitoring sites that would not show differences in air quality data that would be due to the introduction of the LTNs or ZEZ. The 2022 data has been compared to the 2021 data to identify what the wider changes in NO2 levels have been in Oxford City. The results of this analysis indicate that overall, air quality levels have improved across the city by approximately 2 micrograms per cubic metre (2 ug/m3). This reduction is not considered to be statistically significant, as it’s within the margin of error of the monitoring technique. It has therefore been decided not to include this correction as part of the analysis. The analysis is therefore based on a simple comparison between 2021 and 2022 data.

218. The following limitations to the air quality analysis should be noted:

- The data has been compared between the two full calendar years of 2021 and 2022, to allow for comparison of only fully ratified air quality datasets and so that exact LAQM procedures and DEFRA guidelines could be followed. However, the east Oxford LTNs have only been in place from May 2022 onwards.
- Fully ratified data for the automatic monitors that are used to calculate the bias adjustment factor that is used to correct the diffusion tube data is only available at the time of the analysis for up to December 2022. Unratified data cannot be used in comparison with ratified data, as ratification can change the figures significantly. It is particularly important to use the

ratified data in the instance of using two different laboratories to undertake the analyses, to ensure results are comparable.

- There were weeks where LTNs were not in full operation because of episodes of vandalism to bollards, as outlined previously in this evaluation
- Air quality measurements can also be heavily impacted by external factors such as the weather and short-term roadworks. Therefore, it is difficult to isolate the exact contribution of the LTNs to the air quality levels measured. This limitation needs to be acknowledged in this analysis.
- A local study conducted in 2020[xxviii] identified that approximately 40% of Nitrogen Oxides (NOx)[23] in Oxford City are contributed by road transport, as such any changes in the measures provided by diffusion tubes may be caused by changes in other factors which generate NO2, such as domestic combustion (e.g., wood-burners) and other forms of transport.

219. Table 57 below compares the annual mean NO2 levels in ug/m3 for the sensor sites. A numerical difference is calculated between the data for 2022 and 2021 and between 2022 and 2019 in ug/m3 – the associated percentage change is also given.

- When ‘NM’ is shown instead of a reading, this means ‘no measurements’ were available because this tube was not in place during that period; a comparison cannot therefore be made with earlier years and the data available for only 2022 is included simply to supplement the analysis and greyed out accordingly in the table.
- Diffusion tubes prefixed ‘LT’ were installed in March 2021 and generated data for the 9 months April to December 2021. In line with technical guidance and validation from Defra, these 2021 data were used to generate the annual average 2021 figure. See paragraph 7.200 and 7.213 of the Defra Technical Guidance LAQM.TG22.
- Diffusion tubes prefixed ‘TF’ were installed in May 2022 and generated data for the 8 months May to December 2022. In line with technical guidance and validation from Defra, these data were annualised to generate the 2022 figure. See paragraph 7.200 and 7.214 of the Defra Technical Guidance LAQM.TG22.

[23] The term Nitrogen Oxides includes Nitrogen Dioxide, but also includes other compounds of Nitrogen and Oxygen

Table 57 - Air quality data (NO2) from diffusion sampling tubes used in the analysis

				Fully Ratified Dataset							
Diffusion Tube ID	**Site name**	**LTN name**	**Sensor Inside / Outside LTN**	**2019 (ug/m3)**	**2020 (ug/m3)**	**2021 (ug/m3)**	**2022 (ug/m3)**	**Difference (2021/2022)**	**% Difference (2021/2022)**	**Difference (2019/2022)**	**% Difference (2019/2022)**
LT5	189 Divinity Road	East Oxford	Inside	NM	NM	18	12	-6	-33%		
LT8	East Oxford Primary School	East Oxford	Inside	NM	NM	15	13	-2	-13%		
LT1	26 Princes Street	East Oxford	Inside	NM	NM	17	13	-4	-24%		
LT14	94 Howard Street	East Oxford	Inside	NM	NM	16	13	-3	-19%		
LT16	103-139 Hurst Street	East Oxford	Inside	NM	NM	16	13	-3	-19%		
DT81	Cowley Rd/ Union Street	East Oxford	Inside	22	19	30	19	-11	-37%	-3	-14%
LT4	138-146 Morrell Avenue	East Oxford	Outside	NM	NM	16	13	-3	-19%		
TF18	143 Morrell Avenue	East Oxford	Outside	NM	NM	NM	16				
DT72	Cowley Rd./ James Street	East Oxford	Outside	31	22	20	27	7	35%	-4	-13%
DT55	St Clement's	East Oxford	Outside	53	36	39	43	4	10%	-10	-19%
DT77	St Clement's 2	East Oxford	Outside	42	28	30	35	5	17%	-7	-17%
DT85	St Clement's 3	East Oxford	Outside	36	26	29	30	1	3%	-6	-17%
DT4	Boundary Brook Road/ Iffley Road	East Oxford	Outside	28	23	26	27	1	4%	-1	-4%
TF17	23 Iffley Rd/Stanley Road	East Oxford	Outside	NM	NM	NM	26				
LT6	St Christophers School	Cowley	Inside	NM	NM	13	12	-1	-8%		
DT80	Hollow way Road	Cowley	Outside	37	31	35	34	-1	-3%	-3	-8%
DT7	Oxford Road/ Between Towns Road	Cowley	Outside	32	27	30	30	0	0%	-2	-6%
DT8	Oxford Road(Cowley) LP13	Cowley	Outside	31	24	29	29	0	0%	-2	-6%
TF33	119 Barns Road	Cowley	Outside	NM	NM	NM	16				
TF34	Oxford Road/Newmans Road	Cowley	Outside	NM	NM	NM	35				
TF32	22 Garsington Road	Cowley	Outside	NM	NM	NM	20				

Note 1 - 'NM' means 'no measurements' were available because these diffusion tubes were not in place during the relevant time period.
Note 2 - Diffusion tubes prefixed 'LT' were installed in March 2021 and generated data for the 9 months April to December 2021. In line with technical guidance and validation from Defra, these 2021 data were used to generate the annual average 2021 figure. See paragraph 7.200 and 7.213 of the Defra Technical Guidance LAQM.TG22.
Note 3 - Diffusion tubes prefixed 'TF' were installed in May 2022 and generated data for the 8 months May to December 2022. In line with technical guidance and validation from Defra, these data were annualised to generate the 2022 figure. See paragraph 7.200 and 7.214 of the Defra Technical Guidance LAQM.TG22.

220. Of the 16 sensors with comparative 2021 to 2022 data there are 11 which show either no change, an insignificant or significant decrease in NO2 levels and 5 which show an insignificant or significant increase in NO2. The term 'significant' refers to changes of more than 2 ug/m3 of NO2.

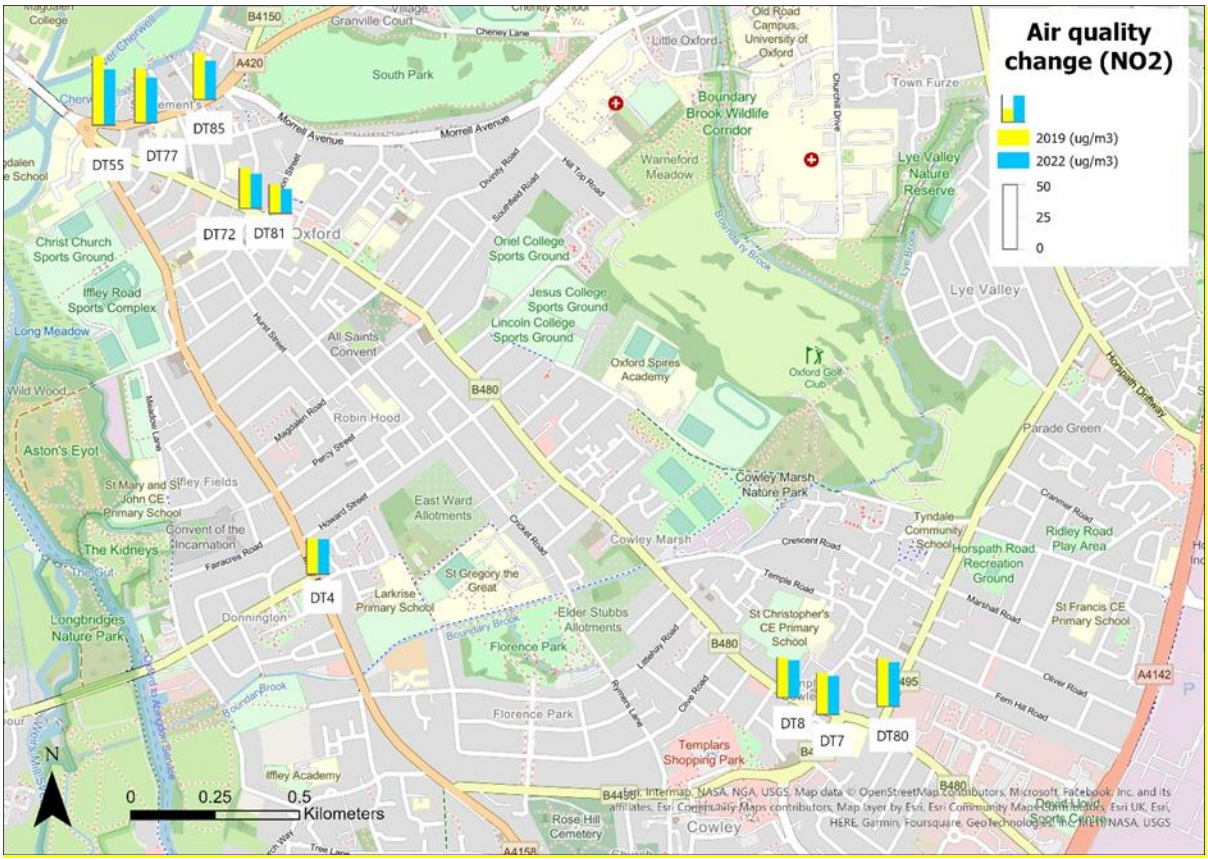
221. All sensors inside the LTNs show a decrease in NO2 with the greatest effects seen on LT5 189 Divinity Road (-6 ug/m3 or -33%) and LT1 26 Princes Street (-4 ug/m3 or -24%). Note that DT81 Cowley Road/Union Street diffuser tube is 10m down Union Street away from Cowley Road; readings are the same in 2020 and 2022 at 19 ug/m3. The 2021 reading of 30 ug/m3 from this site cannot be used for comparison purposes with the 2022 result as the measurement has been extremely influenced by external factors for most of 2021: the emissions from the construction works above the Tesco Express near the middle of the Cowley Road used Union Street as the point of access for some plant. Construction spanned the period August 2020 to August 2022 with the first 18 months being the most intense.

222. On the boundary roads the picture is more mixed. LT4 138-146 Morrell Avenue has shown a reduction (-3 ug/m3 or -19%). But on St Clements there is a significant and consistent increase in NO2 at two locations: DT77 St Clement's Street 2 (5 ug/m3 or 17%); DT55 St Clements (4 ug/m3 or 10%). Whilst at DT72 Cowley Road/James Street there is a significant increase in NO2 levels (7 ug/m3 or 35%). The diffusion tube here is located directly on Cowley Road and has recorded the greatest percentage increase of all sensor locations but still below national and local limits and shows a reduction from the 2019 reading.

223. Of the NO2 levels recorded in 2022, one site is above the national limit of 40 ug/m3: DT55 St Clement's Street increasing from 39 in 2021 to 43 in 2022. However, it is significantly down on the 2019 result of 53 ug/m3. In addition, there are a further three sites above the local target of 30 ug/m3: DT77 St Clement's Street 2 increasing from 30 ug/m3 in 2021 to 35 in 2022; DT80 Hollow Way Road decreasing from 35 ug/m3 in 2021 to 34 in 2022 and TF34 Oxford Road/Newman Road with a reading in 2022 of 35 ug/m3.

224. Overall, these AQ results mirror the findings of the vehicle counts analysis: there is an overall improvement in air quality inside the LTNs. On the boundary roads, Cowley Road and St Clement's Street see a marked deterioration of air quality as measured by levels of NO2 between 2021 and 2022. It can also be seen from figure 19 below that where 2019 data is available, comparative data for 2022 shows an improvement in air quality.

Figure 19 - Air quality comparison (NO2, ug/m3) - between years 2019 and 2022



225. In terms of the public health impact of these changes in air quality, there is strong evidence that a wide range of public health problems including respiratory and cardiovascular illnesses are impacted by air quality. There is also mixed evidence linking poor air quality with health impacts such as increased instance of pre-eclampsia in pregnant women, pre-term birth and low birth weight, as well as increased autism spectrum disorders, diabetes and reduced fertility[xxix].

226. Research by King's College London in 2019[xxx] highlighted some of the impacts of air pollution in Oxford. Each year on average, higher air pollution days in Oxford are responsible for:

- 6 more cardiac arrests outside hospital
- 5 more admissions to hospital for cardiovascular disease
- 4 more admissions to hospital for stroke.

227. In addition, roadside air pollution in Oxford stunts lung growth in children by 14.1%. Cutting air pollution in Oxford by 20% would result, each year, in:

- 83 fewer cases of coronary heart disease
- 28 fewer cases of lung cancer
- 77 fewer children with low lung function
- 38 fewer asthmatic children with bronchitic symptoms
- 31 fewer instances of children being diagnosed with acute bronchitis
- 1 less baby born underweight (at term)
- an increase in children's lung capacity by around 2.8%.

228. As outlined in the *Background* section of this document, the population within the east Oxford LTN area shows a higher instance of cardiovascular and stroke deaths than the England average, and respiratory deaths and COPD hospital admissions similar to the national average, despite having a relatively young population according to health data. Improvements in air quality within the east Oxford LTNs may therefore serve to better the health outlook of this population, though this needs to be balanced against the increased pollution levels seen on the boundary roads, which will have a detrimental health impact.

229. It should be noted that the LTNs are part of wider strategy for Oxford to manage traffic. This includes the introduction of trial traffic filters, expected in 2024, which will introduce strategic traffic filters at six locations in Oxford. Two of the locations will be on St Clement’s Street and Hollow Way with the intention of improving air quality, amongst other benefits, on these two roads. The traffic filters will be subject to separate evaluation to assess whether the projected benefits are realised.

Road Safety

Analysis

230. Using STATS19 data (Britain's official road accident statistics[24]), a simple comparison has been made between incidents in the 5 years prior to LTN implementation (20 May 2017 to 19 May 2022), and the year after implementation (20 May 2022 to 19 May 2023). A simple control comparison has also been undertaken and is presented in Annex K. Overall there has not been significant change in incidents in the LTN area as compared to control.

231. Care should be taken in reading too much into this comparison between a five-year pre-LTN period and a single year post LTN period for a number of reasons:

- Subsequent years of data need to be collected before a direct comparison can be made and changes become statistically significant.
- Highway schemes normally need to time to bed-in before true comparisons can be made. For example, spikes in accidents can occur immediately after alterations to the highway network but longer-term trends show a road safety benefit.
- It is noted that the five-year pre-LTN period includes years when COVID-19 had an impact on traffic volumes.
- In the post-LTN period it is noted that the bollards were not in place 100% of the time due to vandalism (see Annex H).

With these caveats, the maps below show that on the boundary roads, clusters of collisions are appearing in broadly similar locations. For example, pedestrian and cyclist incidents on Cowley Road near James Street and Bullingdon Road junctions (see figures 21 and 22). Applying the same caveats, inside the LTNs, the location of incidents shows little similarity pre- and post- implementation. Within the limits of the analysis and at this early stage, there appear to be no emerging trends or new concerns from a road safety point of view relating to the implementation of the LTNs.

232. Motor vehicle (MV) incidents post LTN implementation have taken place in two boundary road locations similar to the pre-implementation period, on Cowley Road near the junction with Bullingdon Road and with James Street (see figure 23). Inside the LTN there are two slight MV incidents, one at the Charles Street/Catherine Street junction where incidents had previously occurred and a new incident at the south-west end of Bullingdon Road.

[24] STATS19 is a code designating the protocol which outlines information to be collected whenever an injury crash is reported to the police. This code is also frequently used to refer to Britain's official Road Accident Statistics, which are derived from police STATS19 returns and compiled by the Department for Transport.

Figure 20 - Location of <u>all</u> incidents by severity pre- and post- LTN implementation

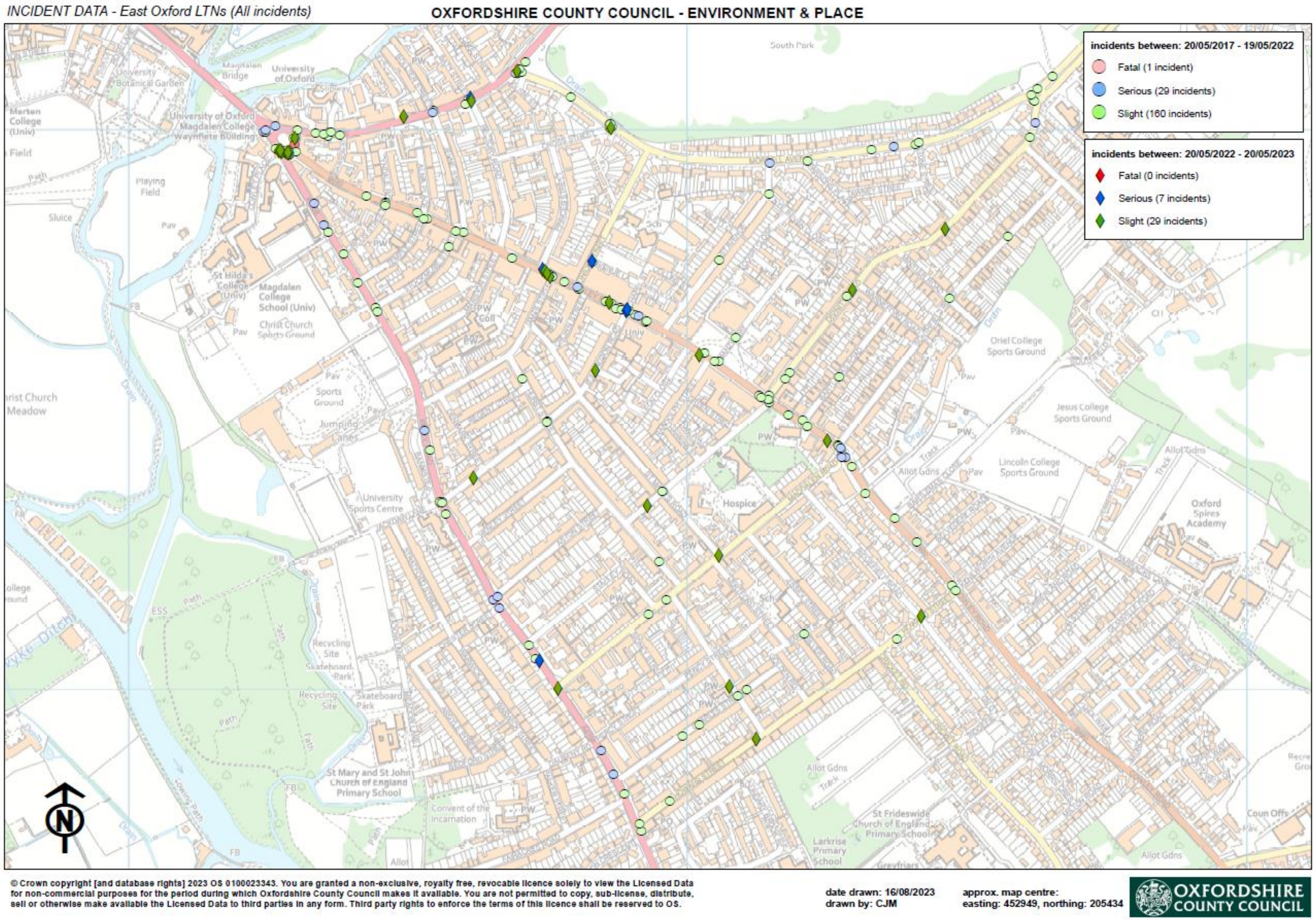


Figure 21 - Location of Pedestrian incidents by severity pre- and post- LTN implementation

