# TECHNICAL NOTE

## DERBY ROADSIDE $NO_2$

T4 LOCAL PLAN TRANSPORT MODEL FORECASTING REPORT FEB 19

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## TABLE OF CONTENTS


| | | |
|---|---|---|
| **1.** | **INTRODUCTION** | **3** |
| **1.1** | **OVERVIEW** | **3** |
| **2.** | **2016 BASE YEAR SCENARIO** | **4** |
| **2.1** | **DEVELOPMENT ASSUMPTIONS** | **4** |
| **2.2** | **INFRASTRUCTURE ASSUMPTIONS** | **4** |
| **2.3** | **GROWTH IN HIGHWAY TRIPS** | **4** |
| **2.4** | **TRAFFIC FLOWS** | **5** |
| **2.5** | **JUNCTION CONGESTION** | **7** |
| **3.** | **2020 FORCAST SCENARIO** | **10** |
| **3.1** | **DEVELOPMENT ASSUMPTIONS** | **10** |
| **3.2** | **INFRASTRUCTURE ASSUMPTIONS** | **12** |
| **3.3** | **GROWTH IN HIGHWAY TRIPS** | **12** |
| **3.4** | **TRAFFIC FLOWS** | **13** |
| **3.5** | **JUNCTION CONGESTION** | **15** |
| **4.** | **2020 WITH PREFERRED SCHEME SCENARIO** | **18** |
| **4.1** | **OVERVIEW** | **18** |
| **4.2** | **IDENTIFICATION OF THE PREFERRED OPTION** | **18** |
| **4.3** | **PREFERRED SCHEME** | **22** |
| **4.4** | **HIGHWAY FLOW IMPACT OF THE PREFERRED SCHEME** | **24** |

| | | |
|---|---|---|
| 4.5 | AADT Flow Change | 31 |
| 5. | 2020 CHARGING CAZ BENCHMARK TEST | 34 |
| 5.1 | Overview | 34 |
| 5.2 | Overview of the Benchmark Charging CAZ D Scheme | 34 |
| 5.3 | Highway Flow Impact of the Benchmark Charging CAZ D Scheme | 36 |
| 6. | 2020 CAZ D 0% UPGRADE SENSITIVITY TEST | 43 |
| 6.1 | Overview | 43 |
| 6.2 | Overview of the CAZ D 0% Upgrade Sensitivity Test | 43 |
| 6.3 | Highway Flow Impact of the CAZ D 0% Upgrade Test | 44 |
| 7. | 2025 REFERENCE CASE | 51 |
| 7.1 | Overview | 51 |
| 7.2 | Flow Change between 2020 and 2025 Reference Cases | 51 |
| 8. | OVERALL CONCLUSIONS | 55 |
| 8.1 | The Preferred Scheme | 55 |
| 8.2 | Benchmark Charging CAZ D | 55 |
| 8.1 | CAZ D 0% Upgrade Sensitivity Test | 56 |
| 8.2 | 2025 With A38 Grade Separation | 56 |

# 1. INTRODUCTION

## 1.1 Overview

1.1.1 SYSTRA has been commissioned by Derby City Council to provide modelling support for the Roadside $NO_2$ Feasibility Study. The purpose of the modelling is understand the transportation and air quality impacts associated with imposing a scheme to improve the $NO_2$ Air Quality within Derby City including the potential assessment of charging Clean Air Zones (CAZ).

1.1.2 SYSTRA have used the Derby Area Transport Model (DATM3) to assess the scenarios. The validation performance of the model has been documented in the T2 Local Plan Transport Model Review Document. For the purposes of testing schemes to improve the Air Quality in the Derby area the following scenarios have been developed:

- A **2016 base scenario**, information from which will be used to undertake the 2016 base year air quality modelling.
- A **2020 forecast scenario** representing the first year when a scheme is assumed to be implemented
- A **2020 with Preferred Scheme scenario** which includes the scheme that is to be taken forwards by Derby City
- A **2020 with Benchmark charging CAZ scenario** as requested by JAQU, which is an outer Ring Road CAZ D
- **A 2020 CAZ D 0% Upgrade Sensitivity Test** as requested by JAQU, which is an outer Ring Road CAZ D with zero additional upgrade resulting from the charging CAZ.
- A **2025 forecast scenario** which represents the situation once the A38 Grade Separation is completed as this has a significant impact on traffic flows and therefore Air Quality within Derby.

1.1.3 This Technical Note outlines the modelling assumptions adopted in the development of each of the above scenarios and provides key outputs from each scenario. The model outputs have been used to create AADT flows for use in the detailed air quality models prepared by Ricardo.

# 2. 2016 BASE YEAR SCENARIO

## 2.1 Development Assumptions

2.1.1 The table below outlines the residential allocation sites in the Derby area where development has occurred between 2012 and 2016. In addition to these residential allocations the 2016 scenario is constrained to TEMPRO 7.2.

**Table 1. Development schemes – 2012-2016**

| SCHEME | TYPE | SIZE BY 2016 | OVERALL SIZE | LA |
|---|---|---|---|---|
| Longlands, Repton | Residential | 34 Dwellings | 142 Dwellings | SDDC |
| Elton Road (Rolls-Royce) Phase 1 | Residential | 50 Dwellings | 100 Dwellings | Derby City |

## 2.2 Infrastructure Assumptions

2.2.1 The 2016 scenario includes all highway and public transport schemes that have been constructed by 2016. These are listed below:

- Castle Ward area changes;
- Connecting Derby scheme;
- A6 Grade Separation at Raynesway;
- New Bus Station;
- Infinity Park Way; and,
- London Road Bridge fully open to all traffic.

## 2.3 Growth in Highway Trips

2.3.1 Table 2 provides a summary of highway trip growth between 2012 and 2016. The model forecasts a 6% growth in traffic on the highway network in both morning and evening peak hours.

2.3.2 To provide confidence in the traffic growth levels generated by the model we have compared the trip growth against NTM Traffic Growth information extracted for the Derby area from TEMPRO 7.2. This dataset forecasts a 5.3% growth in highway trips between 2012 and 2016 in the morning peak and 5.8% growth in the evening peak. The model outputs are therefore considered to be closely representing TEMPRO growth assumptions.

**Table 2. Highway Trip Growth 2012 - 2016**

| PEAK HOUR | 2012 | 2016 | % CHANGE | NTM 15 GROWTH |
|---|---|---|---|---|
| Morning Peak | 209288 | 221792 | 6% | 5% |
| Inter Peak (6hr) | 266123 | 279148 | 5% | 6% |
| Evening Peak | 192129 | 204024 | 6% | 6% |

## 2.4 Traffic Flows

2.4.1 Figures 1 – 3 illustrate traffic flows in 2016 in the morning peak, inter peak and evening peak hours. These show a high traffic levels on the local Strategic Road Network (A50, A52, A38) and along the local routes, particularly along the inner ring road, outer ring road and the following key corridors around the city:

- London Road;
- Osmaston Road;
- Burton Road;
- Kedleston Road; and,
- A61.