INCIDENT DATA - East Oxford LTNs (Pedestrian incidents)

OXFORDSHIRE COUNTY COUNCIL - ENVIRONMENT & PLACE

date drawn: 16/08/2023
drawn by: CJM

approx. map centre:
easting: 452949, northing: 205434

OXFORDSHIRE COUNTY COUNCIL

Figure 22 - Location of Cycle incidents by severity pre- and post- LTN implementation

INCIDENT DATA - East Oxford LTNs (Pedal Cycle incidents)

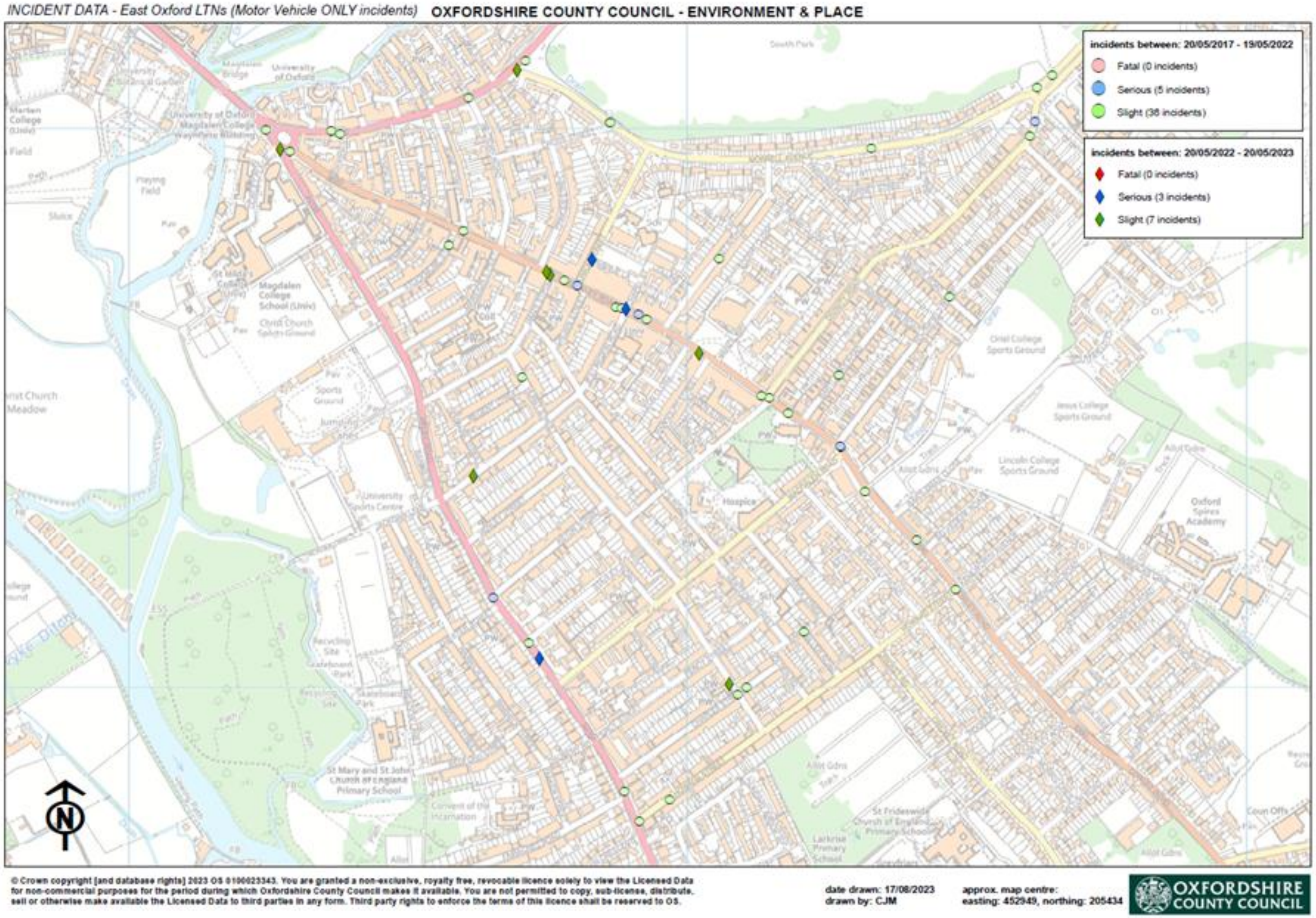
OXFORDSHIRE COUNTY COUNCIL - ENVIRONMENT & PLACE

date drawn: 16/08/2023
drawn by: CJM

approx. map centre:
easting: 452949, northing: 205434

OXFORDSHIRE COUNTY COUNCIL

Figure 23 - Location of Motor Vehicle (MV) incidents by severity pre- and post- LTN implementation



233. The tables 58 to 60 below give some insight into the number of incidents pre- and post- implementation; the number of incidents in the five-year pre-implementation period has been averaged and are shown by severity and mode and compared with the post-implementation year for boundary roads, in-LTN area and The Plain. The Plain is singled out for the relatively higher number incidents that have occurred there. However, the same caveat applies of not reading too much into one year's data post-LTN implementation compared to the five years of pre-implementation data.

Table 58 - Road safety incidents by mode and severity - boundary roads

Incidents Boundary Rd	Pre LTN (5 year average)				Post LTN (1 year)			
	Ped	Cycle	MV	All	Ped	Cycle	MV	All
Fatal	0	0	0	0	0	0	0	0
Serious	0.4	2.8	0.2	3.4	0	3	2	5
Slight	4.2	10.8	4.6	19.6	3	4	4	11
Mode total	4.6	13.6	4.8	23.0	3	7.0	6.0	16

234. On the boundary roads there is a reduction in the number of incidents involving cyclists in the 'slight' category, down from an average 10.4 pre-LTN implementation to 4 post-LTN introduction. This might be explained by the introduction of Quickways. The impact of the Quickways will be subject to its own evaluation.

Table 59 - Road safety incidents by mode and severity - In-LTN

Incidents In-LTN	Pre LTN (5 year average)				Post LTN (1 year)			
	Ped	Cycle	MV	All	Ped	Cycle	MV	All
Fatal	0	0	0	0	0	0	0	0
Serious	0	0	0.2	0.2	0	0	1	1
Slight	0.4	3.4	1.4	5.2	1	6	2	9
Mode total	0.4	3.4	1.6	5.4	1	6	3	10

235. Inside the LTN area there is an increase in the number of incidents involving cyclists up from 3.6 to 6 in the 'slight' category, but these are small numbers.

Table 60 - Road safety incidents by mode and severity - The Plain

Incidents The Plain	Pre LTN (5 year average)				Post LTN (1 year)			
	Ped	Cycle	MV	All	Ped	Cycle	MV	All
Fatal	0	0.2	0	0.2	0	0	0	0
Serious	0.2	1.8	0	2	0	1	0	1
Slight	0.2	6.8	0.4	7.4	0	8	1	9
Mode total	0.4	8.8	0.4	9.6	0	9.0	1.0	10

236. On The Plain no significant change can be seen from the periods studied; a longer post-LTN implementation monitoring period is required. It should be noted that safety improvements were implemented at The Plain in November 2022 which included some amendments to road markings and traffic signs, installation of light cycle lane segregation, bollards and vegetation clearance.

Conclusions

237. In conclusion, there are both positive and negative outcomes associated with the LTNs. Positive results include consistent reductions in car use within the LTNs and indications of overall traffic evaporation from the area, with associated improvements in air quality within the east Oxford LTNs. It is worth noting that without a network-wide evaluation though, to what degree traffic evaporation is being caused by the combination of re-routing, modal shift or total avoidance of travel, cannot be fully ascertained. There are also comprehensive increases in cycle use along the boundary roads and on roads crossing between Iffley and Cowley Roads, indicating there may be some level of modal shift associated with the traffic evaporation. This trend continues to improve but should be subject to longer term monitoring. Pedestrian use, however, has generally not increased, except for Bullingdon Road – the only location to have seen a significant uplift, with some locations showing decreasing footfall both within and outside the LTNs; given increases in footfall at control sites, an increase might be anticipated based on background trends, which is not apparent in and around the east Oxford LTNs.

238. More significant negative impacts seem to be stemming from the increased congestion at The Plain. The knock-on impact of this is to create further delays along St Clement's Street, affecting buses and private vehicles alike, particularly during the Afternoon- and PM-peak hours and in the in-bound direction towards The Plain roundabout and the city centre. This, in turn, has increased air pollution levels on the boundary roads, particularly along St Clement's Street, where the legal limit has been exceeded at the location by The Plain roundabout. It is worth noting, however, that although air quality has worsened on the boundary roads in general, at all the locations air quality is still better than it was in 2019.

239. The emergency services simulated impact previously reported seems to be significantly mitigated by the introduction of ANPR at the six locations identified, three of which have already been approved in the Cowley LTNs area, and three of which have been consulted on within east Oxford LTNs. Should the LTNs be made permanent, it is strongly recommended that the ANPR changes should be approved in east Oxford to reduce the impact on emergency services. Continued congestion could, however, off-set this mitigation, as a change in average road speeds within the area increases the delays for emergency services.

240. Whilst wider traffic levels have not grown significantly since pre-implementation, the change in the pattern of traffic has resulted in worsening journey times and congestion at certain times of the day, since Oxford's road network is sensitive to change. Although journey times have improved during the period of evaluation of the trial, delay, particularly to buses is still an issue. Oxfordshire County Council has proposals to improve bus journey times across the city, but targeted improvements for buses in the east of the city have already been implemented as part the commitment through the Bus Service Improvement Partnership and the Bus Journey Time Reliability Fund, including implementation of additional bus lanes. It is worth noting that the data analysis undertaken in this report pre-dates the implementation of the in-bound bus lane on St Clement's Street,

London Place and Headington Hill, the results of which should be monitored to assess efficacy in mitigating bus journey time delays.

241. Oxfordshire County Council has policies in place to reduce volumes of traffic in Oxford, such as the trial traffic filters, workplace parking levy and expanded ZEZ. The trial traffic filters were expected to be in place but due to the Network Rail redevelopment of Oxford Station it has not been possible to implement the trial. In light of the delay to the trial traffic filters and the impact of Botley Road roadworks, further short-term measures are being considered in order to mitigate the delays being caused for bus runtimes, city-wide It is recommended that any schemes being considered should be assessed in the context of the available data; given that the patterns of delays are markedly different on each route at different times of day, any mitigatory measures need to take this into account, as well as assessing efficacy of the bus lanes already implemented.

242. It should be noted that research has shown that modal shift is most effectively instigated through a package of measures and less so where infrastructural measures are not supported by wider behavioural change initiatives. As such, a wider package of behavioural change measures both providing a ‘carrot’ and a ‘stick’, as well as maximising intervention at times of life-change, are likely to prove more successful in reducing overall car use alongside the infrastructural elements such as the LTNs, Quickways and bus lanes. Oxfordshire County Council should consider this if the east Oxford LTNs are made permanent.

243. It is also worth noting that there are elements of the LTNs which have not been (fully) evaluated in this report. For example, health and safety implications have only been touched on, since longer-term observation is required to fully assess the effect on these aspects. In addition, impact on the use of space have not been analysed here. Studies to assess the effects on activities within the LTNs, such as levels of social interaction of different kinds and use of the space for play for example, investigating how these link to perceptions of the area would be beneficial, particularly if considering placemaking initiatives to complement the LTNs in the future. These studies could also consider the mental health implications of the changes, including the impact of active travel on mental health and any wider changes in use of the area, such as improved (or worsened) social cohesion.

244. In conclusion, there are some clear positive changes surrounding the east Oxford LTNs, such as the increased cycling levels and reduced overall car usage. However, measures should be investigated to ameliorate the journey time related disbenefits for buses and emergency vehicles and action should be taken to mitigate this negative effect of traffic-related congestion prior to wider policy aims being implemented. Whilst already an issue prior to the east Oxford LTNs being implemented, the congestion and associated journey times have worsened in the aftermath, making mitigatory measures of even greater importance than previously, should the east Oxford LTNs be made permanent.

Annex A

East Oxford LTN area Public Health data report

East Oxford LTN area – Public Health data

1st September 2023

Contents

1 Introduction

This report provides demographic, Public Health and related data for the East Oxford Low Traffic Neighbourhood (LTN) area of Oxford City, including:

- Demographic, housing, health, economic and travel to work data from the ONS Census 2021 survey (March 2021);
- Public Health, hospital and life expectancy data provided by the Office for Health Improvement and Disparities via fingertips;
- Benefit claimants data from the Department of Work and Pensions.

2 Key points from the data

Population and health data for the East Oxford LTN area shows that:

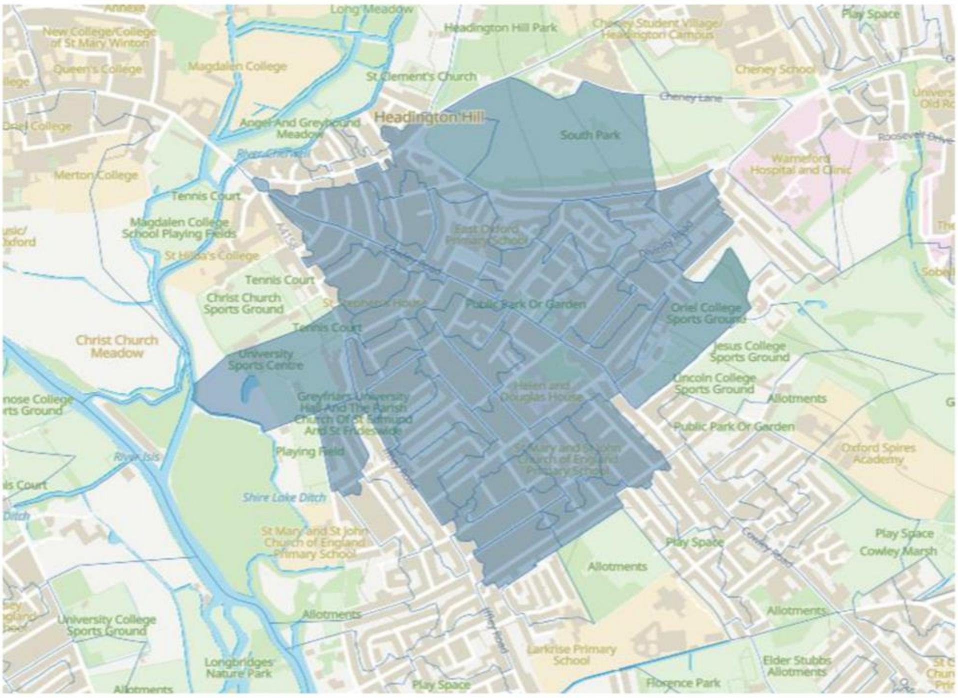
- As of March 2021, the area had 12,000 residents living in 4,300 households.
- Compared with Oxford city, the area had double the proportion of residents aged 20-24 years.
- Residents were more likely than Oxford city to be from a White ethnic background.
- Households were more likely to be private rented accommodation (52% compared with 32% for Oxford) and to have 4 or more people living in the household.
- The proportion of households in relative deprivation varies across the LTN area, which means that the area averages hide some wide differences.
- Residents were more likely to have higher level qualifications (degree and above) and were more likely to be in professional occupations. The proportion in elementary occupations was also slightly higher than the Oxford average.
- Households in the area were less likely to have a car than the average for Oxford and those in employment were more likely to work mainly from home. *(Note that the Census 2021 survey was carried out in March 2021 when lock down restrictions were in place).*
- The COVID-19 lockdown led to a major change in the proportion of people working from home. The proportion in the East Central Oxford area was above average in 2011 and in 2021.
- Residents of the area were more likely than average to be in very good health and to be "not disabled". The area had a lower proportion of people providing unpaid care. This comparison is likely to be affected by the younger age profile of the local population.
- Rates of older people in poverty were above average.
- Life expectancy data for 2016-20 for the area shows Males in the area with a significantly lower (worse than) life expectancy than the England average (76.3 compared with 79.5 years). Life expectancy for Females was better than the England average[1].
- Hospital admissions for alcohol attributable conditions for the area was significantly worse than the national average.
- The rate of emergency hospital admissions due to Chronic Obstructive Pulmonary Disease (COPD), a condition potentially affected by air quality, was similar to the Oxford and England averages.
- Over a third of children in year 6 (aged 10-11 years) living in the area were measured as overweight/obese.

[1] Data for Oxford for a comparable 5-years combined time period is not available

3 Geographical area

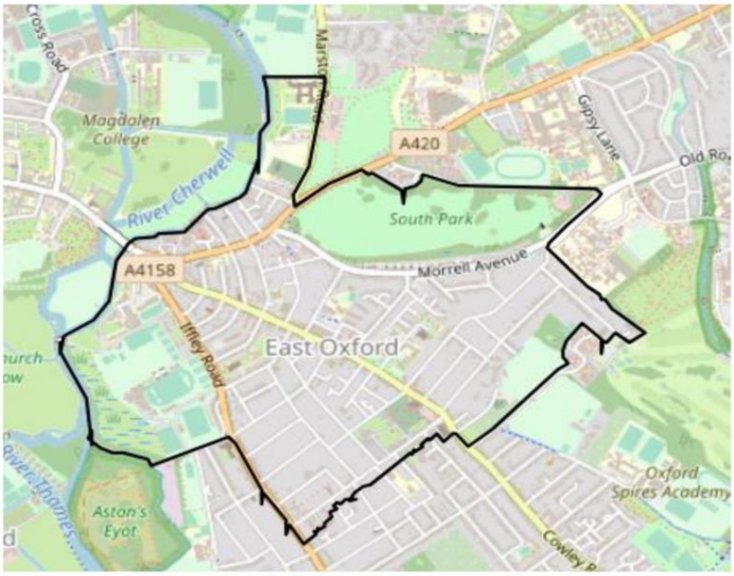
The Census 2021 profile for the East Oxford LTN area included in this chapter is based on a geographical area built from smaller “output areas” (see map below and annex 1 for the list of areas).

Map showing Output Areas selected for the East Oxford LTN



Small area Public Health, hospital admissions and life expectancy data however is not available at output area level. This type of data is published by Middle Layer Super Output (MSOA) area and the following map shows the extent of the MSOA covering the East Oxford LTN area.

Map showing boundary of Middle Layer Super Output Area Oxford 011, East Central Oxford



Map from www.nomisweb.co.uk

4 Demographic profile – Census 2021

According to the ONS Census survey of March 2021, the East Oxford Low Traffic Neighbourhood area included 12,000 residents living in 4,300 households.

Compared with Oxford city, this area had double the proportion of residents aged 20-24 years.

- 3,300 residents in the East Oxford LTN area were aged 20-24 years, 28% of the total (14% in Oxford).

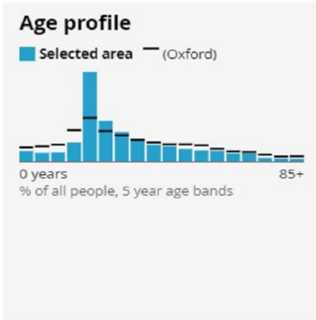
Population

12,000

people

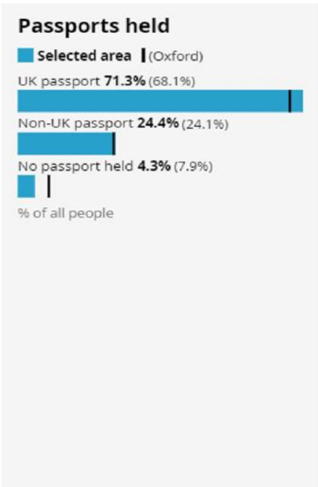
162,000 people in Oxford

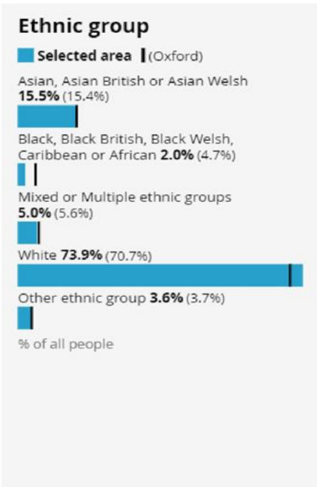
Rounded to the nearest 100 people

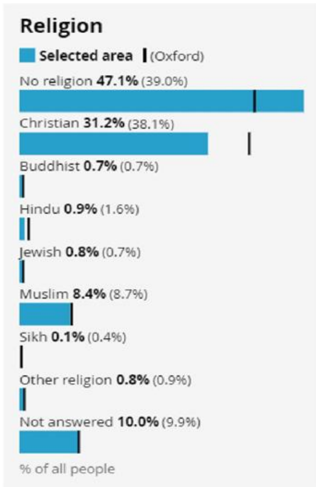


[Build a custom area profile - Census 2021, ONS]

Residents of the East Oxford LTN area were more likely than Oxford city to have a UK passport, be from a White ethnic background and to have no stated religion.



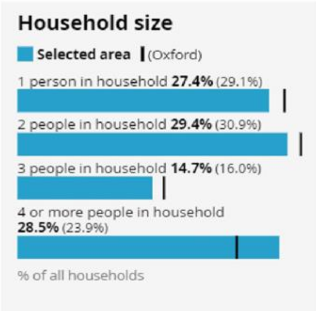


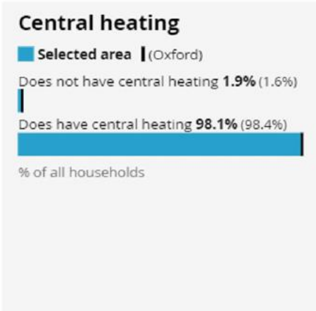


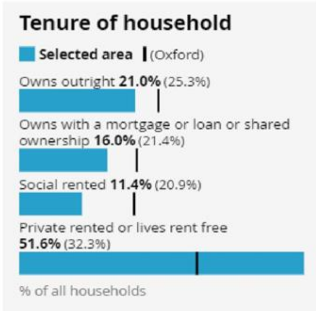
[Build a custom area profile - Census 2021, ONS]

5 Housing – Census 2021

Households in the East Oxford LTN area were more likely to be living in private rented accommodation (52% compared with 32% for Oxford) and to have 4 or more people living in the household.



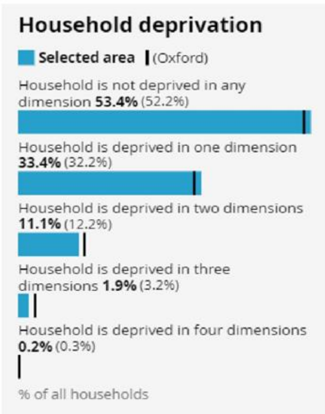




Build a custom area profile - Census 2021, ONS

6 Household deprivation – Census 2021

Overall, the East Oxford LTN area has a lower proportion of households classified as deprived on any dimension (using the Census 2021 data and definition[2]) than the Oxford City average (or a higher proportion classified as not deprived).



Build a custom area profile - Census 2021, ONS

[2] See Household deprivation variable: Census 2021 - Office for National Statistics (ons.gov.uk)
The dimensions of deprivation used to classify households are indicators based on four selected household characteristics:

- Education - A household is classified as deprived in the education dimension if no one has at least level 2 education and no one aged 16 to 18 years is a full-time student.
- Employment - A household is classified as deprived in the employment dimension if any member, not a full-time student, is either unemployed or economically inactive due to long-term sickness or disability.
- Health - A household is classified as deprived in the health dimension if any person in the household has general health that is bad or very bad or is identified as disabled.
- Housing - A household is classified as deprived in the housing dimension if the household's accommodation is either overcrowded, in a shared dwelling, or has no central heating.

Household deprivation varies across the LTN area however, which means that averages for the area hide some wide differences.

The area between Cowley Road, St Mary's Road and Leopold Street [1] is more likely to have households in relative deprivation.

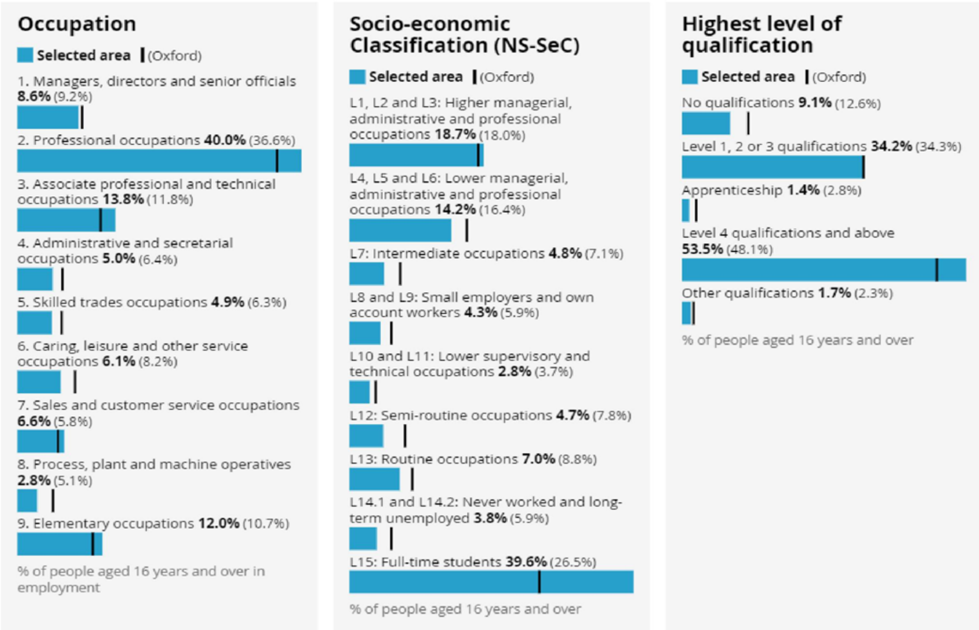
Maps (by output area) for East Oxford LTN area showing % households deprived on one, two, three or four dimensions

Household deprivation - Census Maps, ONS

7 Occupation and qualifications – Census 2021

Of people aged 16+ years, residents of the East Oxford LTN area were more likely to have higher level qualifications (degree and above) and to be in professional occupations.

The proportion in elementary occupations was also slightly higher than the Oxford average.

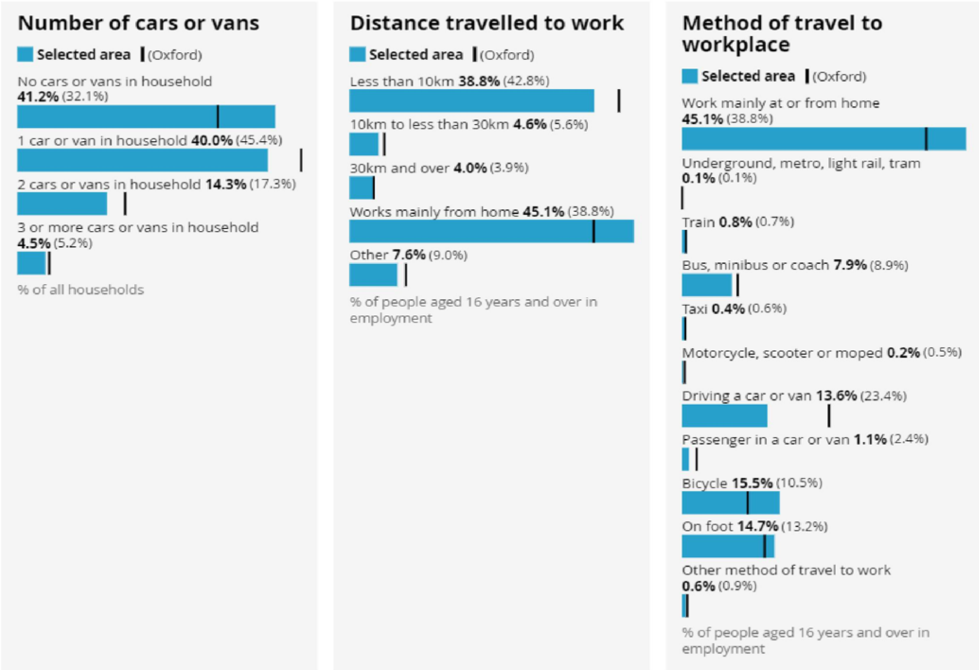


Build a custom area profile - Census 2021, ONS

8 Car ownership and travel to work – Census 2021

As of March 2021, households in the East Oxford LTN area were less likely to have a car than the average for Oxford and those in employment were more likely to work mainly from home.

Note that the Census 2021 survey was carried out in March 2021 when lock down restrictions were in place.



[Build a custom area profile - Census 2021, ONS]

Comparing 2011 and 2021 Census findings for the East Central Oxford MSOA shows the proportion of households with at least one car declined slightly in the area, while in Oxford the % of households with car(s) increased slightly. This may be linked to changes in household tenure and occupancy.

The COVID-19 lockdown led to a major change in the proportion of people working from home. The proportion in the East Central Oxford area was above average in 2011 and in 2021.

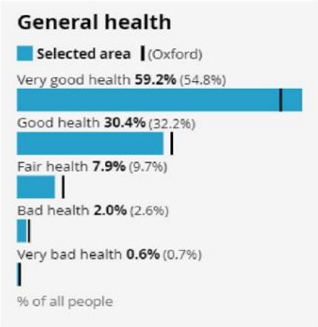
Households with at least 1 car	**2011**	**2021**	***2011 to 2021***
East Central Oxford MSOA	56%	55%	*-1ppt*
Oxford	67%	68%	*+1ppt*

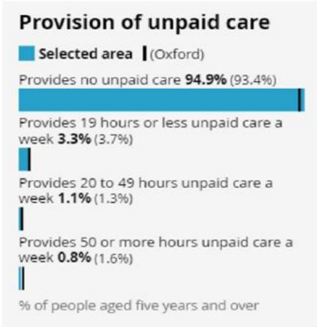
Working from home as % of those in employment	2011	2021	*2011 to 2021*
East Central Oxford MSOA	8%	45%	*+37ppt*
Oxford	6%	39%	*+33ppt*

ONS Census 2011 and Census 2021 from www.nomisweb.co.uk; from Car ownership and Method of travel to work tables. Note slight differences to the above charts as this table is for the Middle Layer Super Output Area, see maps in section 3

9 Health and caring – Census 2021

Residents of the East Oxford LTN area were more likely than average to be in very good health and to be "not disabled". The area had a lower proportion of people providing unpaid care. This comparison is likely to be affected by the younger age profile of the local population and the higher-than-average proportion of students.





Build a custom area profile - Census 2021, ONS

10 Low income and health-related benefit claimants

Within the East Oxford LTN (MSOA) area there were:

- 175 unemployment claimants
- 136 claimants of pension credit
- 156 children living in relative low income* households
- 93 residents claiming attendance allowance
- 280 claiming personal independence payments

The proportion per population of claimants were each below average for these measures with the exception of pension credit where the rate per population aged 65+ in East Oxford was above the Oxford average (14.4% vs 10.2%).

Claimants of income and health-related benefits for East Central Oxford MSOA

		East Central Oxford MSOA		Oxford	
Benefit type		**Count**	**%**	**%**	***Denominator (Census 2021)***
Unemployment claimants	June23	175	1.8%	2.2%	*aged 16-74*
Pension credit	Nov22	136	14.4%	10.2%	*aged 65+*
Children in Low Income Households*	2021/22	156	9.4%	13.2%	*aged 0-19*
Attendance allowance	Nov22	93	9.9%	10.4%	*aged 65+*
Personal Independence Payments	Apr23	280	2.7%	3.4%	*aged 16+*

DWP from statXplore

**Children in relative low income households. Relative low-income is defined as a family whose equivalised income is below 60 per cent of contemporary median income. Gross income measure is Before Housing Costs (BHC) and includes contributions from earnings, state support and pensions.*

11 Life expectancy and hospital admissions

Life expectancy data (5 years combined for 2016-20) for the East Central Oxford MSOA area shows Males in the area had a significantly lower (worse than) life expectancy at 76.3 years than the England average (79.5 years).

For females, life expectancy was better than the England average (85.5 years vs 83.2 years).

Life Expectancy and mortality for East Central Oxford MSOA

Indicator	Period	011 East Central Oxford		Counties & UAs (2021/22-2022/23)	England	England		
		Count	Value	Value	Value	Worst	Range	Best
Life Expectancy								
Life expectancy at birth, (upper age band 90 and over) (Male)	2016 - 20	-	76.3	81.5	79.5	66.6		
Life expectancy at birth, (upper age band 90 and over) (Female)	2016 - 20	-	85.5	84.8	83.2	72.0		
Mortality								
Deaths from all causes, all ages, standardised mortality ratio	2016 - 20	221	96.8	87.1	100.0	251.0		36.0
Deaths from all causes, under 75 years, standardised mortality ratio	2016 - 20	91	97.0	78.5	100.0	309.2		26.1
Deaths from all cancer, all ages, standardised mortality ratio	2016 - 20	58	94.7	89.1	100.0	200.8		32.2
Deaths from all cancer, under 75 years, standardised mortality ratio (SMR)	2016 - 20	35	104.8	86.5	100.0	231.0		29.2
Deaths from circulatory disease, all ages, standardised mortality ratio	2016 - 20	67	127.3	81.3	100.0	244.7		32.1
Deaths from circulatory disease, under 75 years, standardised mortality ratio	2016 - 20	24	129.7	72.0	100.0	374.4		12.6
Deaths from coronary heart disease, all ages, standardised mortality ratio	2016 - 20	29	129.0	74.1	100.0	307.5		16.6
Deaths from stroke, all ages, standardised mortality ratio	2016 - 20	19	157.5	90.8	100.0	415.7		0.0
Deaths from respiratory diseases, all ages, standardised mortality ratio	2016 - 20	23	81.8	82.0	100.0	335.4		21.8
Deaths from causes considered preventable, under 75 years, standardised mortality ratio	2016 - 20	36	80.9	73.6	100.0	378.4		17.3

Local Health - Small Area Public Health Data - Data - OHID (phe.org.uk) (trend data currently not available). Comparable data for Oxford is not available.

Hospital admissions data shows East Central Oxford MSOA having rates of admissions similar to the England average, other than for hospital admissions for alcohol attributable conditions where the area was significant worse than average.

For Chronic Obstructive Pulmonary Disease (COPD), a condition potentially affected by air quality[3], the rate of age standardised emergency hospital admissions (for the 5 year period combined 2016/17 to 2020/21) was 95.4. This was similar to the Oxford average (105.5) and similar to the England average (100).

Hospital admissions for residents of East Central Oxford MSOA

Indicator	Period	011 East Central Oxford		Counties & UAs (2021/22-2022/23)	England	England		
		Count	Value	Value	Value	Worst	Range	Best
Emergency Hospital Admissions: Adults								
Emergency hospital admissions for all causes, all ages, standardised admission ratio ⚠	2016/17 - 20/21	-	91.4	93.1	100.0	215.6		31.5
Emergency hospital admissions for coronary heart disease, standardised admission ratio ⚠	2016/17 - 20/21	-	103.6	71.9	100.0	396.1		23.0
Emergency hospital admissions for stroke, standardised admission ratio ⚠	2016/17 - 20/21	-	78.4	80.3	100.0	260.9		28.4
Emergency hospital admissions for Myocardial Infarction (heart attack), standardised admission ratio ⚠	2016/17 - 20/21	-	110.8	81.0	100.0	318.7		21.4
Emergency hospital admissions for Chronic Obstructive Pulmonary Disease (COPD), standardised admission ratio ⚠	2016/17 - 20/21	-	95.4	63.5	100.0	554.5		9.3
Hospital admissions, harm and injury and Long Term Conditions								
Emergency hospital admissions for intentional self harm, standardised admission ratio ⚠	2016/17 - 20/21	-	88.3	98.9	100.0	541.4		10.2
Emergency hospital admissions for hip fracture in persons 65 years and over, standardised admission ratio ⚠	2016/17 - 20/21	-	108.4	96.4	100.0	527.4		29.3
Hospital admissions for alcohol attributable conditions, (Broad definition) ⚠	2016/17 - 20/21	595	109.9	77.1	100.0	391.1		35.9
Hospital admissions for alcohol attributable conditions, (Narrow definition) ⚠	2016/17 - 20/21	205	107.4	73.7	100.0	471.9		22.6

Local Health - Small Area Public Health Data - Data - OHID (phe.org.uk) (trend data currently not available)

⚠ *Hospital data is flagged by NHS Digital as having a data quality issue affecting HES data for Nottingham University Hospitals Trust (NUH) in 2016/17. Over 30% of records from this trust did not have a valid geography of residence assigned.*

Note that conditions such as asthma and diabetes is recorded by primary care and available for reporting at GP practice level, but statistics are not reported within geographical boundaries - either for the East Oxford LTN area or for the East Central Oxford MSOA.

[3] Chronic obstructive pulmonary disease (COPD) - Causes - NHS (www.nhs.uk)

12 Healthy weight

For children in reception year (aged 4-5 years) in the East Central Oxford MSOA, just above 1 in 6 (18%) were measured as overweight/obese. This was similar to[4] the averages for Oxford and England.

In their final year of primary school aged 10-11 years, over a third (35%) of children were measured as overweight/obese in the East Central Oxford MSOA - also similar to the averages for Oxford and England.