Figure 1. 2016 Traffic Flows – Morning Peak

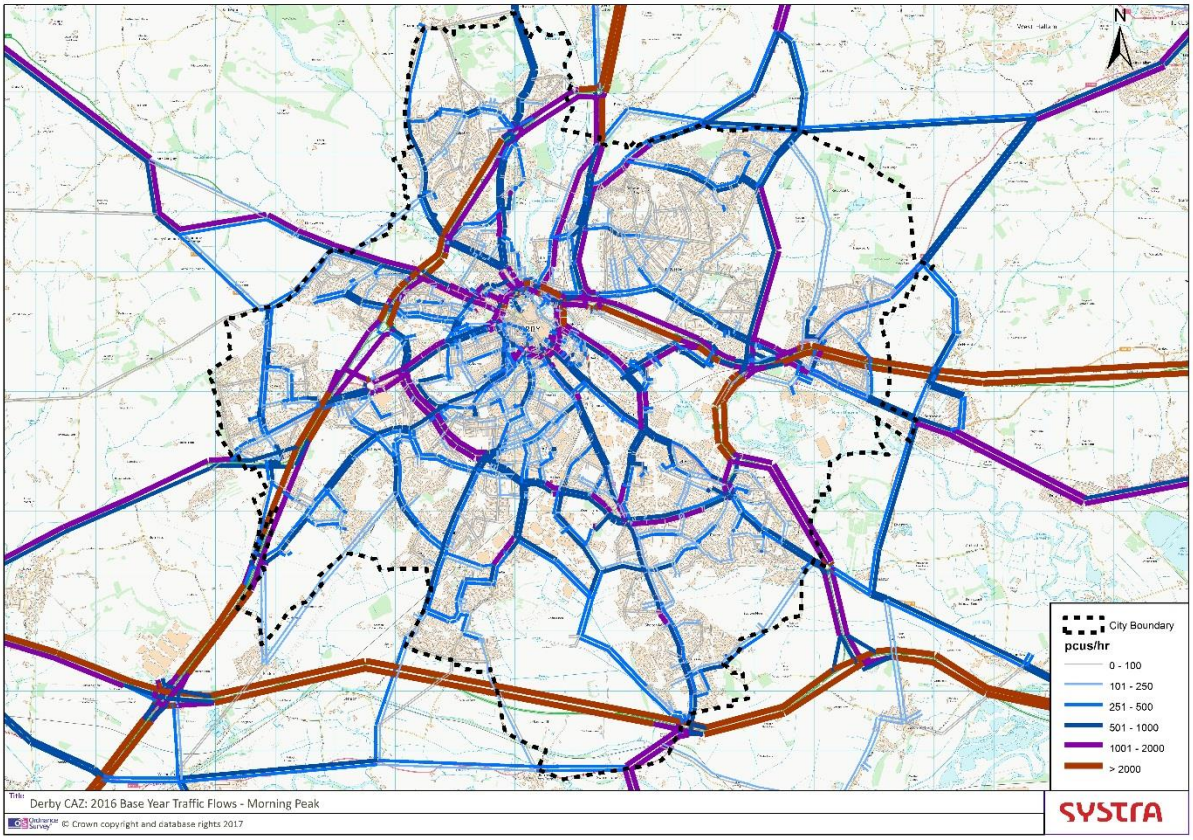



Figure 2. 2016 Traffic Flows – Inter Peak

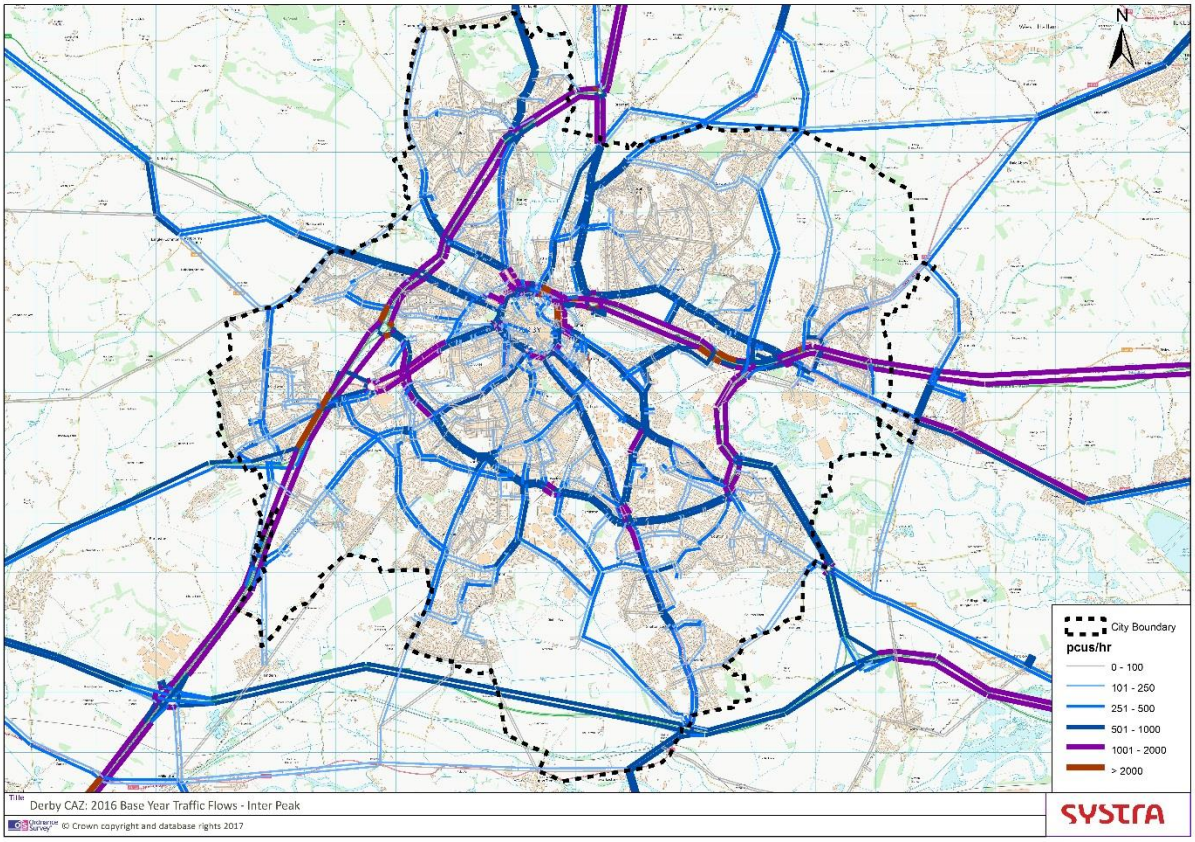
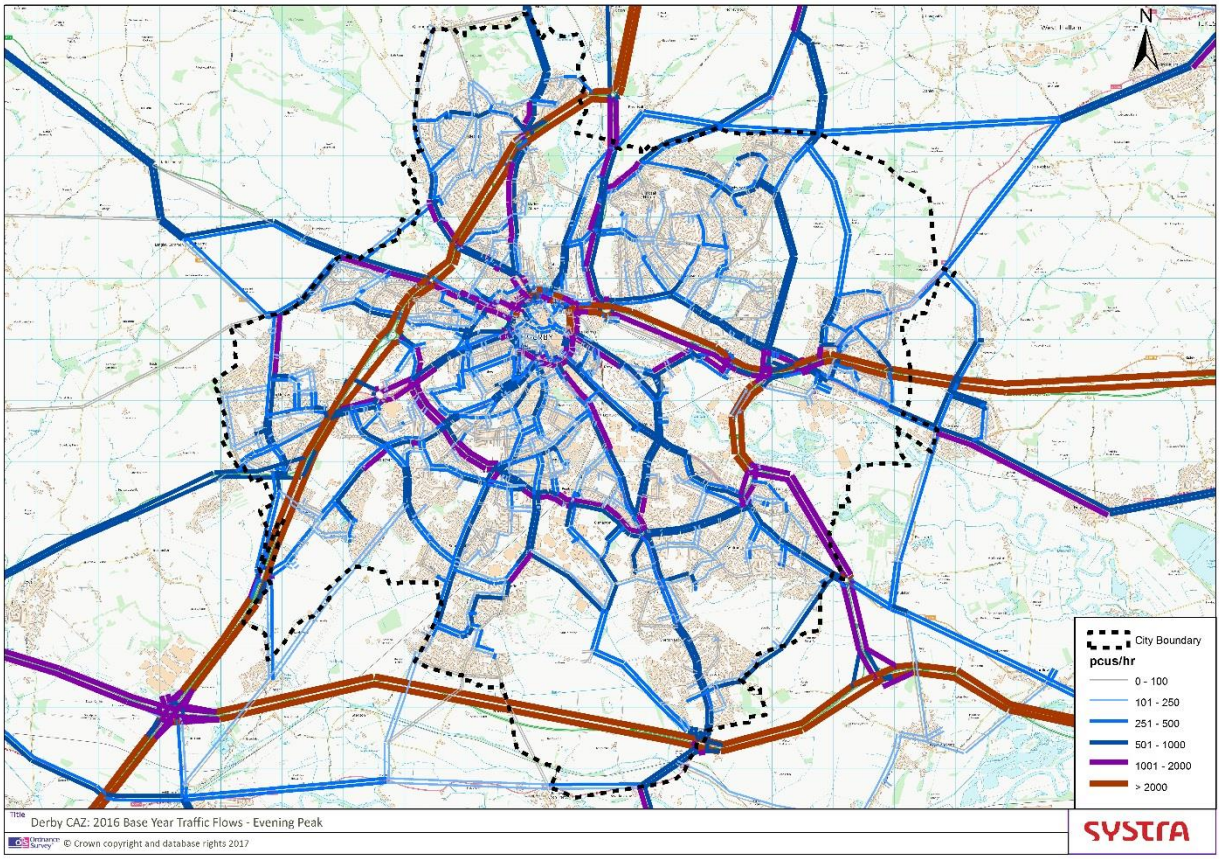