Prevalence of children overweight (including obese) for East Central Oxford MSOA, 3-years data combined (2019/20 – 21/22)

	East Central Oxford MSOA	Oxford	England
Reception (aged 4-5 years)	17.9% (range 13.4% to 26.3%)	18.7%	22.6%
Year 6 (aged 10-11 years)	35.3% (range 24.9% to 44.7%)	33.7%	35.8%

Local Health – Small Area Public Health Data, OHID from NCMP

[4] "Similar to average" means statistically similar - with overlapping confidence interval ranges

ANNEX 1: List of OA codes in the LTN and MSOA area

OA codes in LTN area used in Census 2021 profile	OA codes in East Central Oxford MSOA Oxford 011
E00145425 E00145427 E00145428 E00145430 E00145431 E00145432 E00145433 E00145592 E00145593 E00145594 E00145595 E00145596 E00145597 E00145598 E00145599 E00145601 E00145605 E00145606 E00145607 E00145621 E00145622 E00145623 E00145624 E00145625 E00145626 E00145627 E00145628 E00145629 E00145630 E00145632 E00145633 E00145634	E00145592 E00145597 E00145598 E00145599 E00145593 E00145595 E00145601 E00145605 E00145591 E00145594 E00145596 E00145606 E00145600 E00145602 E00145603 E00145604 E00145607 E00145622 E00145624 E00145627 E00145628 E00145630 E00145623 E00145625 E00145626 E00145629 E00145634 E00145621 E00145631 E00145632 E00145633

Annex B

Calculations Used for Statistical Analysis

Difference

245. To calculate the difference in counts the average daily traffic counts for the pre-implementation period was subtracted from the post-implementation period (dates for each period vary by data source). To derive the percentage difference, this difference was divided by the pre-implementation period average daily counts (in some instanced the mean and in some instanced the median, depending on the data source).

Difference in Difference (DiD)

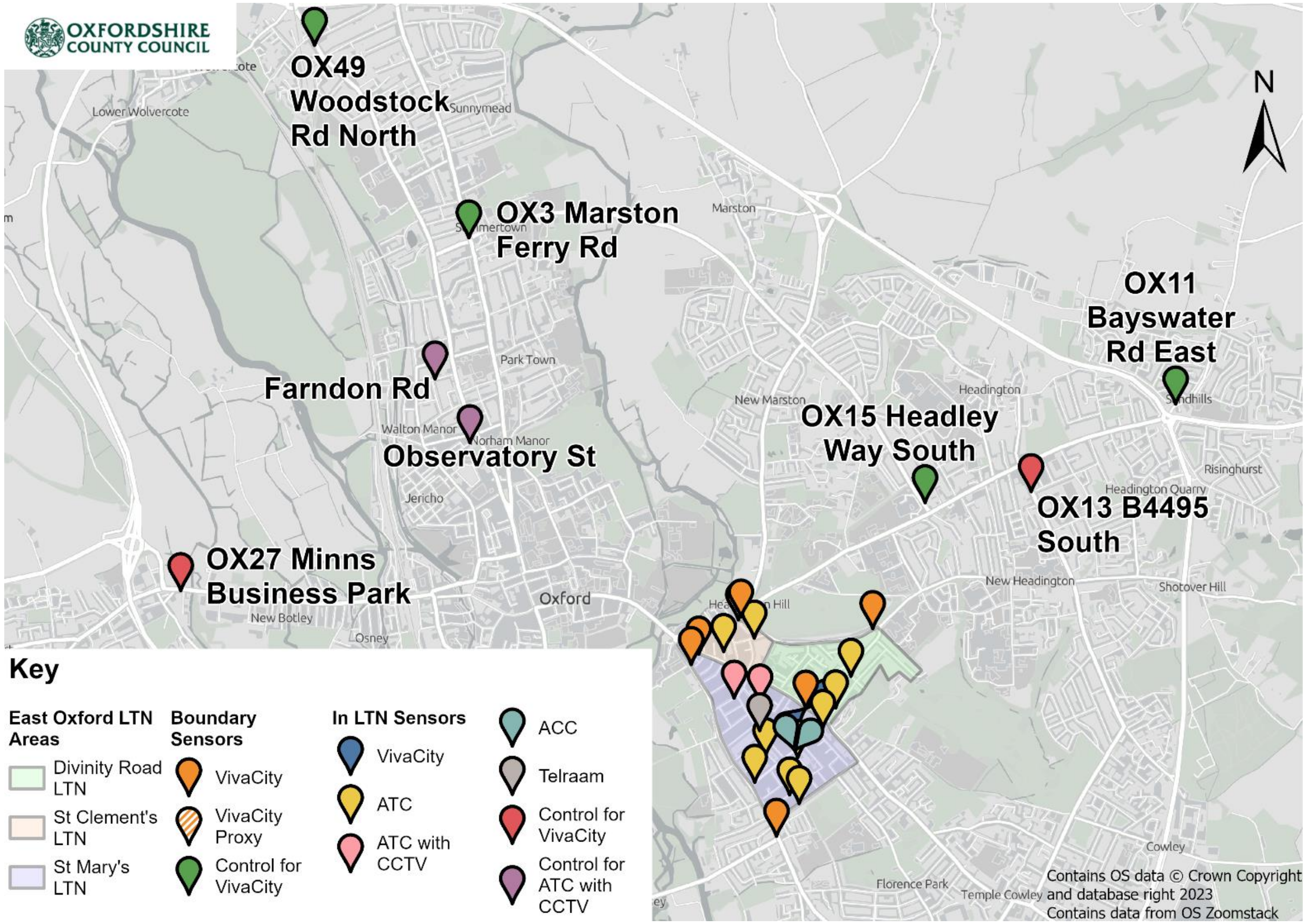
246. The calculation for DiD (impact estimate) takes the difference in the average daily traffic volumes (by mode) for the roads inside the east Oxford LTN before and after the implementation of the traffic filters, and then subtracts the difference in the average daily traffic volume (by mode) for the control area roads before and after the implementation of the traffic filters. The resulting difference is the estimated effect of the LTN on the traffic volumes by mode of transport. The same method was also applied to the boundary roads and their control roads. For the control roads, the aggregated daily average across all the roads from each individual road's daily median count was taken.

247. To account for the potential scaling effect on -/+ difference calculations (owing to differences in traffic volume sizes between control and intervention area roads), firstly the DiD (impact estimate) as a percentage increase/decrease in average daily traffic volumes were calculated. This percentage was then applied to the pre-implementation traffic count to derive the estimated average daily count (by mode), which was the estimated effect attributed to the east Oxford LTN traffic filters.

Annex C

Map of all sensor locations

Figure 24 - Map of all traffic sensor locations used in report analysis



Types of traffic sensors used

VivaCity object identification sensors

Figure 25 - Vivacity camera installed on lamp post

248. These sensors count and classify a variety of road users including cars, pedestrians and cyclists, using cameras and machine vision. No personal data is collected, and the raw images from the camera are not used. In this evaluation VivaCity count lines[25] have been analysed from sensors on Cowley Road, Iffley Road and Morrell Avenue, at two locations on each of the former two roads and one location in the latter, and two are located inside the LTNs (one in St Mary's LTN and one in Divinity Road LTN).

249. Data is received as counts broken down by sensor and mode of transport down to 5-minute intervals for which the sensor has been live. These modes of transport are pedestrians, cycles, cars, motorbikes, Light Goods Vehicles (LGV), Other Goods Vehicles (OGV1, OGV2 and bus). OGV1 and OGV2 are grouped to HGVs and bus counts are not included in this analysis.

[25] Sensor 'count lines' are virtual lines across a road and used as part of the sensor analysis derived from each camera sensor. The modes such as pedestrians, cars, cyclists are then counted. Each sensor has at least one count line and some have multiple count lines.

Temporary Automatic Traffic Counters (ATCs)

Figure 26 - An ATC installation

250. These sensors are used to count vehicles inside the LTNs where there are limited VivaCity cameras available. ATCs use pneumatic tubing that is laid across a road to count air pulses from passing traffic. They can determine flow rate, mean speed, and type of vehicle. ATCs are unable to count pedestrians and cycle counts can only be used with caution.

251. Data was received from the ten sensor surveys as counts broken down by sensor, travel direction and mode of transport for each 15-minute interval during the survey period. These modes of transport are cycle, motorcycle, car, LGV, bus, and several categories of HGV.

252. It was decided to omit the cycle counts from the analysis as other studies indicated that cycles are not always picked up by the counters. This is due to the low speed and weight of bicycles. There is inconsistency in how many cycles are recorded, or not, from site to site, making any comparison unreliable.

253. This issue does also occur when surveying motorcycles. However, the problem is less of an issue due to the greater weight of the vehicles. Therefore, motorcycles have been included in the analysis, but three sensors which contained extreme outliers in either the before or during period have been removed from the dataset. All categories of HGV have been grouped together, including the occasional bus recorded, as there were no scheduled bus routes using these roads during the survey periods.

254. Days where only partial data was collected were omitted from the analysis. Roads affected by partial data include Hertford Street (in 2021) and Jeune Street (in 2022).

255. The second survey method used combined temporary ATC and CCTV data collection together. This method covered two additional in-LTN area ATCs and two control sites. It recorded vehicles differently from the ATCs undertaken without CCTV, with data hourly, no cycles or motorcycles monitored, and with cars and LGVs grouped together. When grouping vehicles together, this gives two vehicle categories of cars/LGVs and HGVs.

Closed Circuit TV (CCTV)

256. CCTV images are recorded for the duration of the survey and that CCTV footage is then manually analysed to count pedestrians and cycles. This method has been used to supplement the ATC count data to understand the impact on pedestrian and cycle counts (see paragraph 250 above).

257. Data is recorded in counts for every 15-minute interval from 7am to 7pm by direction and pedestrian or cycle during the survey period.

Automatic Cycle Counter (ACC)

Figure 27 - An ACC installation

258. These sensors use in-road inductive loops (metal detectors) that count cycles passing over them by direction and by hour of the day.

259. Data is received as hourly counts broken down by sensor for cycles.

Telraam counter

Figure 28 - A Telraam counter

260. A Telraam sensor is a small electronic device installed in a window overlooking a road. The sensor counts and classifies a variety of road users including cars, pedestrians and cyclists as well as car speed using artificial intelligence (AI) and a tracking algorithm. No personal data is collected, and the raw images from the camera are not saved or exported from the device. Data from these sensors is publicly available at the Telraam website[26].

261. Telraam sensors provide counts for multiple modes of transport, similar to VivaCity sensors, also using a camera and AI algorithm to classify and count road users. However, Telraam sensors have been designed for citizens to be able to monitor their local street by placement looking out from a first-floor window. The data collected by these devices is openly available on the internet in a dashboard. Data is received as hourly counts broken down by sensor, direction of travel and mode of transport of pedestrian, two-wheeler, car or heavy. Two-wheeler includes both cycles and motorbikes with heavy including LGVs and HGVs.

[26] telraam.net

Annex D

Boundary roads - detailed analysis

262. Percentage difference is presented and coloured with the hourly count difference in brackets and the 'before' to 'after' below, following the methodology in *Traffic Volume Analysis/Methodology/Granularity*. Differences are calculated before rounding so may not exactly match the before and after counts.

Table 61 - Granular analysis of boundary roads

Mode	Road	Weekday						Weekend	
		AM-peak		Day		PM-peak		Day	
		In	Out	In	Out	In	Out	In	Out
Pedestrian	Iffley Road east	+9% (+3) 38 -> 41	-15% (-1) 5 -> 4	-8% (-2) 29 -> 26	-13% (-1) 5 -> 5	-5% (-2) 29 -> 28	-12% (-1) 9 -> 8	+10% (+3) 32 -> 36	+27% (+1) 5 -> 7
	Iffley Road north	+89% (+4) 5 -> 9	-50% (-1) 1 -> 1	+21% (+1) 4 -> 5	-14% (+0) 1 -> 1	-16% (-1) 4 -> 3	-36% (-1) 3 -> 2	+31% (+1) 5 -> 6	-52% (-1) 2 -> 1
	Cowley Road north	+0% (+0) 157 -> 157	-1% (-1) 47 -> 47	-12% (-26) 216 -> 191	-3% (-3) 124 -> 121	-15% (-32) 209 -> 177	-3% (-9) 253 -> 244	-7% (-19) 283 -> 264	-6% (-11) 171 -> 161
	Morrell Avenue	+40% (+1) 3 -> 4	-30% (-2) 5 -> 4	+17% (+0) 2 -> 2	-15% (-1) 3 -> 3	-15% (-1) 3 -> 3	-8% (+0) 3 -> 3	+38% (+1) 2 -> 2	-23% (-1) 2 -> 2
Cycle	Iffley Road east	+38% (+30) 81 -> 111	+38% (+4) 11 -> 15	+25% (+7) 28 -> 35	+4% (+0) 12 -> 12	+21% (+7) 31 -> 37	+19% (+4) 19 -> 22	+21% (+6) 28 -> 34	+25% (+4) 14 -> 18
	Iffley Road north	+16% (+29) 181 -> 209	+4% (+2) 41 -> 43	+12% (+14) 118 -> 132	+8% (+4) 55 -> 59	+3% (+2) 70 -> 72	+23% (+41) 174 -> 214	+16% (+15) 97 -> 112	+10% (+7) 68 -> 75
	Cowley Road north	+7% (+8) 112 -> 120	+8% (+4) 48 -> 51	-12% (-12) 95 -> 83	+5% (+3) 70 -> 74	-6% (-3) 57 -> 54	+35% (+55) 155 -> 210	-11% (-8) 76 -> 68	+9% (+6) 63 -> 69
	Morrell Avenue	+14% (+6) 42 -> 48	+28% (+16) 58 -> 74	+14% (+4) 28 -> 32	+33% (+9) 28 -> 37	+47% (+23) 50 -> 73	+52% (+12) 23 -> 35	+14% (+3) 18 -> 21	+31% (+4) 11 -> 15
Car	Iffley Road east	-25% (-162) 657 -> 495	-18% (-80) 456 -> 376	-12% (-55) 450 -> 395	-19% (-84) 440 -> 356	-7% (-41) 583 -> 542	-24% (-159) 668 -> 509	-12% (-61) 510 -> 450	-20% (-102) 503 -> 401

	Iffley Road north	+17% (+47) 282 -> 329	+44% (+76) 174 -> 250	+24% (+54) 225 -> 279	+30% (+66) 219 -> 284	+23% (+60) 259 -> 319	+28% (+85) 304 -> 388	+21% (+55) 262 -> 317	+31% (+71) 232 -> 303
	Cowley Road north	+63% (+77) 122 -> 199	+82% (+60) 74 -> 134	+61% (+79) 130 -> 208	+77% (+95) 124 -> 219	+40% (+66) 162 -> 228	+42% (+66) 160 -> 226	+46% (+73) 160 -> 233	+57% (+89) 155 -> 244
	Morrell Avenue	+30% (+24) 80 -> 103	+7% (+9) 133 -> 142	+24% (+20) 82 -> 102	+17% (+16) 91 -> 106	+10% (+12) 128 -> 140	+0% (+0) 125 -> 125	+22% (+17) 79 -> 96	+17% (+14) 81 -> 95
	St Clement's Proxy	-11% (-42) 395 -> 353		-1% (-2) 340 -> 338		-33% (-155) 475 -> 320		-5% (-19) 379 -> 360	
Motorcycle	Iffley Road east	+14% (+2) 15 -> 17	+20% (+1) 3 -> 3	-18% (-3) 16 -> 13	-15% (-1) 8 -> 7	-11% (-2) 18 -> 16	+12% (+1) 12 -> 13	-12% (-2) 14 -> 13	-1% (+0) 7 -> 7
	Iffley Road north	+9% (+1) 8 -> 9	+63% (+1) 2 -> 3	-6% (-1) 8 -> 8	-5% (-1) 9 -> 9	+16% (+1) 8 -> 9	-5% (-1) 13 -> 12	+4% (+0) 7 -> 7	-21% (-2) 10 -> 8
	Cowley Road north	-28% (-4) 13 -> 9	+0% (+0) 3 -> 3	-17% (-4) 22 -> 18	+5% (+1) 13 -> 13	-15% (-4) 25 -> 21	-2% (+0) 16 -> 16	-16% (-3) 20 -> 17	+8% (+1) 11 -> 12
	Morrell Avenue	-50% (-2) 4 -> 2	-33% (-1) 3 -> 2	-23% (-1) 6 -> 5	-13% (-1) 6 -> 6	-7% (-1) 10 -> 10	+8% (+1) 10 -> 10	-17% (-1) 5 -> 4	-6% (+0) 6 -> 5
LGV	Iffley Road east	-22% (-18) 84 -> 66	-7% (-3) 49 -> 46	-15% (-12) 80 -> 67	-14% (-13) 94 -> 80	-23% (-9) 39 -> 30	-19% (-15) 77 -> 62	-17% (-5) 28 -> 24	-5% (-2) 35 -> 33
	Iffley Road north	+9% (+4) 47 -> 51	+46% (+13) 28 -> 40	+22% (+11) 52 -> 63	+36% (+19) 52 -> 71	+20% (+5) 25 -> 30	+28% (+10) 35 -> 44	+19% (+3) 18 -> 22	+38% (+7) 18 -> 25
	Cowley Road north	+16% (+6) 38 -> 44	+68% (+12) 17 -> 29	+45% (+16) 36 -> 51	+74% (+24) 32 -> 55	+9% (+2) 22 -> 24	+49% (+8) 16 -> 24	+30% (+4) 14 -> 18	+98% (+10) 10 -> 20
	Morrell Avenue	+19% (+3) 13 -> 16	+52% (+6) 11 -> 16	+23% (+5) 19 -> 24	+37% (+6) 15 -> 21	+18% (+2) 11 -> 12	+25% (+2) 10 -> 12	+33% (+2) 6 -> 8	+36% (+2) 4 -> 6
HGV	Iffley Road east	+0% (+0) 19 -> 19	+0% (+0) 17 -> 17	+10% (+2) 21 -> 23	-6% (-1) 21 -> 20	+4% (+1) 14 -> 15	-14% (-2) 17 -> 14	-1% (+0) 13 -> 13	-20% (-2) 9 -> 7
	Iffley Road north	-6% (-1) 18 -> 17	-4% (-1) 13 -> 13	+1% (+0) 21 -> 21	+6% (+1) 15 -> 16	+5% (+1) 14 -> 14	-12% (-2) 13 -> 12	-1% (+0) 12 -> 12	-20% (-2) 8 -> 6
	Cowley Road north	-31% (-10) 31 -> 22	-23% (-6) 27 -> 21	-27% (-8) 31 -> 23	-7% (-2) 28 -> 26	-27% (-7) 27 -> 20	-15% (-3) 22 -> 19	-2% (+0) 19 -> 18	+8% (+1) 15 -> 16
	Morrell Avenue	-13% (-1) 8 -> 7	-8% (-1) 7 -> 6	-17% (-1) 8 -> 6	-23% (-2) 9 -> 7	-36% (-3) 7 -> 5	-37% (-3) 8 -> 5	-5% (+0) 3 -> 3	-13% (-1) 4 -> 3

Annex E

In-LTN survey dates

Table 62 - In-LTN survey dates

Type	Road	Survey	2021		2022	
			Start	Finish	Start	Finish
ATC	Minster Road	ATC	07/11/2021	23/11/2021	03/11/2022	21/11/2022
	Southfield Road	ATC	19/11/2021	30/11/2021	03/11/2022	21/11/2022
	Cross Street	ATC	07/11/2021	23/11/2021	03/11/2022	21/11/2022
	Jeune Street	ATC	07/11/2021	23/11/2021	03/11/2022	12/11/2022
	Stanley Road	ATC	07/11/2021	23/11/2021	03/11/2022	21/11/2022
	Magdalen Road (Iffley Road)	ATC	07/11/2021	23/11/2021	03/11/2022	21/11/2022
	Magdalen Road (Cowley Road)	ATC	07/11/2021	23/11/2021	03/11/2022	21/11/2022
	Hertford Street	ATC	12/11/2021	23/11/2021	03/11/2022	21/11/2022
	Charles Street	ATC	19/11/2021	30/11/2021	03/11/2022	21/11/2022
	Howard Street	ATC	07/11/2021	23/11/2021	03/11/2022	21/11/2022
ATC with CCTV	James Street	ATC	11/10/2021	24/10/2021	11/10/2022	24/10/2022
		CCTV	11/10/2021	24/10/2021	17/10/2022	30/10/2022
	Bullingdon Road	ATC	11/10/2021	24/10/2021	11/10/2022	24/10/2022
		CCTV	11/10/2021	24/10/2021	17/10/2022	30/10/2022
Control for ATC with CCTV	Farndon Road	ATC	11/10/2021	24/10/2021	11/11/2022	20/11/2022
		CCTV	11/10/2021	24/10/2021	17/10/2022	30/10/2022
	Observatory Street	ATC	11/10/2021	24/10/2021	11/10/2022	24/10/2022
		CCTV	11/10/2021	24/10/2021	17/10/2022	30/10/2022

In-LTN - detailed analysis

263. Percentage difference is presented and coloured with the hourly count difference in brackets and the 'before' to 'after' below, following the methodology in *Traffic Volume Analysis/Methodology/Granularity*. Differences are calculated before rounding so may not exactly match the before and after counts.

Table 63 – In-LTN ATC granularity

Mode	Road	Weekday						Weekend	
		AM-peak		Day		PM-peak		Day	
		In	Out	In	Out	In	Out	In	Out
Car	Jeune St	+80% (+25) 32 -> 57		+19% (+3) 16 -> 20		+63% (+13) 21 -> 34		+29% (+5) 17 -> 22	
	Cross St	-76% (-83) 109 -> 26	-70% (-31) 44 -> 13	-42% (-25) 61 -> 36	-63% (-26) 41 -> 15	-61% (-56) 91 -> 35	-53% (-33) 63 -> 29	-56% (-35) 62 -> 27	-63% (-25) 40 -> 15
	Minster Rd	-12% (-1) 6 -> 5	-34% (-1) 4 -> 2	+16% (+1) 6 -> 7	+4% (+0) 5 -> 6	-6% (+0) 8 -> 7	-14% (-1) 9 -> 8	+43% (+2) 5 -> 7	+17% (+1) 5 -> 5
	Southfield Rd	-85% (-33) 39 -> 6	-88% (-55) 63 -> 8	-83% (-37) 45 -> 7	-83% (-33) 40 -> 7	-90% (-89) 99 -> 10	-77% (-34) 44 -> 10	-84% (-38) 44 -> 7	-84% (-34) 40 -> 6
	Stanley Rd	-9% (-1) 6 -> 5	-20% (-1) 4 -> 3	+14% (+1) 8 -> 9	-28% (-2) 8 -> 5	-54% (-9) 17 -> 8	+39% (+3) 8 -> 12	+27% (+2) 7 -> 9	-17% (-1) 7 -> 6
	Magdalen Rd (Iffley Rd)		-88% (-156) 178 -> 22		-74% (-95) 129 -> 34		-82% (-125) 153 -> 28		-74% (-98) 131 -> 33
	Magdalen Road (Cowley Rd)	-71% (-108) 151 -> 44	+48% (+8) 17 -> 25	-71% (-82) 116 -> 34	+24% (+5) 20 -> 25	-67% (-96) 145 -> 48	+2% (+1) 32 -> 33	-73% (-89) 123 -> 34	+19% (+4) 23 -> 27
	Hertford St	-64% (-9) 14 -> 5	+32% (+2) 7 -> 9	-71% (-9) 13 -> 4	+27% (+3) 11 -> 13	-77% (-14) 18 -> 4	-25% (-4) 17 -> 13	-72% (-10) 14 -> 4	+34% (+3) 10 -> 13
	Charles St	-72% (-23) 31 -> 9	+26% (+3) 13 -> 16	-35% (-4) 12 -> 8	+20% (+3) 16 -> 20	-83% (-44) 53 -> 9	+34% (+7) 22 -> 30	-16% (-2) 11 -> 9	+18% (+4) 21 -> 25
	Howard St	-85% (-128) 151 -> 23		-84% (-109) 129 -> 20		-88% (-167) 191 -> 23		-83% (-114) 138 -> 24	

Table 64 – In-LTN additional ATC with CCTV granularity

Mode	Road	Weekday						Weekend	
		AM-peak		Day		PM-peak		Day	
		In	Out	In	Out	In	Out	In	Out
Pedestrian	James St	+9% (+2) 19 -> 21	+6% (+1) 18 -> 19	-13% (-4) 28 -> 24	-8% (-2) 29 -> 26	+1% (+0) 36 -> 36	-5% (-2) 45 -> 42	-28% (-9) 33 -> 24	-17% (-6) 33 -> 27
	Bullingdon Rd	+47% (+19) 40 -> 58	+28% (+5) 16 -> 21	+57% (+26) 45 -> 71	+69% (+23) 32 -> 55	+74% (+41) 56 -> 97	+78% (+48) 62 -> 110	+30% (+17) 57 -> 75	+55% (+21) 38 -> 59
Cycle	James St	+31% (+2) 6 -> 8	+14% (+3) 18 -> 21	-1% (+0) 9 -> 8	+4% (+1) 15 -> 16	+5% (+1) 19 -> 20	+19% (+3) 17 -> 20	-29% (-3) 10 -> 7	-5% (-1) 16 -> 15
	Bullingdon Rd	-12% (-4) 38 -> 34	+23% (+2) 8 -> 10	+41% (+6) 14 -> 20	+87% (+8) 9 -> 16	+35% (+6) 18 -> 25	+39% (+11) 27 -> 38	+11% (+2) 17 -> 19	+21% (+3) 13 -> 16
Car/LGV	James St	-89% (-41) 47 -> 5	-81% (-43) 53 -> 10	-69% (-20) 29 -> 9	-81% (-44) 54 -> 10	-70% (-29) 41 -> 13	-85% (-64) 76 -> 12	-74% (-24) 33 -> 8	-81% (-47) 58 -> 11
	Bullingdon Rd	+92% (+2) 2 -> 4	-57% (-15) 26 -> 11	+95% (+2) 2 -> 5	-52% (-18) 34 -> 16	+122% (+4) 3 -> 7	-52% (-23) 43 -> 21	+11% (+0) 3 -> 3	-39% (-13) 34 -> 20

Table 65 – In-LTN ACC granularity

Mode	Road	Weekday						Weekend	
		AM-peak		Day		PM-peak		Day	
		In	Out	In	Out	In	Out	In	Out
Cycle	Magdalen Rd	+20% (+8) 40 -> 48	+500% (+10) 2 -> 12	+19% (+3) 14 -> 17	+278% (+8) 3 -> 11	+9% (+1) 16 -> 17	+453% (+20) 5 -> 25	+27% (+4) 13 -> 17	+200% (+9) 4 -> 13
	St Mary's Rd	+0% (+0) 4 -> 4	-60% (-2) 3 -> 1	+7% (+0) 3 -> 3	-40% (-1) 2 -> 1	-12% (+0) 3 -> 3	-42% (-1) 3 -> 2	+7% (+0) 2 -> 3	-30% (-1) 2 -> 1

Table 66 - In-LTN Telraam granularity

Mode	Road	Weekday						Weekend	
		AM-peak		Day		PM-peak		Day	
		In	Out	In	Out	In	Out	In	Out
Pedestrian	Hurst St	+3% (+0) 15 -> 15	+24% (+2) 8 -> 10	-3% (+0) 12 -> 11	+29% (+3) 9 -> 11	+12% (+2) 18 -> 20	+15% (+3) 18 -> 20	+50% (+6) 13 -> 19	+78% (+7) 9 -> 16
Car	Hurst St	+10% (+1) 11 -> 12	-64% (-6) 10 -> 4	-47% (-10) 22 -> 12	-52% (-9) 18 -> 9	-50% (-11) 21 -> 11	-56% (-13) 23 -> 10	-26% (-4) 14 -> 11	-44% (-6) 13 -> 7
Two-wheeler	Hurst St	-4% (-1) 33 -> 32	-19% (-4) 23 -> 18	-11% (-3) 30 -> 26	+11% (+2) 21 -> 23	-10% (-3) 30 -> 27	-12% (-4) 37 -> 33	+6% (+2) 27 -> 29	+20% (+4) 18 -> 22
HGV	Hurst St	+34% (+1) 2 -> 2	-15% (+0) 1 -> 1	-39% (-2) 6 -> 4	-35% (-2) 5 -> 3	-49% (-4) 7 -> 4	+50% (+2) 4 -> 5	-32% (-1) 2 -> 1	-7% (+0) 1 -> 1

**Note, where there are minor differences in numbers, this is due to rounding errors*

Table 67 Additional ATC with CCTV control data

Road	Pedestrian, In + Out				Cycle, In + Out			
	Weekday + Weekend			Weekday	Weekday + Weekend			Weekday
	before	after	diff.	diff.	before	after	diff.	diff.
Farndon Rd	216	196	-9%	-5%	80	69	-14%	-16%
Observatory St	952	910	-4%	-1%	230	234	2%	2%
Average	**584**	**553**	**-5%**	**-2%**	**155**	**152**	**-2%**	**-3%**

Road	Car/LGV, In + Out				HGV, In + Out			
	Weekday + Weekend			Weekday	Weekday + Weekend			Weekday
	before	after	diff.	diff.	before	after	diff.	diff.
Farndon Rd	456	322	-30%	-31%	75	53	-30%	-28%
Observatory St	929	917	-1%	2%	157	123	-21%	-18%
Average	**693**	**619**	**-11%**	**-9%**	**116**	**88**	**-24%**	**-21%**

Annex F

Other roads analysis

Figure 29 - Location of other roads used in the analysis

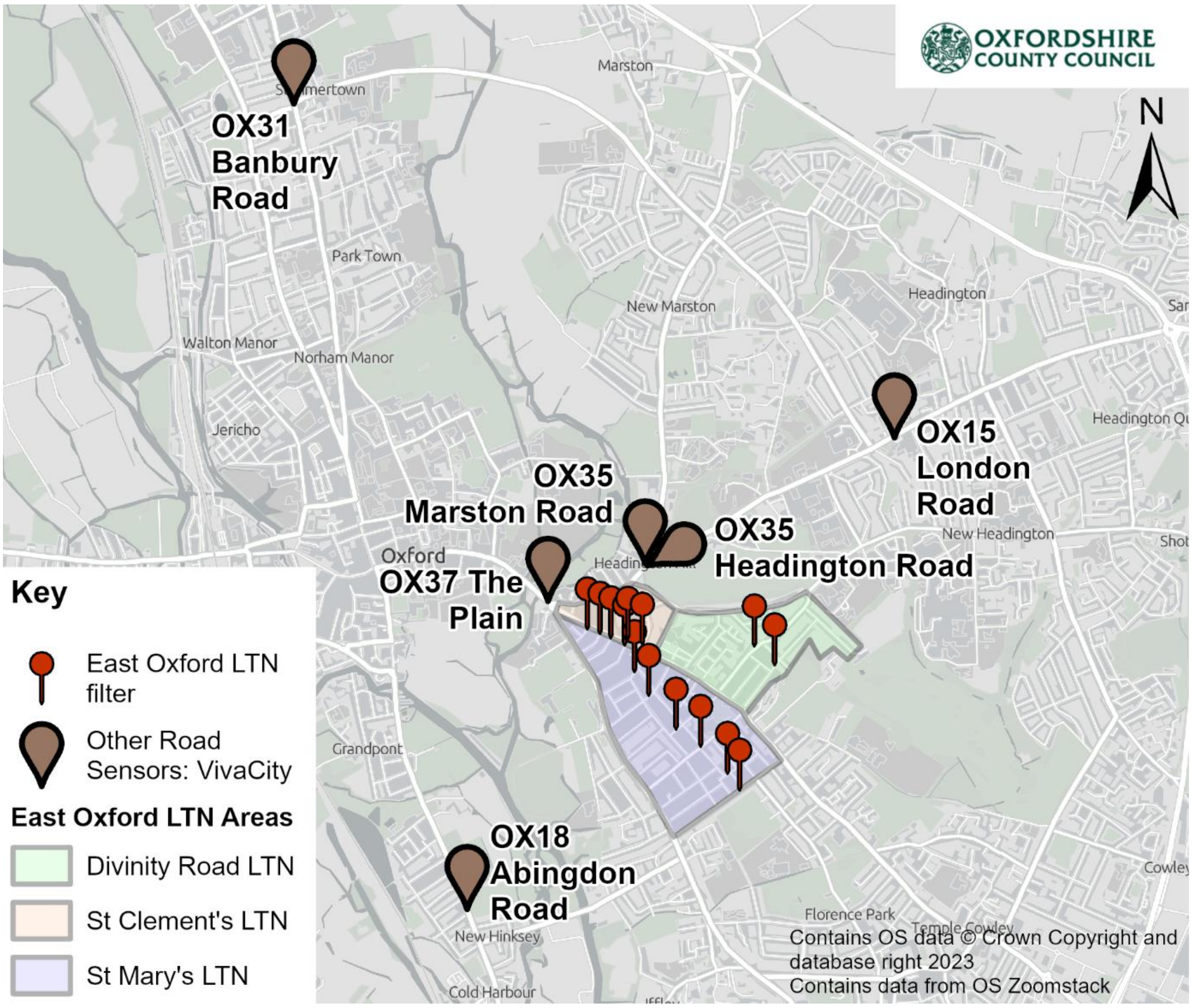


Table 68 - Other roads VivaCity car, In, Out, weekday + weekend

	Car, weekday + weekend								
	In + out			In			Out		
Road	before	after	diff.	before	after	diff.	before	after	diff.
OX37 The Plain	11,104	9,620	-13.4%	5,621	5,321	-5.3%	5,439	4,404	-19.0%
OX31 Banbury Road	11,305	13,019	15.2%	5,853	6,532	11.6%	5,431	6,435	18.5%
OX35 Marston Road	7,144	6,025	-15.7%	3,510	2,796	-20.3%	3,628	3,207	-11.6%
OX35 Headington Road	5,822	5,791	-0.5%	2,972	2,814	-5.3%	2,810	2,969	5.7%
OX18 Abingdon Road	13,283	13,085	-1.5%	6,405	6,257	-2.3%	6,811	6,810	0.0%
OX15 London Road	12,727	12,238	-3.8%	6,122	5,981	-2.3%	6,535	6,252	-4.3%

Annex G

Quickway cycle scheme details

Table 69 - Quickway opening dates

Road	From	To	Fully open date
Old Road/Morrell Ave/Warneford Lane (OXR12)	A420	Churchill Drive	11 August 2022
Cowley – Oxford Road (OXR14)	The Plain	Hollow Way	11 August 2022
Marston Road (OXR7)	Headington Road	Cherwell Drive	4 October 2022
Iffley Road/Rose Hill/Littlemore (OXR17)	The Plain	Eastern By-pass	20 October 2022

Note - for this exercise the completion of the installation of the wands/orcas (which was after the lining work) is used to denote when the schemes went live. However, with Cowley Road, as it didn't have any wands/orcas installed along it (due to available road width), the last night of lining work is used as the end date for this part of the project.