Figure 3. 2016 Traffic Flows – Evening Peak




## 2.5 Junction Congestion

2.5.1 Figure 4-6 shows the overall congestion on the network in the 2016 Base Year during the morning peak, inter peak and evening peak, as measured by volume to capacity ratio.

2.5.2 The plots indicate congestion along the following key roads:

- Inner Ring Road;
- Outer Ring Road (A5111);
- London Road;
- Osmaston Road;
- Burton Road;
- Duffield Road;
- A52 (Pentagon Roundabout); and,
- A61.

Figure 4. 2016 Junction Congestion – Morning Peak

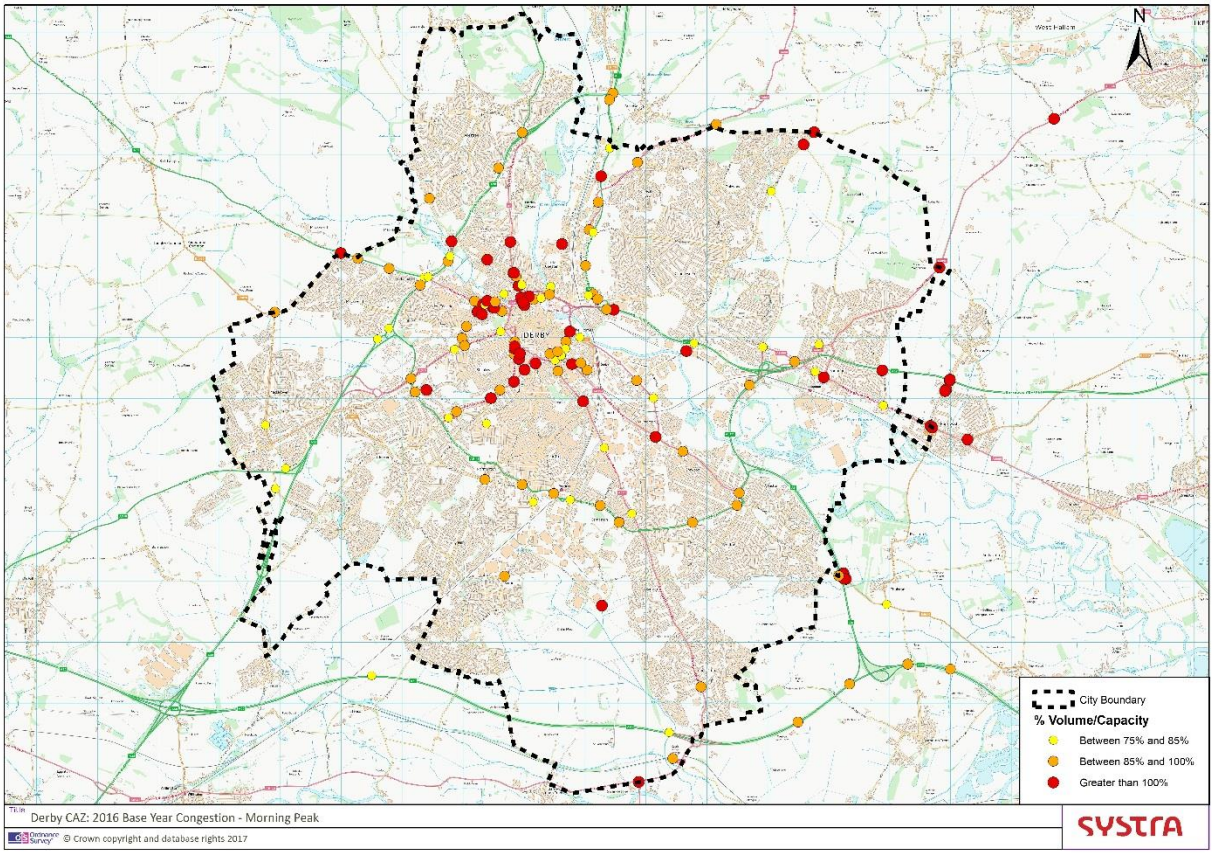



Figure 5. 2016 Junction Congestion – Inter Peak

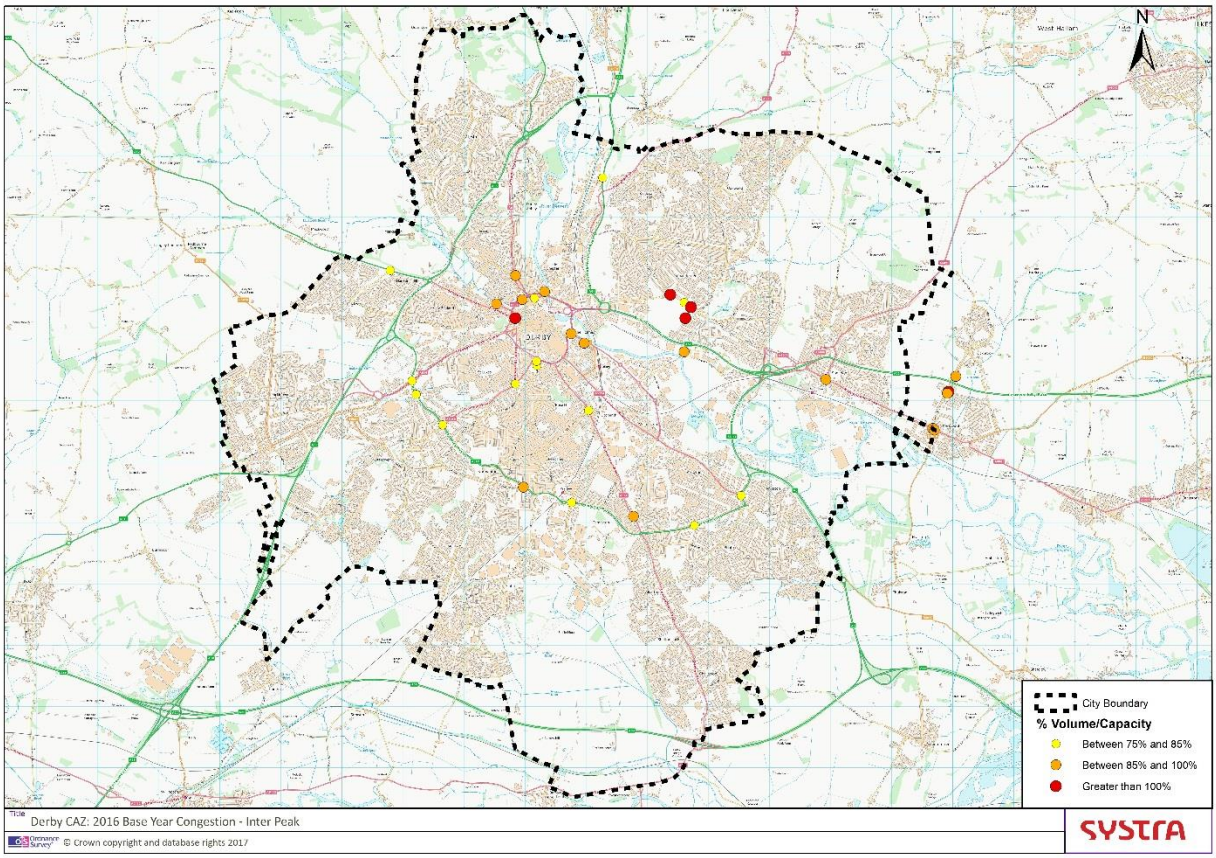
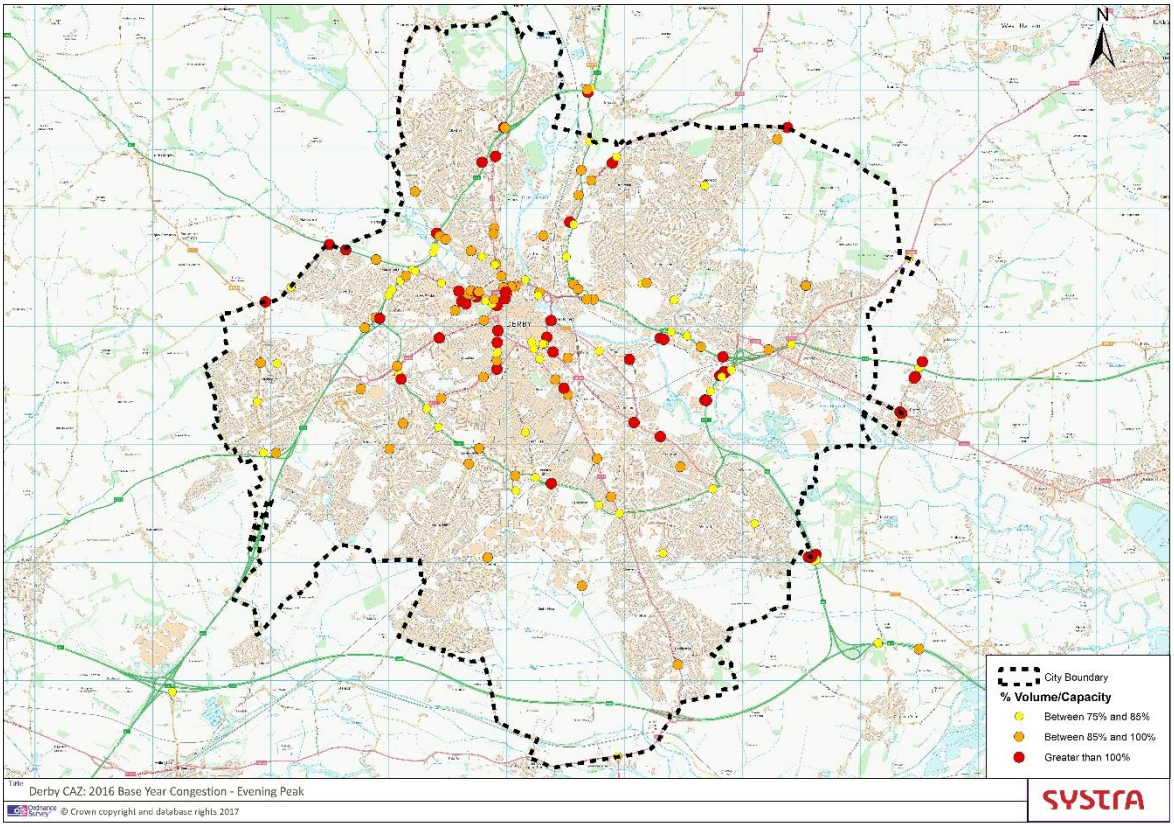


**Figure 6. 2016 Junction Congestion – Evening Peak**



# 3. 2020 FORCAST SCENARIO

## 3.1 Development Assumptions

3.1.1 Table 2 below outlines the residential and employment allocation sites in the Derby area where development has occurred or is predicted to occur by 2020. In addition to these development allocations the 2020 scenario is constrained to TEMPRO 7.2.