Figure 30 - Location of Quickways – shown in orange

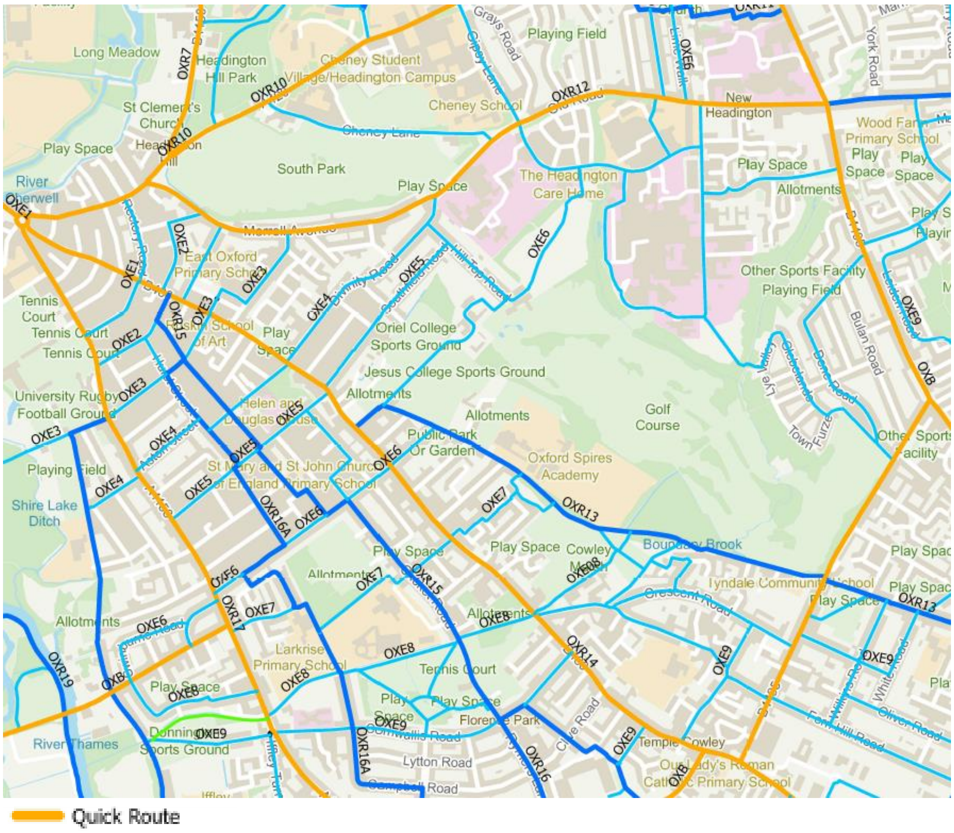


Figure 31 – Quickway, Iffley Road, showing orcas and wands

Figure 32 - Quickway, Iffley Road, showing cycle path junction details

Figure 33 - Quickway, Marston Road, showing orcas and wands

Figure 34 - Quickway, Warneford Lane, showing orcas and wands

Annex H

Summary of east Oxford LTN bollard outages

Table 70 - list of bollard outage periods by road

Area	Location	Date reported	Issue	Other notes	Date resolved	How long out in days?	Total days out, by road
East Oxford	Barnet street	24/06/2022	Fire damage	Done	08/07/2022	14	
East Oxford	**Barnet Street**	22/03/2023	Plastic bollard thrown in residential garden		05/04/2023	14	**28**
East Oxford	Bullingdon road	02/12/2022	bollard missing		06/12/2022	4	
East Oxford	Bullingdon road	15/11/2022	report of missing bollard		22/11/2022	7	
East Oxford	Bullingdon road	27/06/2022	Run over	Done	11/07/2022	14	
East Oxford	Bullingdon road	07/09/2022	Damaged bollard	Bollard Replaced	21/09/2022	14	
East Oxford	Bullingdon road	31/10/2022	missing	replaced - spent a while digging out sand which had been put into the base/	14/11/2022	14	
East Oxford	**Bullingdon Road**	01/09/2022	bollard socket damaged	Installed new bollard	19/09/2022	18	**71**
East Oxford	**Circus street**	22/11/2022	bollard missing on inspection		22/11/2022	0	**0**
East Oxford	Divinity road	04/08/2022	bollard socket damaged	installed temp bollard	06/08/2022	2	
East Oxford	Divinity Road	21/05/2022	Bollard removed (x1)	Bollard Replaced	26/05/2022	5	
East Oxford	Divinity Road	15/11/2022	report of missing bollard	socket damaged in one so not replaced	22/11/2022	7	
East Oxford	Divinity road	31/10/2022	missing	replaced	14/11/2022	14	
East Oxford	Divinity road	22/11/2022	bollard socket damaged		06/12/2022	14	
East Oxford	Divinity road	02/12/2022	bollard missing	one missing	16/12/2022	14	
East Oxford	**Divinity Road**	03/10/2022	Damaged bollard	2x bolalrds raplaced (were both missing)	26/10/2022	23	**79**
East Oxford	Essex Street	07/09/2022	Damaged bollard	Bollard Replaced	21/09/2022	14	
East Oxford	Essex street	31/10/2022	reported missing	waiting order	14/11/2022	14	
East Oxford	Essex street	02/12/2022	bollard missing		16/12/2022	14	
East Oxford	**Essex street**	06/12/2022	base damaged	plate in place	20/12/2022	14	**56**
East Oxford	Howard Street	21/05/2022	Bollard removed (x1)	Socket damaged as well as bollard removed	26/05/2022	5	
East Oxford	Howard Street	26/10/2022	base damage	bollard not locking	05/11/2022	10	
East Oxford	Howard street	24/06/2022	Fire damage	Done	08/07/2022	14	
East Oxford	**Howard Street**	11/10/2022	Missing	replaced	26/10/2022	15	**44**
East Oxford	**James Street**	01/09/2022	Bollard damaged	Installed new bollard	19/09/2022	18	**18**
	Leopold Street	13/07/2022	Bollard broken	inspection 2 persons visits due to H&S	15/07/2022	2	
East Oxford	Leopold Street	21/05/2022	Bollard removed (x1)	Bollard replace temporary / Socket damaged as well as bollard removed	26/05/2022	5	
East Oxford	leopold street	24/06/2022	Missing	Done	08/07/2022	14	
East Oxford	leopold street	27/06/2022	Run over	Done	11/07/2022	14	
East Oxford	Leopold Street	19/12/2022	bollard missing	being made safe/ Base damaged	02/01/2023	14	
East Oxford	**Leopold Street**	01/09/2022	bollard socket damaged	Installed new bollard	21/09/2022	20	**69**
East Oxford	Magdalen Road	13/07/2022	Bollard reported missing	inspection 2 persons visits due to H&S	15/07/2022	2	
East Oxford	Magdalen Road	04/08/2022	bollard socket damaged	installed temp bollard	06/08/2022	2	
East Oxford	Magdalen Road	18/07/2022	Damaged bollard		22/07/2022	4	
East Oxford	Magdalen Road	09/01/2023	bollard missing		23/01/2023	14	
East Oxford	**Magdalen Road**	10/10/2022	Missing	replaced	26/10/2022	16	**36**
East Oxford	Marston Street	04/08/2022	Bollard missing	replaced	04/08/2022	0	
East Oxford	Marston Street	03/05/2023	bollard missing	New Bollard fitted	17/05/2023	14	
East Oxford	**Marston Street**	07/10/2022	report bollard missing		14/11/2022	38	**52**
East Oxford	Princes Street	16/08/2022	bollard missing	OK still in place	17/08/2022	1	
East Oxford	**Princes Street**	07/10/2022	Damaged bollard		14/11/2022	38	**39**
East Oxford	rectory road	22/11/2022	bollard missing on inspection		22/11/2022	0	
East Oxford	Rectory Road	31/10/2022	missing	replaced	14/11/2022	14	
East Oxford	Rectory road	02/12/2022	bollard missing		16/12/2022	14	
East Oxford	**Rectory Road**	10/10/2022	Missing	replaced	26/10/2022	16	**44**
East Oxford	Southfield	02/12/2022	bollard missing		16/12/2022	14	
East Oxford	Southfield Road	04/08/2022	Bollard damaged	bollard damaged/ To replace	04/08/2022	0	
East Oxford	Southfield road	26/10/2022	base damage	bollard not locking	05/11/2022	10	
East Oxford	**Southfield road**	12/10/2022	missing	Bollard replaced	26/10/2022	14	**38**
East Oxford	Stockmore Street	22/11/2022	bollard missing on inspection		22/11/2022	0	
East Oxford	**Stockmore Street**	21/05/2022	Bollard removed (x2)	replaced 2 new bollards	26/05/2022	5	**5**
East Oxford	**Temple Street**	02/12/2022	bollard missing		16/12/2022	14	**14**

Comparison of bollard outages with count data

264. In the following timelines, the blue line shows count data on the road of interest, the red line the time that the named bollard was out.

Figure 35 – Timeline of VivaCity car counts on Leopold Street (west) and bollard outage on Leopold Street

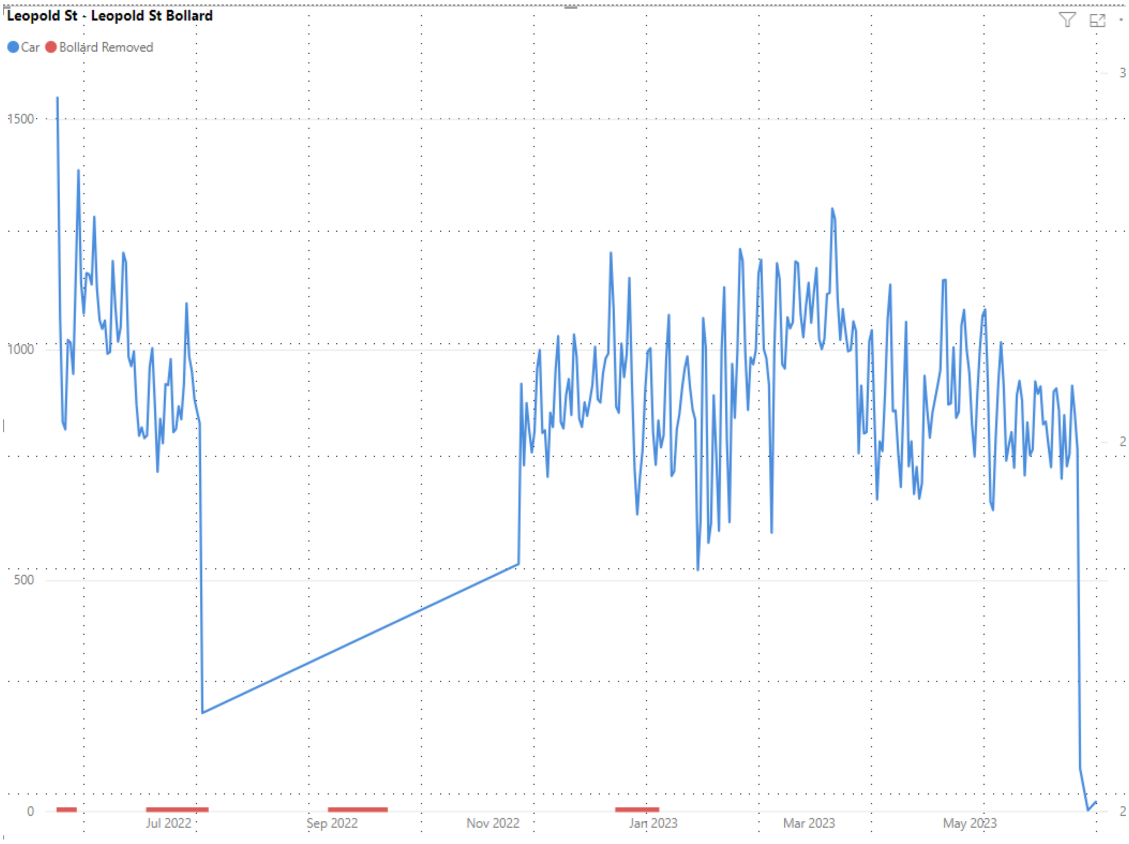


Figure 36 - Timeline of VivaCity car counts on Divinity Road (north) and bollard outage on Divinity Road

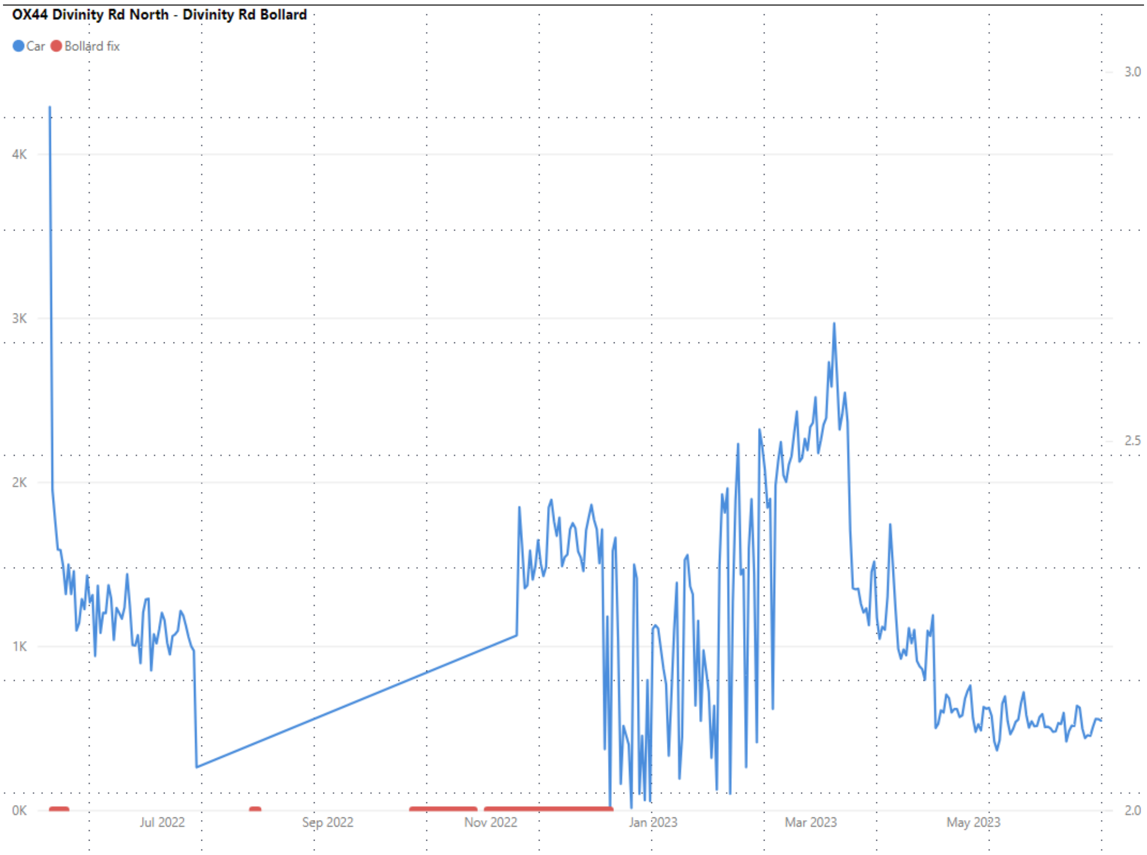


Figure 37 - Timeline of VivaCity car counts on Cowley Road (north) and bollard outage on James Street

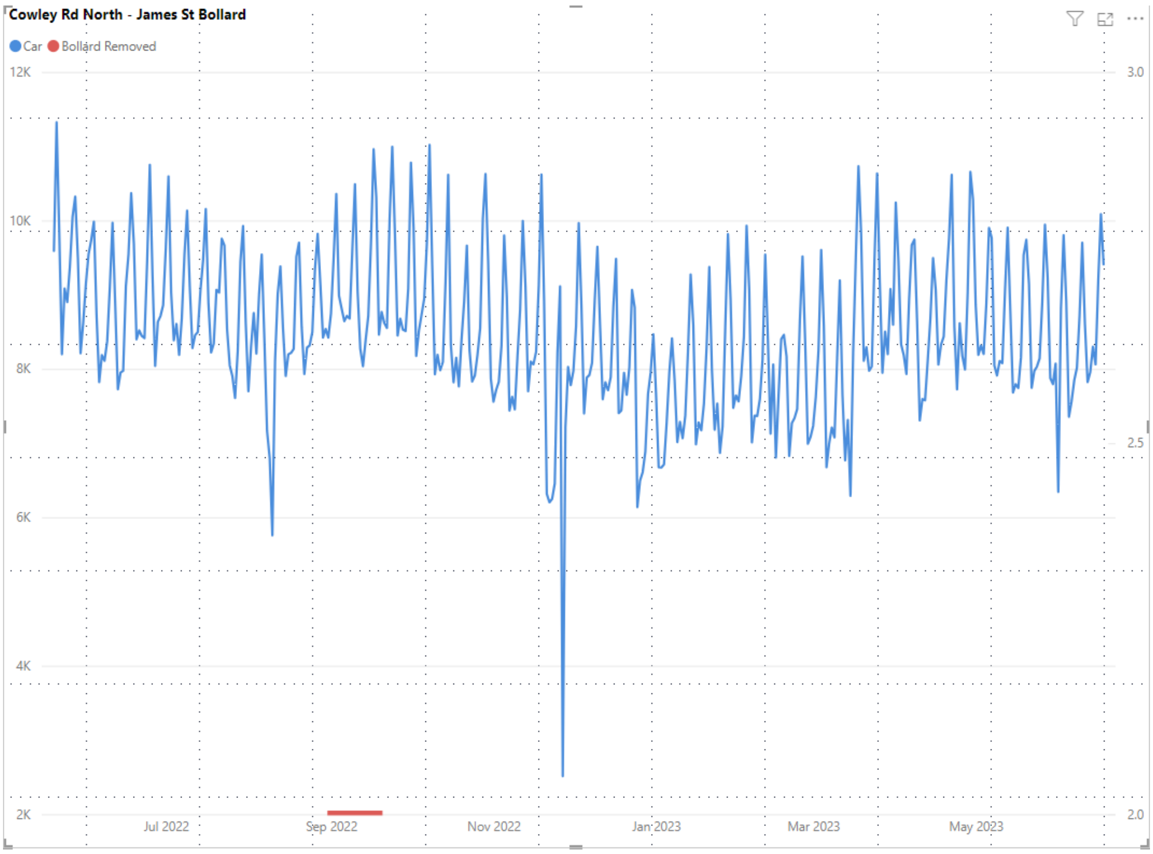
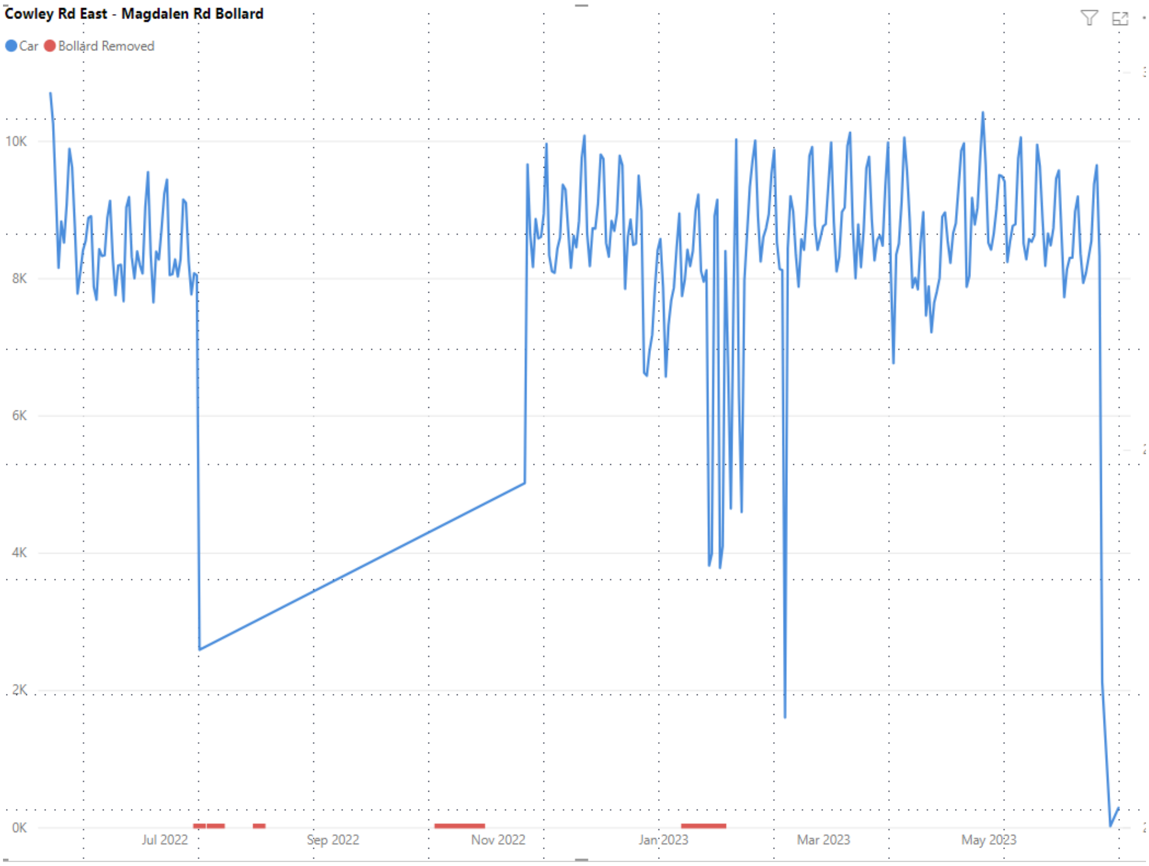


Figure 38 - Timeline of VivaCity car counts on Cowley Road (east) and bollard outage on Magdalen Road



Annex I

Journey time analysis tables (% difference in duration)

Table 71 - Boundary road segments towards and away from The Plain roundabout (percentage difference in duration)