Table 3. 2020 Land Use Assumptions

| DEVELOPMENT | TYPE | SIZE BY 2020 | OVERALL SIZE | LA |
|---|---|---|---|---|
| Elton Road (Rolls-Royce) Phase 2 | Residential | 100 Dwellings | 100 Dwellings | Derby City |
| Friar Gate Goods Yard | Retail | 9,000 sqm | 12,500 sqm | Derby City |
| Hackwood Farm | Residential | 400 Dwellings | 400 Dwellings | Derby City |
| | Retail | 1,000 sqm | 1,000 sqm | Derby City |
| Nightingale Works | Residential | 400 Dwellings | 400 Dwellings | Derby City |
| Onslow Road | Residential | 200 Dwellings | 200 Dwellings | Derby City |
| Boulton Moor | Residential | 400 Dwellings | 800 Dwellings | Derby City |
| Longlands, Repton | Residential | 142 Dwellings | 142 Dwellings | SDDC |
| Wragley Way | Residential | 110 dwellings | 880 dwellings | SDDC |
| | Education | 1,285 sqm | 1,285 sqm | SDDC |
| Land off Holmleigh Way | Residential | 119 Dwellings | 119 Dwellings | SDDC |
| Chellaston Fields | Residential | 275 Dwellings | 500 Dwellings | SDDC |
| | Retail | 650 sqm | 650 sqm | SDDC |
| | Education | 300 sqm | 300 sqm | SDDC |
| Aston-on-Trent | Residential | 74 Dwellings | 74 Dwellings | SDDC |

| DEVELOPMENT | TYPE | SIZE BY 2020 | OVERALL SIZE | LA |
|---|---|---|---|---|
| Land NE of Hatton | Retail | 600 sqm | 600 sqm | SDDC |
| | Residential | 213 Dwellings | 400 Dwellings | SDDC |
| Boulton Moor Phase 2/3 | Residential | 80 Dwellings | 630 Dwellings | SDDC |
| | Residential | 10 Dwellings | 190 Dwellings | SDDC |
| Broomy Farm | Residential | 199 Dwellings | 400 Dwellings | SDDC |
| North of William Nadin Way | Residential | 205 Dwellings | 570 Dwellings | SDDC |
| Willington Road, Etwall | Residential | 130 Dwellings | 199 Dwellings | SDDC |
| Land off The Mease, Hilton | Residential | 203 Dwellings | 485 Dwellings | SDDC |
| | Education | 300 sqm | 300 sqm | SDDC |
| | Employment | 28,000 sqm | 35,000 sqm | SDDC |
| Land South of Cadley Hill | Employment | 20,000 | 25,000 | SDDC |
| Land to the west of Mickleover P1/P2/P3 | Residential | 90 Dwellings | 300 Dwellings | SDDC |
| | Residential | 80 Dwellings | 252 Dwellings | SDDC |
| | Residential | 10 Dwellings | 710 Dwellings | SDDC |
| Woodville Regeneration Area | Residential | 37 Dwellings | 150 Dwellings | SDDC |
| | Employment | 24,000 sqm | 60,000 sqm | SDDC |
| Church Street, Church Gresley | Residential | 174 Dwellings | 350 Dwellings | SDDC |
| Land at Swadlincote Lane, Church Gresley | Employment | 12,000 | 15,000 | SDDC |

## 3.2 Infrastructure Assumptions

3.2.1 The 2020 scenario includes all highway and public transport schemes that have been constructed or are predicted to be constructed by 2020. These are listed below. The schemes in bold will be built between 2016 and 2020 and are therefore not in the 2016 scenario.

- Castle Ward area changes;
- Connecting Derby scheme;
- A6 Grade Separation at Raynesway;
- New Bus Station;
- Infinity Park Way;
- London Road Bridge fully open to all traffic;
- **Radbourne Lane Development Mitigation;**
- **Schemes associated with the South Derbyshire Core Strategy (south of the A50);**
- **Rolls Royce Victory Road Realignment;**
- **Pinch-Point schemes at Markeaton (A38/A52) and Abbey Hill (A38/A61) junctions;**
- **New signal controlled access onto Osmaston Road and improvements to Mitre Island associated with the Tesco's Allenton development;**
- **A52 Wyvern improvements; and**
- **A516 Newhouse Farm Access Junction.**

3.2.2 The A38 Grade Separation Scheme is not included in the core 2020 scenario. The improvement scheme, which comprises the grade separating of three congested junctions along the A38, is likely to have a significant impact on the traffic routeing within the local area. However, this scheme is not expected to be completed until 2024.

## 3.3 Growth in Highway Trips

3.3.1 Table 3 provides a summary of highway trip growth between 2012 and 2020. The model forecasts an 11% growth in traffic on the highway network in both morning and evening peak hours.

3.3.2 To provide confidence in the traffic growth levels generated by the model we have compared the trip growth against NTM Traffic Growth information extracted for the Derby area from TEMPRO 7.2. This dataset forecasts a 12% growth in highway trips between 2016 and 2020 in the morning peak and the evening peak. The model outputs are therefore considered to be closely representing TEMPRO growth assumptions.

**Table 4. Highway Trip Growth 2016 - 2020**

| PEAK HOUR | 2012 | 2016 | % CHANGE | NTM 15 GROWTH |
|---|---|---|---|---|
| Morning **Peak** | 209288 | 231913 | 11% | 12% |
| Inter Peak (6hr) | 266123 | 291683 | 10% | 13% |
| Evening Peak | 192129 | 212783 | 11% | 12% |

## 3.4 Traffic Flows

3.4.1 Figures 7 – 9 illustrate traffic flows in 2020 in the morning peak, inter peak and evening peak hours. These show a high traffic levels on the local Strategic Road Network (A50, A52, A38) and along the local routes, particularly along the inner ring road, outer ring road and the following key corridors around the city:

- London Road;
- Osmaston Road;
- Burton Road;
- Kedleston Road; and,
- A61.

Figure 7. 2020 Traffic Flows – Morning Peak

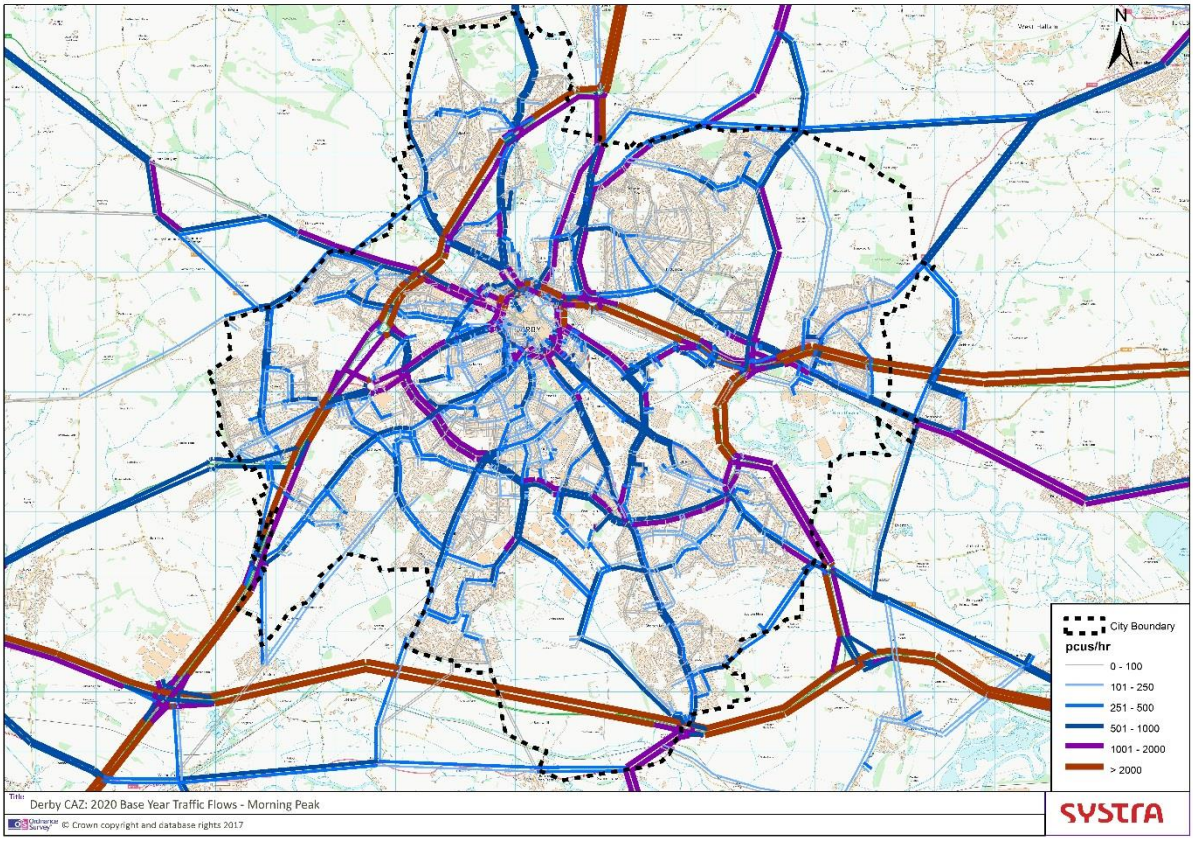



Figure 8. 2020 Traffic Flows – Inter Peak

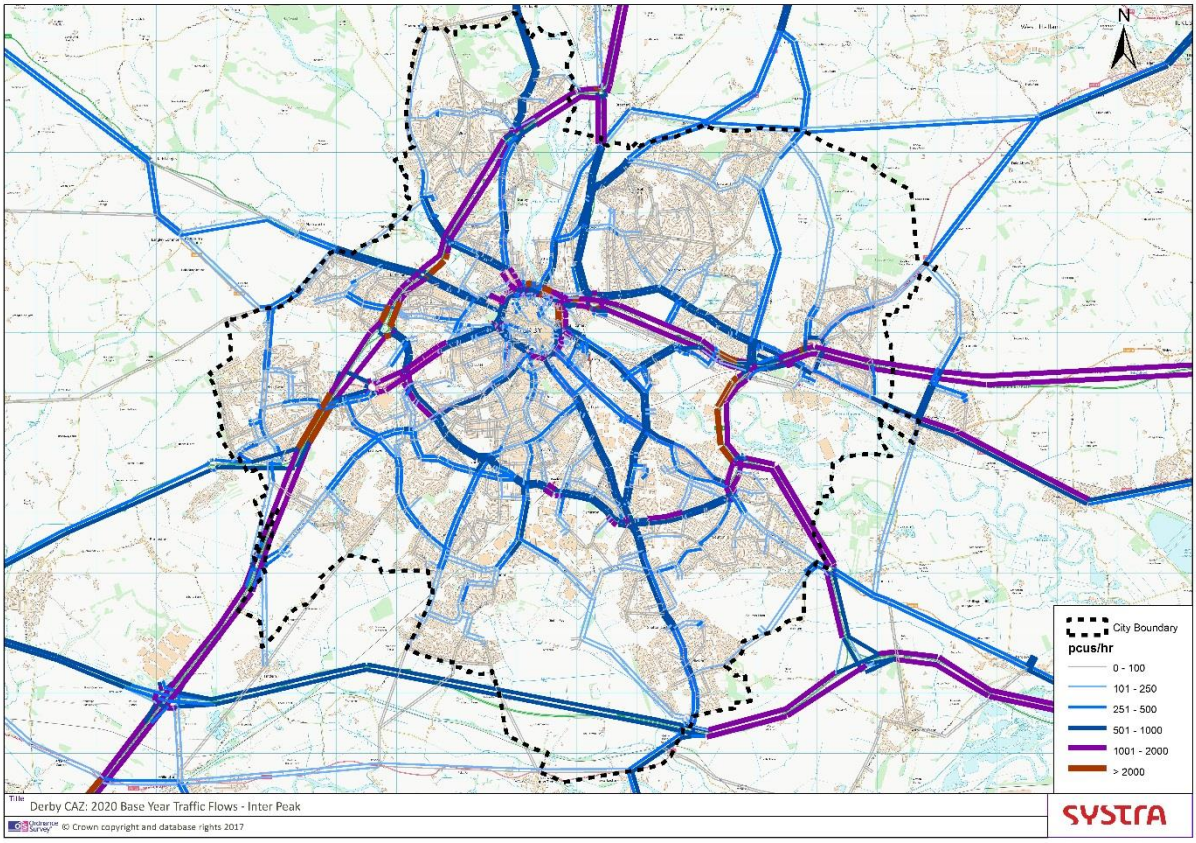
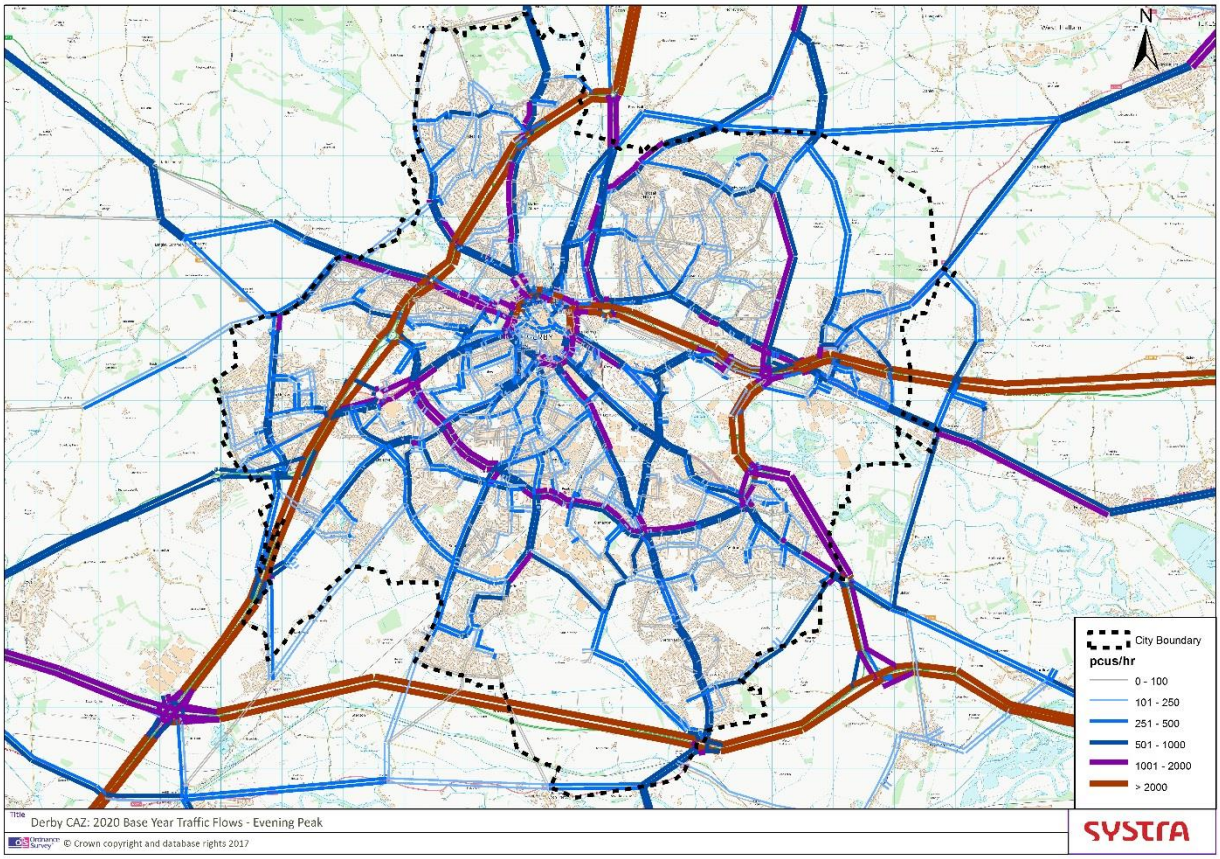


Figure 9. 2020 Traffic Flows – Evening Peak




## 3.5 Junction Congestion

3.5.1 Figures 10-12 show the overall congestion on the network in the 2020 scenario during the morning peak, inter peak and evening peak, as measured by volume to capacity ratio.