Boundary road segments (towards 'The Plain roundabout')		Weekday '% Diff'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
St Clement's Str	Top of Morrell Av to The Plain roundabout	+107.8%	+289.6%	+242.5%	+32.4%
Morrell Av	Roundabout Warneford L up to St Clements Str	-2.8%	+0.7%	+39.0%	-7.1%
Cowley Rd	Magdalen Rd to The Plain	+24.7%	+32.2%	+63.3%	+7.6%
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	+8.4%	+4.8%	+6.5%	+7.0%
Garsington Rd (B480)	Eastern Bypass to Hollow Way	+4.5%	+2.0%	+45.8%	+1.3%
Iffley Rd	Donnington Bridge Rd to The Plain	+60.8%	+11.9%	+0.9%	+6.8%
Iffley/Henley Av	Church Cowley Rd to Donnington Bridge Rd	-26.0%	-3.7%	-16.5%	+10.4%
Henley Av/ Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	+31.7%	+42.3%	+21.6%	+5.1%

Boundary road segments (away from 'The Plain roundabout')		Weekday '% Diff'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
St Clement's Str	The Plain roundabout to the top of Morrell Av	+20.00%	+33.77%	+13.44%	+10.94%
Morrell Av	St Clements Str, down to Warneford L. roundabout	-11.94%	-9.02%	-10.15%	-6.90%
Cowley Rd	The Plain to Magdalen Rd	+4.20%	+8.58%	+5.13%	+6.63%
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	+6.07%	+8.57%	-8.47%	+10.25%
Garsington Rd (B480)	Hollow Way to Eastern Bypass	+4.23%	+4.29%	+8.97%	+4.76%
Iffley Rd	The Plain to Donnington Bridge Rd	-7.17%	+1.00%	-18.49%	+4.59%
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	+7.91%	+12.64%	+17.58%	+12.33%
Henley Av/ Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	+1.43%	+4.55%	-3.51%	+5.81%

Table 72 Multiplier road segments towards and away from The Plain roundabout (percentage difference in duration)

Boundary road segments (east to west)		Weekday '% Diff'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
Between Towns Rd	Cowley Rd to Iffley Rd	+15.9%	+12.7%	+28.5%	+8.3%
Hollow Way	Horspath Driftway to Cowley Rd	+15.8%	+15.8%	+61.9%	+10.2%
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	0.0%	+2.8%	-19.5%	+11.8%

Boundary road segments (west to east)		Weekday '% Diff'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
Between Towns Rd	Iffley Rd to Cowley Rd	+12.9%	+9.6%	+10.9%	+8.3%
Hollow Way	Cowley Rd to Horspath Driftway	+19.2%	+8.9%	+11.1%	+12.2%
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	-21.7%	+1.4%	-9.0%	+10.4%

Journey time analysis tables (percentage difference in speed)

Table 73 - Boundary road segments towards and away from The Plain roundabout (percentage difference in speed)

Boundary road segments (towards 'The Plain roundabout')		Weekday 'Diff%'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
St Clement's Str	Top of Morrell Av to The Plain roundabout	-51.9%	-74.3%	-70.8%	-24.5%
Morrell Av	Roundabout Warneford L up to St Clements Str	+2.8%	-0.7%	-28.1%	+7.7%
Cowley Rd	Magdalen Rd to The Plain	-19.8%	-24.4%	-38.8%	-7.1%
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	-7.8%	-4.6%	-6.1%	-6.5%
Garsington Rd (B480)	Eastern Bypass to Hollow Way	-4.3%	-2.0%	-31.4%	-1.3%
Iffley Rd	Donnington Bridge Rd to The Plain	-37.8%	-10.6%	-0.9%	-6.4%
Iffley/Henley Av	Church Cowley Rd to Donnington Bridge Rd	+35.2%	+3.8%	+19.8%	-9.4%
Henley Av/ Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	-24.1%	-29.7%	-17.8%	-4.8%

Boundary road segments (away from 'The Plain roundabout')		Weekday '% Diff'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
St Clement's Str	The Plain roundabout to the top of Morrell Av	-16.7%	-25.2%	-11.8%	-9.9%
Morrell Av	St Clements Str, down to Warneford L. roundabout	+13.6%	+9.9%	+11.3%	+7.4%
Cowley Rd	The Plain to Magdalen Rd	-4.0%	-7.9%	-4.9%	-6.2%
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	-5.7%	-7.9%	+9.3%	-9.3%
Garsington Rd (B480)	Hollow Way to Eastern Bypass	-4.1%	-4.1%	-8.2%	-4.5%
Iffley Rd	The Plain to Donnington Bridge Rd	7.7%	-1.0%	22.7%	-4.4%
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	-7.3%	-11.2%	-15.0%	-11.0%
Henley Av/ Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	-1.4%	-4.3%	+3.6%	-5.5%

Table 74 - Multiplier road segments towards and away from The Plain roundabout (percentage difference in speed)

Multiplier road segments (east to west)		Weekday 'Diff%'			
Road	**Road Segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
Between Towns Road	Cowley Rd to Iffley Rd	-13.7%	-11.3%	-22.2%	-7.7%
Hollow Way	Horspath Driftway to Cowley Rd	-13.6%	-13.6%	-38.2%	-9.2%
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	0.0%	-2.7%	+24.2%	-10.6%

Multiplier road segments (west to east)		Weekday 'Diff%'			
Road	**Road segment direction**	**AM-peak**	**Afternoon-peak**	**PM-peak**	**Evening**
Between Towns Road	Iffley Rd to Cowley Rd	-11.4%	-8.7%	-9.8%	-7.7%
Hollow Way	Cowley Rd to Horspath Driftway	-16.1%	-8.2%	-10.0%	-10.9%
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	+27.8%	-1.4%	9.9%	-9.4%

Reliability: Planning Time Index (PTI)

Table 75 - Boundary road segments towards and away from The Plain roundabout, planning Time Index (PTI) by time of day

Boundary road segments (towards 'The Plain roundabout')		AM-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
St Clement's Str	The top of Morrell Av to The Plain roundabout	2.46	3.97	+61.3%	made worse
Morrell Av	Roundabout on Warneford L up to St Clements Str	1.32	1.64	+24.5%	made worse
Cowley Rd	Magdalen Rd.to The Plain	1.73	2.32	+34.1%	made worse
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	1.98	2.10	+5.8%	made worse
Garsington Rd (B480)	Eastern Bypass to Hollow Way	3.91	3.69	-5.7%	Improved
Iffley Rd	Donnington Bridge Rd to The Plain	3.28	4.26	+30.1%	made worse
Iffley/Henley Av	Church Cowley Rd to Donnington Bridge Rd	4.57	1.82	-60.3%	Improved
Henley Av/ Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	2.00	2.74	+37.2%	made worse

Boundary road segments (towards 'The Plain roundabout')		Afternoon-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
St Clement's Str	The top of Morrell Av to The Plain roundabout	1.57	5.29	+236.3%	made worse
Morrell Av	Roundabout on Warneford L up to St Clements Str	1.15	1.44	+24.3%	made worse
Cowley Rd	Magdalen Rd.to The Plain	1.39	2.97	+113.7%	made worse
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	1.56	1.44	-7.5%	Improved
Garsington Rd (B480)	Eastern Bypass to Hollow Way	1.58	1.73	+10.1%	made worse
Iffley Rd	Donnington Bridge Rd to The Plain	1.36	1.53	+13.0%	made worse
Iffley/Henley Av	Church Cowley Rd to Donnington Bridge Rd	1.84	1.51	-18.0%	Improved
Henley Av/ Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	1.72	3.37	+96.5%	made worse

Boundary road segments (towards 'The Plain roundabout')		PM-peak			
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**	**PTI Impact**
St Clement's Str	The top of Morrell Av to The Plain roundabout	5.03	8.25	+64.0%	made worse
Morrell Av	Roundabout on Warneford L up to St Clements Str	1.50	3.71	+147.7%	made worse
Cowley Rd	Magdalen Rd.to The Plain	1.71	3.60	+110.6%	made worse
Cowley/Oxford Rd	Hollow Way to Magdalen Rd	1.58	1.55	-2.3%	Improved
Garsington Rd (B480)	Eastern Bypass to Hollow Way	2.15	3.48	+61.8%	made worse
Iffley Rd	Donnington Bridge Rd to The Plain	1.73	1.62	-6.1%	Improved
Iffley/Henley Av	Church Cowley Rd to Donnington Bridge Rd	2.30	1.64	-28.7%	Improved
Henley Av/ Rose Hill/Oxford Rd	Eastern Bypass to Church Cowley Rd	2.37	2.99	+26.2%	made worse

Boundary road segments (away from 'The Plain roundabout')		AM-peak			
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**	**PTI Impact**
St Clement's Str	The Plain roundabout to the top of Morrell Av	1.50	1.68	+12.4%	made worse
Morrell Av	St Clements Str, down to Warneford L. roundabout	1.24	1.16	-6.4%	Improved
Cowley Rd	The Plain to Magdalen Rd	1.11	1.10	-0.6%	Improved
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	2.87	3.05	+6.3%	made worse
Garsington Rd (B480)	Hollow Way to Eastern Bypass	1.36	1.29	-5.4%	Improved
Iffley Rd	The Plain to Donnington Bridge Rd	3.63	1.77	-51.3%	Improved
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	1.52	1.34	-11.8%	Improved
Henley Av/ Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	2.01	1.49	-25.6%	Improved

Boundary road segments (away from 'The Plain Roundabout')		Afternoon-peak			
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**	**PTI Impact**
St Clement's Str	The Plain roundabout to the top of Morrell Av	1.42	1.91	+34.8%	made worse
Morrell Av	St Clements Str, down to Warneford L. roundabout	1.16	1.15	-0.4%	Improved
Cowley Rd	The Plain to Magdalen Rd	1.35	1.54	+14.2%	made worse
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	2.83	3.59	+27.1%	made worse
Garsington Rd (B480)	Hollow Way to Eastern Bypass	1.29	1.20	-6.8%	Improved
Iffley Rd	The Plain to Donnington Bridge Rd	1.65	1.32	-20.3%	Improved
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	1.50	1.37	-9.0%	Improved
Henley Av/ Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	1.86	1.29	-30.8%	Improved

Boundary road segments (away from 'The Plain roundabout')		PM-peak			
Road	**Road segment direction**	**Pre PTI**	**Post PTI**	**PTI Diff**	**PTI Impact**
St Clement's Str	The Plain roundabout to the top of Morrell Av	1.72	1.95	+13.5%	made worse
Morrell Av	St Clements Str, down to Warneford L. roundabout	1.23	1.22	-0.9%	Improved
Cowley Rd	The Plain to Magdalen Rd	1.61	1.56	-3.4%	Improved
Cowley/Oxford Rd	Magdalen Rd to Hollow Way	3.07	2.60	-15.2%	Improved
Garsington Rd (B480)	Hollow Way to Eastern Bypass	1.63	2.85	+75.1%	made worse
Iffley Rd	The Plain to Donnington Bridge Rd	5.35	1.75	-67.2%	Improved
Iffley/Henley Av	Donnington Bridge Rd to Church Cowley Rd	2.48	1.78	-28.1%	Improved
Henley Av/ Rose Hill/Oxford Rd	Church Cowley Rd to Eastern Bypass	3.13	1.44	-54.0%	Improved

Table 76 - Multiplier road segments towards and away from The Plain roundabout, planning Time Index (PTI) by time of day

Multiplier road segments (east to west)		AM-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
Between Towns Rd	Cowley Rd to Iffley Rd	1.91	3.26	+70.5%	made worse
Hollow Way	Horspath Driftway to Cowley Rd	3.11	3.26	+4.7%	made worse
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	2.05	2.80	+36.3%	made worse

Multiplier road segments (east to west)		Afternoon-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
Between Towns Rd	Cowley Rd to Iffley Rd	1.57	1.85	+18.1%	made worse
Hollow Way	Horspath Driftway to Cowley Rd	2.05	2.53	+23.5%	made worse
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	1.55	1.36	-12.1%	Improved

Multiplier road segments (east to west)		PM-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
Between Towns Rd	Cowley Rd to Iffley Rd	2.57	3.42	+33.3%	made worse
Hollow Way	Horspath Driftway to Cowley Rd	3.65	4.26	+16.7%	made worse
Donnington Bridge Rd	Iffley Rd to Abingdon Rd	4.95	4.33	-12.4%	Improved

Multiplier road segments (west to east)		AM-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
Between Towns Rd	Iffley Rd to Cowley Rd	2.00	1.89	-5.4%	Improved
Hollow Way	Cowley Rd to Horspath Driftway	2.09	2.26	+8.1%	made worse
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	4.75	1.54	-67.5%	Improved

Multiplier road segments (west to east)		Afternoon-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
Between Towns Rd	Iffley Rd to Cowley Rd	1.88	2.07	+10.2%	made worse
Hollow Way	Cowley Rd to Horspath Driftway	1.52	1.49	-2.0%	Improved
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	1.57	1.26	-19.5%	Improved

Multiplier road segments (west to east)		PM-peak			
Road	Road segment direction	Pre PTI	Post PTI	PTI Diff	PTI Impact
Between Towns Rd	Iffley Rd to Cowley Rd	1.87	1.88	+0.6%	made worse
Hollow Way	Cowley Rd to Horspath Driftway	1.54	1.49	-3.0%	Improved
Donnington Bridge Rd	Abingdon Rd to Iffley Rd	2.30	1.50	-34.7%	Improved

Annex J

Bus analysis: change in stop-to-stop runtime

Table 77 - In-bound boundary roads and east to west, change in stop-to-stop runtime – including multiplier roads

Previous stop name	Stop name	Road group	AM-peak Diff%	Afternoon-peak Diff%	PM-peak Diff%	Evening Diff%
Garsington Road	The Original Swan	Cowley Rd	+43.60%	+40.28%	-2.64%	
The Original Swan	The Original Swan	Cowley Rd	+29.70%		+14.73%	
Templars Square	The Original Swan	Cowley Rd	+4.10%	+14.47%	+0.26%	+9.12%
Fern Hill Road	The Original Swan	Cowley Rd	+15.90%	+46.80%	+43.37%	-1.00%
The Original Swan	Clive Road	Cowley Rd	+8.90%	+23.61%	+1.94%	-10.47%
Clive Road	Marsh Road	Cowley Rd	-0.10%	+15.50%	-4.58%	-8.39%
Marsh Road	Shelley Road	Cowley Rd	-9.20%	+4.52%	+0.52%	-2.72%
Shelley Road	Howard Street east	Cowley Rd	-6.00%	+3.45%	-2.55%	-4.95%
Howard Street east	Magdalen Road east	Cowley Rd	-11.10%	-0.51%	-5.86%	+0.77%
Magdalen Road east	Manzil Way	Cowley Rd	-3.50%	+12.78%	-10.35%	-6.32%
Manzil Way	James Street east	Cowley Rd	-8.70%	+3.47%	-9.82%	-5.55%
James Street east	Stockmore Street	Cowley Rd	+13.40%	+32.29%	+27.02%	+5.02%
Stockmore Street	The Plain	Cowley Rd	+21.60%	+166.57%	+145.85%	+10.37%
		Cowley Rd Avg.	**+7.58%**	**+30.27%**	**+15.22%**	**-1.28%**
Spencer Crescent	Rose Hill Parade	Iffley Rd	+20.10%	+29.94%	+9.55%	+18.09%
Dudgeon Drive	Rose Hill Parade	Iffley Rd	+18.00%		+6.94%	
Rose Hill Parade	Courtland Road	Iffley Rd	+20.40%	+27.70%	+23.21%	+11.01%
Courtland Road	Westbury Crescent	Iffley Rd	+15.10%	+29.84%	+25.06%	+4.75%
Westbury Crescent	Iffley Turn	Iffley Rd	+37.50%	+117.11%	+77.35%	+3.21%
Iffley Turn	Henley Avenue	Iffley Rd	+7.00%	+23.45%	+7.91%	+3.45%
Henley Avenue	Freelands Road	Iffley Rd	-7.80%	+6.62%	-7.63%	+8.56%
Freelands Road	Howard Street west	Iffley Rd	-33.30%	-31.68%	-33.94%	-11.78%
Townsend Square	Howard Street west	Iffley Rd	+2.10%	+9.65%	-4.80%	
Howard Street west	Magdalen Road west	Iffley Rd	+18.50%	+0.21%	+2.31%	=7.51%
Magdalen Road west	Henley Street	Iffley Rd	+59.30%	+0.38%	-1.07%	-6.39%
Henley Street	James Street west	Iffley Rd	+92.60%	+5.00%	-0.20%	-0.37%
James Street west	The Plain	Iffley Rd	+148.60%	+20.85%	+10.79%	+12.45%
		Iffley Rd Avg.	**+30.62%**	**+19.92%**	**+8.88%**	**+4.59%**
Mortimer Drive	Crotch Crescent	Marston Rd	+4.94%	+32.97%	+6.19%	
Crotch Crescent	Jack Straws Lane	Marston Rd	-3.00%	+4.15%	-2.33%	+5.06%
Jack Straws Lane	Edgeway Road	Marston Rd	+2.21%	+13.37%	+6.22%	+19.25%
Edgeway Road	Clive Booth Hall	Marston Rd	+3.78%	+12.47%	+4.60%	+25.34%
Clive Booth Hall	Kings Mill Lane	Marston Rd	+18.02%	+47.95%	+27.41%	+52.97%
		Marston Rd Avg.	**+5.19%**	**+22.18%**	**+8.42%**	**+25.65%**

Warneford Hospital	Divinity Road	Morrell Ave	-7.00%	-15.12%	-17.87%	
Divinity Road	Stone Street	Morrell Ave	-2.94%	-22.62%	-29.72%	
Stone Street	East Avenue	Morrell Ave	-12.72%	-26.27%	-23.75%	
East Avenue	Union Street	Morrell Ave	-7.03%	-18.43%	+186.86%	
		Morrell Ave Avg.	**-7.42%**	**-20.61%**	**+28.88%**	

Brookes University	Glebe Street	St Clements Str	-3.60%	+101.11%	+258.97%	-5.60%
Brookes University	Glebe Street	St Clements Str	-9.77%	+104.89%	+228.87%	
Kings Mill Lane	Glebe Street	St Clements Str	-22.78%	+60.99%	+103.24%	+4.61%
Union Street	Glebe Street	St Clements Str	+48.11%	+219.78%	+243.82%	
Brookes University	St Clements Street	St Clements Str	+16.80%	+99.52%	+69.40%	+6.64%
Glebe Street	St Clements Street	St Clements Str	+11.50%	+98.38%	+42.74%	+20.14%
Glebe Street	St Clements Street	St Clements Str	+12.62%	+118.82%	+25.98%	+38.79%
		St Clements Str Avg.	**+7.55%**	**+114.78%**	**+139.00%**	**+12.92%**

Previous Stop Name	**Stop Name**	**Road group**	**AM-peak Diff%**	**Afternoon-peak Diff%**	**PM-peak Diff%**	**Evening Diff%**
The Original Swan	The Original Swan	Between Ts. Rd	+45.50%	+22.35%	+48.34%	+16.18%
Clive Road	The Original Swan	Between Ts. Rd	+14.18%	+83.26%	+22.19%	+1.41%
The Original Swan	Templars Square	Between Ts. Rd	-1.60%	+3.10%	-2.17%	+201.14%
		Between Ts. Rd Avg.	**+19.36%**	**+36.23%**	**+22.78%**	**+72.91%**

Howard Street west	Townsend Square	Donnington B.	-0.96%	-6.49%	-19.66%	
Townsend Square	Donnington Bridge	Donnington B.	+0.04%	-11.93%	-52.06%	
Donnington Bridge	Weirs Lane	Donnington B.	+21.59%	-38.69%	-54.57%	
		Donnington B. Avg.	**+6.89%**	**-19.03%**	**-42.09%**	

Cinnaminta Road	Corner House	Hollow Way Rd	-5.20%	+16.40%	+21.56%	+4.64%
Corner House	Paul Kent Hall	Hollow Way Rd	-3.60%	+36.27%	+18.91%	+2.29%
Paul Kent Hall	Barracks Lane	Hollow Way Rd	-2.60%	+11.42%	+46.15%	+1.35%
Rupert Road	Crescent Hall	Hollow Way Rd	+0.90%	+30.22%	+74.75%	+4.09%
Crescent Hall	Fern Hill Road	Hollow Way Rd	+45.90%	+12.36%	+177.21%	-2.31%
		Hollow Way Rd Avg.	**+7.08%**	**+21.33%**	**+67.72%**	**+2.01%**

Table 78 - Out-bound boundary roads and west to east, change in stop-to-stop runtime - including multiplier roads

Previous Stop Name	Stop Name	Road group	AM-peak Diff%	Afternoon-peak Diff%	PM-peak Diff%	Evening Diff%
Queens Lane	The Plain.	Cowley Rd	+3.89%	+13.51%	+4.01%	+16.59%
The Plain	James Street east	Cowley Rd	-0.53%	+2.55%	-23.52%	+8.54%
James Street east	Manzil Way	Cowley Rd	-2.16%	+2.24%	-12.08%	-4.27%
Manzil Way	Magdalen Road east	Cowley Rd	-2.95%	+1.80%	-8.49%	+4.67%
Magdalen Road east	Howard Street east	Cowley Rd	-4.77%	+1.31%	-3.57%	-0.39%
Howard Street east	Shelley Road	Cowley Rd	-2.16%	+71.45%	+7.05%	+6.92%
Shelley Road	Marsh Road	Cowley Rd	-3.09%	+167.03%	+18.68%	+3.46%
Marsh Road	Clive Road	Cowley Rd	+2.81%	+140.62%	+31.68%	+2.94%
Templars Square	The Original Swan	Cowley Rd	+59.90%	+49.06%	+19.33%	-0.89%
The Original Swan	Garsington Road	Cowley Rd	+31.85%	+1.64%	-25.33%	
		Cowley Rd Avg.	**+8.28%**	**+45.12%**	**+0.78%**	**+4.18%**

Queens Lane	The Plain	Iffley Rd	+1.50%	+9.87%	+8.54%	+17.08%
St Cross Road	The Plain	Iffley Rd	+12.06%	-0.56%	+31.64%	
The Plain	James Street west	Iffley Rd	+18.90%	+17.64%	-0.05%	-3.11%
James Street west	Henley Street	Iffley Rd	+4.62%	-4.41%	-33.01%	-5.97%
Henley Street	Magdalen Road west	Iffley Rd	+8.20%	-32.16%	-42.71%	-3.82%
Magdalen Road west	Howard Street west	Iffley Rd	+-1.04%	-30.97%	-37.78%	+3.50%
Howard Street west	Freelands Road	Iffley Rd	+11.54%	+7.48%	+4.45%	-0.70%
Freelands Road	Iffley Turn	Iffley Rd	+6.02%	+15.40%	+6.71%	+1.80%
Iffley Turn	Westbury Crescent	Iffley Rd	+20.09%	+20.65%	+11.06%	+3.15%
Westbury Crescent	Rose Hill Parade	Iffley Rd	+27.03%	+16.88%	+5.68%	+7.55%
		Iffley Rd Avg.	**+10.89%**	**+1.98%**	**-4.55%**	**+2.17%**

St Clements Street	Cherwell Street	Marston Rd	+13.60%	+6.57%	+2.96%	+8.81%
Clive Booth Hall	Ferry Road	Marston Rd	+6.30%	-2.58%	+5.03%	+19.76%
Ferry Road	Edgeway Road	Marston Rd	-1.00%	-5.47%	+17.91%	+5.78%
Edgeway Road	Jack Straws Lane	Marston Rd	+4.90%	+6.92%	+13.14%	+27.28%
Jack Straws Lane	Crotch Crescent	Marston Rd	-9.40%	+6.67%	-13.81%	-6.44%
		Marston Rd Avg.	**+2.88%**	**+2.42%**	**+5.05%**	**+11.04%**

St Clements Street	South Park	Morrell Ave	+4.80%	+17.80%	+9.09%	+13.94%
South Park	Union Street	Morrell Ave	-6.10%	-10.64%	-22.69%	+115.92%
Union Street	East Avenue	Morrell Ave	-7.60%	-17.79%	-29.62%	+143.21%
East Avenue	Stone Street	Morrell Ave	-3.20%	-37.95%	-34.86%	+117.53%
		Morrell Ave Avg.	-3.03%	-12.15%	-19.52%	+97.65%

Queens Lane	St Clements Street	St Clements Str	+3.30%	+10.91%	+0.52%	+20.44%
Queens Lane	St Clements Street	St Clements Str	+11.30%	+5.57%	+2.39%	+22.00%
Queens Lane	St Clements Street	St Clements Str	+4.25%	+9.50%	+10.00%	+11.80%
St Cross Road	St Clements Street	St Clements Str	+2.80%	+15.13%	-4.38%	
		St Clements Str Avg.	**+5.41%**	**+10.28%**	**+2.13%**	**+18.08%**

Previous stop name	Stop name	Road group	AM-peak Diff%	Afternoon-peak Diff%	PM-peak Diff%	Evening Diff%
The Original Swan	Templars Square	Between Ts. Rd	-13.77%	-27.53%	-4.90%	-7.94%
		Between Ts. Rd Avg.	**-13.77%**	**-27.53%**	**-4.90%**	**-7.94%**

Canning Crescent	Weirs Lane	Donnington B.	-19.30%	-6.51%	-4.12%	
Weirs Lane	Donnington Bridge	Donnington B.	-31.70%	+16.46%	+8.41%	
Donnington Bridge	Townsend Square	Donnington B.	-60.40%	-7.84%	-16.92%	
		Donnington B. Avg.	**-37.13%**	**+0.70%**	**-4.21%**	

The Original Swan	Fern Hill Road	Hollow Way Rd	+33.37%	+17.53%	+20.96%	-3.93%
Fern Hill Road	Crescent Hall	Hollow Way Rd	+10.93%	-3.48%	+13.83%	-2.18%
Barracks Lane	Paul Kent Hall	Hollow Way Rd	+16.00%	-5.09%	+4.23%	+8.34%
Paul Kent Hall	Corner House	Hollow Way Rd	+25.37%	+10.32%	+5.73%	+8.12%
		Hollow Way Rd Avg.	**+21.42%**	**+4.82%**	**+11.19%**	**+2.59%**

Annex K

Road Safety - control comparison

265. For each year heading the period is May-Dec and Jan-Apr the following year. The control area is Oxford 20mph + 30mph roads excluding the Cowley LTN and east Oxford LTN areas.

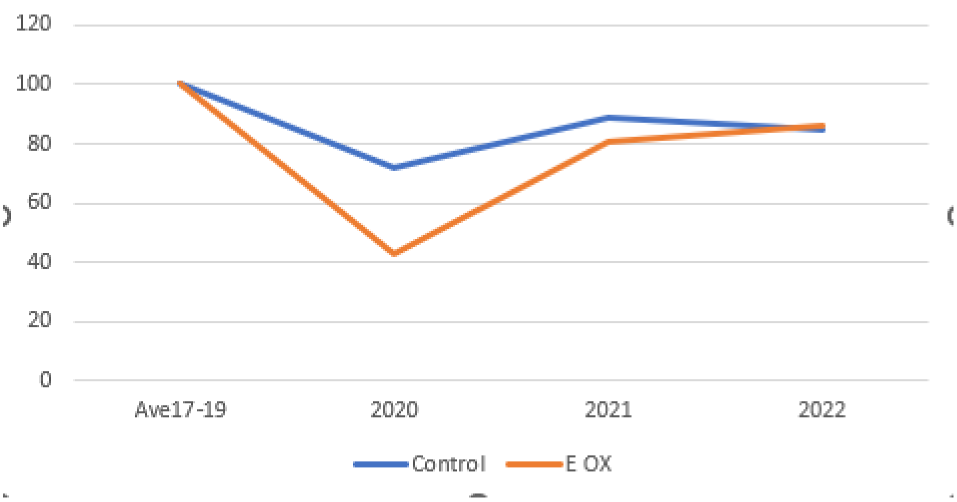
Table 79 - Comparison of control area versus east Oxford LTN area, all road safety incidents:

	2017	2018	2019	2020	2021	2022	Average 2017-2021	% Change
Control area	170	175	198	130	161	154	166.8	-7%
East Oxford LTN area	48	36	48	19	36	38	37.4	+1%

266. The east Oxford LTN area figure for 2022 shows a slight increase compared with the 5-year average before.

267. Using the 3-year 2017-2019 data and indexing on the average annual total shows that while the pandemic period saw a sharper fall in east Oxford compared to the control, there is no discernible difference in 2021 and 2022

Figure 39 - Comparison of control area versus east Oxford LTN: as a percentage of 2017-2019 average annual total.



268. Overall there has not been significant change in incidents in the LTN area compared to control.

Annex L

Background traffic volumes in Oxford

269. An analysis has been undertaken of traffic flows on the principal routes in and out of Oxford city using permanently installed, live ATCs (Blackcat sensors). The locations can be seen on the map, figure 40 and cross-referenced in table 80 below. The data has also been split to show counts near to the city centre (inner cordon) and at points further out from the city (outer cordon). The annual average daily traffic count (AADT) is used: flows are the sum of both directions and are shown as the average of all daily counts over a year or part year. This means that although data for 2023 stops at September, the average will not change much with the addition of the remaining four months of the year and is appropriate to use for a high-level analysis such as this. Where data is highlighted in 2019, it means that there were issues with data availability or quality and in these cases 2018 data in the main, has been substituted. Bus counts have been excluded from Abingdon Road data because of operational issues with sensors; this might add approximately 4000 on the count line, but as this is applied consistently across years then a comparison by year may be made.

Figure 40 - Location of count sensors used in analysis of overall trends in Oxford city traffic

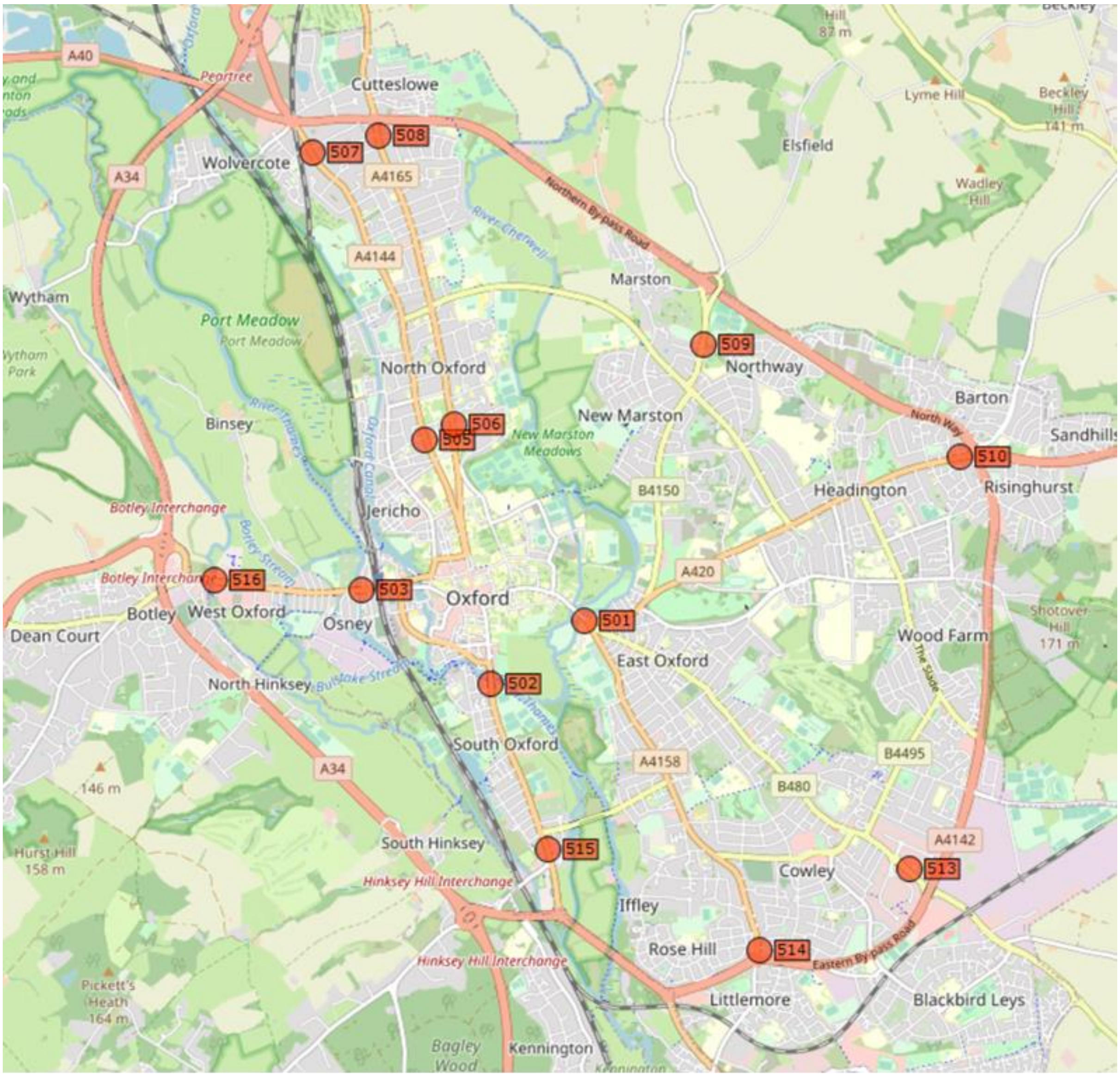


Table 80 - Annual average daily traffic (AADT) in Oxford

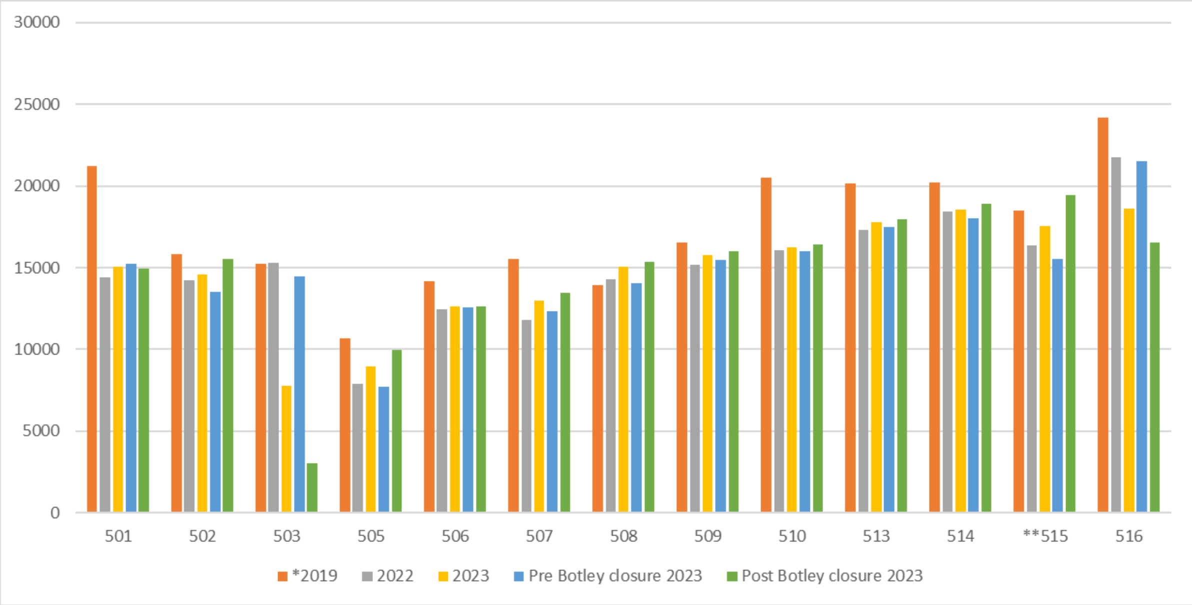
Site	Location	*2019	2021	2022	2023	2023 vs 2019	% change 2023 vs 2019	Pre Botley Closure 2023	Post Botley Closure 2023	Post versus pre Botley Closure	% change pre versus post Botley Closure
501	Magdalen Bridge	21227	14724	14385	15046	-6181	-29.1%	15215	14947	-268	-1.8%
502	Folly Bridge	15856	12197	14223	14597	-1259	-7.9%	13545	15528	1982	14.6%
503	Osney Bridge	15254	12769	15296	7739	-7515	-49.3%	14478	3027	-11451	-79.1%
505	Woodstock Rd Inner	10695	7212	7858	8955	-1740	-16.3%	7695	9979	2284	29.7%
506	Banbury Rd Inner	14194	11086	12447	12614	-1580	-11.1%	12583	12631	48	0.4%
	Inner Cordon	**77226**	**57988**	**64209**	**58950**	**-18276**	**-23.7%**	**63517**	**56112**	**-7405**	**-11.7%**
507	Woodstock Rd Outer	15526	11257	11785	12958	-2568	-16.5%	12319	13431	1112	9.0%
508	Banbury Rd Outer	13903	12700	14278	15074	1171	8.4%	14061	15380	1319	9.4%
509	Marsh Ln	16568	14390	15147	15796	-771	-4.7%	15486	16014	528	3.4%
510	London Rd Outer	20493	15443	16092	16252	-4241	-20.7%	16009	16421	412	2.6%
513	Garsington Rd Outer	20141	15388	17309	17782	-2359	-11.7%	17515	17968	454	2.6%
514	Oxford Rd (Rose Hill)	20191	17872	18445	18544	-1648	-8.2%	18049	18889	840	4.7%
**515	Abingdon Rd Outer	18509	16204	16375	17568	-941	-5.1%	15548	19453	3905	25.1%
516	Botley Rd Outer	24187	21319	21754	18586	-5601	-23.2%	21530	16528	-5002	-23.2%
	Outer Cordon	**125331**	**103254**	**109431**	**113973**	**-11358**	**-9.1%**	**108987**	**117557**	**8570**	**7.9%**
	Total	**226744**	**182561**	**195394**	**191510**	**-35234**	**-15.5%**	**194033**	**190197**	**-3837**	**-2.0%**

* Highlighted sites data is pre 2019

** Bus lane counts not included

270. 2023 has not yet seen a return to the overall traffic levels of 2019 (-16% change). This effect is more pronounced for the inner cordon (-24% change) than the outer cordon (-9% change). These figures include the effect of the Botley Road closure, itself having a -2% effect on overall traffic. Taking this into account the overall traffic in the city is down 14% in 2023 compared to 2019.

Figure 41 - Annual average daily Traffic (AADT) in Oxford



271. Figure 41 illustrates the same results graphically, showing 2019 traffic levels were higher than both 2022 and 2023 across all sensor positions except 508 Banbury Road Outer cordon.

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