3.5.2 The plots indicate congestion along the following key roads:

- Inner Ring Road;
- Outer Ring Road (A5111);
- London Road;
- Osmaston Road;
- Burton Road;
- Duffield Road;
- A52 (Pentagon Roundabout); and,
- A61.

Figure 10. 2020 Junction Congestion – Morning Peak

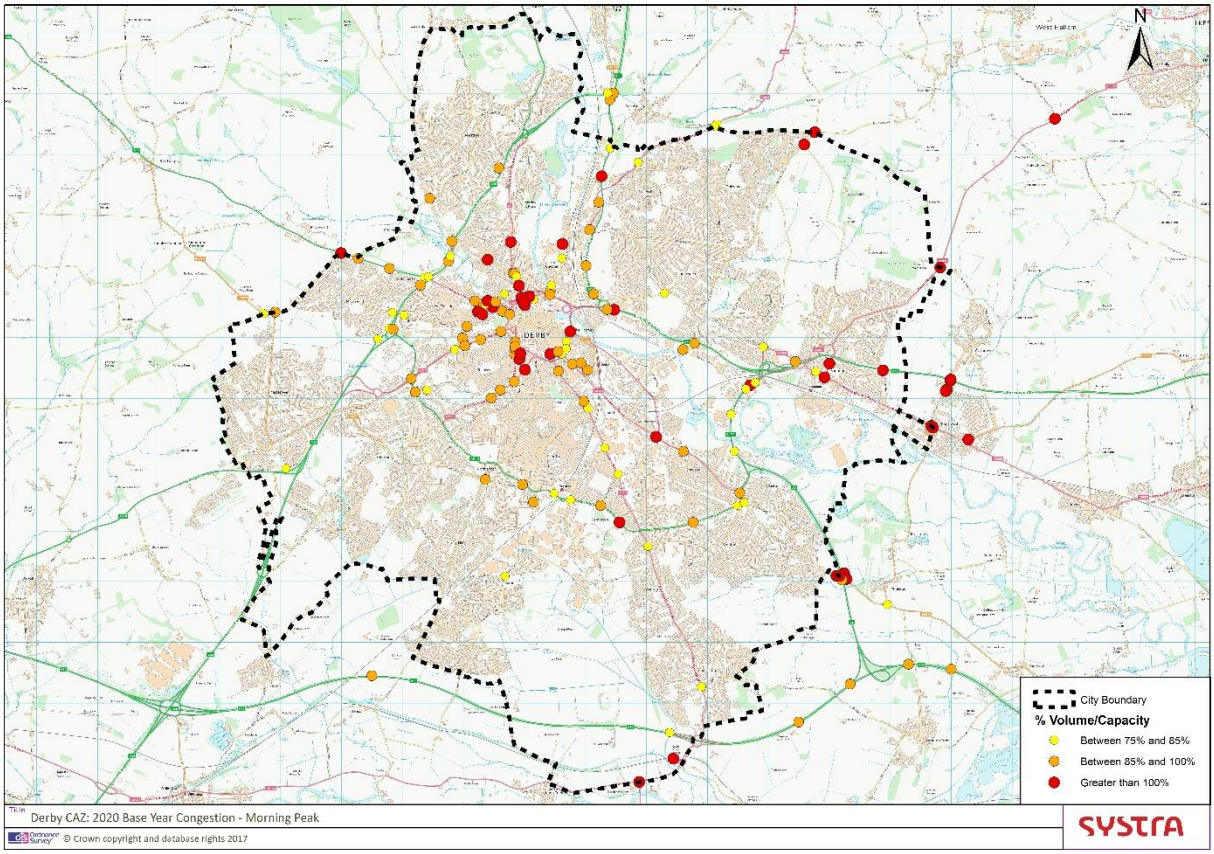



Figure 11. 2020 Junction Congestion – Inter Peak

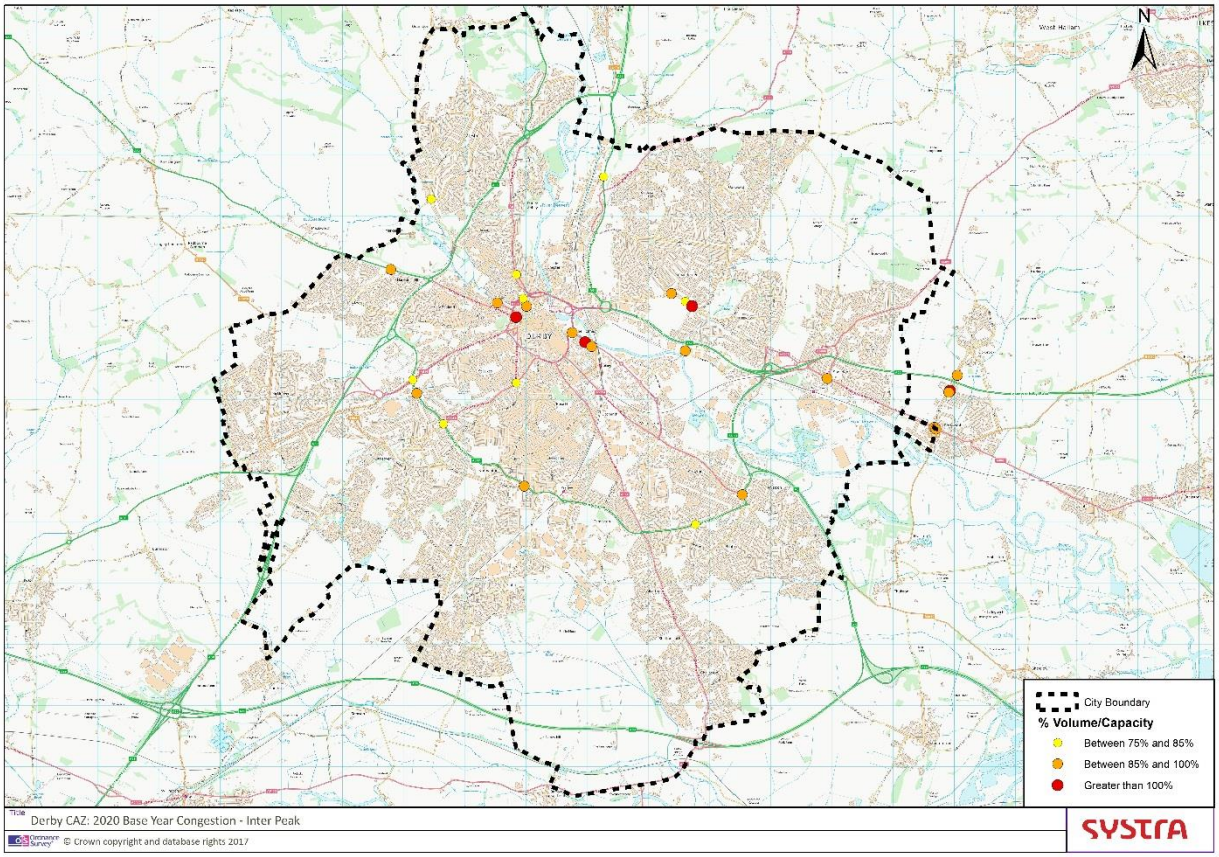
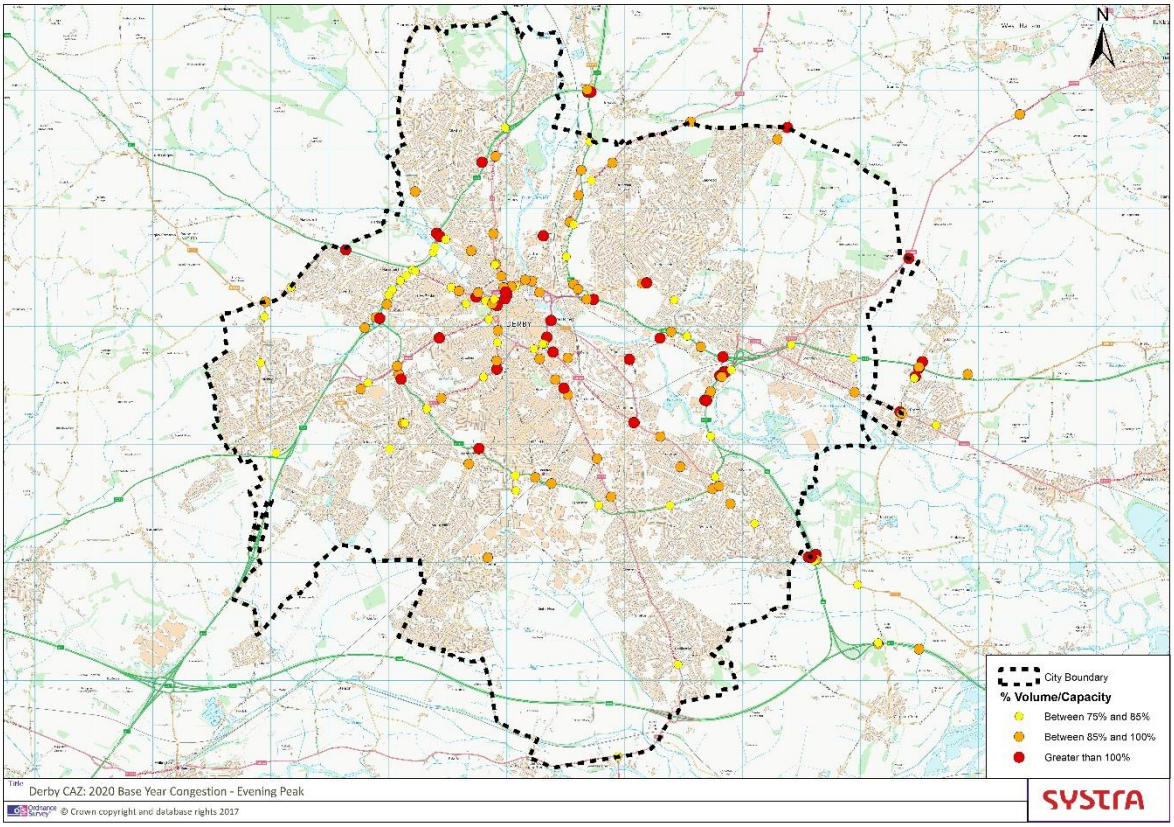


**Figure 12. 2020 Junction Congestion – Evening Peak**



# 4. 2020 WITH PREFERRED SCHEME SCENARIO

## 4.1 Overview

4.1.1 The chapter below presents the traffic impacts of Derby City's Preferred Scheme aimed at addressing the air quality issues at locations where the required limit of NOX is predicted to be exceeded in 2020 using the local air quality models developed by Ricardo. The only location where the NOX levels exceeded the threshold identified by JAQU is on Stafford Street which forms part of the western section of Derby's Inner Ring Road.

4.1.2 The traffic assessment of the Preferred Scheme builds on the 2020 Forecast scenario discussed previously and all the analysis in this chapter compares the preferred scenario with this 2020 Forecast scenario.

## 4.2 Identification of the Preferred Option

4.2.1 Whilst early assessments of a CAZ D scheme encompassing all city centre areas up to the Outer Ring Road suggested it would resolve the NOX exceedance issues on Stafford Street, other options to address this issue by 2020 without the need of a Charging Scheme were also investigated.

4.2.2 This included the option to reduce the use of Stafford Street for all vehicles through the introduction of measures to restrict capacity and encourage the use of other routes to resolve the NOX exceedance issues. This approach has subsequently become the Preferred Option for the following reasons.

- It can be designed to focus on the drivers that are using Stafford Street to undertake their journey and therefore minimise the transport and economic impacts on the City as a whole. Therefore, providing a proportionate response to the issues identified.
- Can be implemented using standard Urban Traffic Control (UTC) technology through enhancements to the system that is already operational within the city.
- It can be implemented and achieve the required reductions in NOX by 2020.
- The enhancements to the UTC system enables similar approaches to be used elsewhere in the city enabling areas that are below the NOX exceedance levels but have relatively high concentrations to be addressed in a similar manner.

4.2.3 A summary of how the Preferred scheme has been developed is provided in the following section of this report, with details of the suggested scheme provided in section 4.3 and the transport impacts provided in sections 4.4 and 4.5.

4.2.4 To develop a focused scheme that addresses the NOX exceedance issues on Stafford Street an incremental process of outline scheme testing has been undertaken using the DATM highway model to predict the transport impacts and ENEVAL to predict the resultant impact on roadside emissions of NOX. Details of these option refinement tests are provided in T5: Derby Roadside $NO_2$ Preferred Option Refinement

4.2.5 From the detailed air quality modelling a target percentage reduction of NOX emissions of around 40% was identified to resolve the NOX exceedance in the air quality models. As a result, the following general accumulative schemes were tested.

- Option 1.1 - the physical alterations pertaining to both the Stafford Street/ Uttoxeter New Road roundabout and the Stafford Street / Friar Gate Signal Junction:
    - Stafford Street/ Uttoxeter New Road roundabout:
    - Stafford Street - Northbound exit off the roundabout restricted to one lane.
    - Mercian Way – Left lane approach onto the roundabout restricted to left turn only.
    - Uttoxeter New Road– Right lane approach onto the roundabout restricted to right turn only.
    - Stafford Street/ Friar Gate signal junction:
    - Northbound on Stafford Street – Left lane changed to left turn only.
    - Northbound on Ford Street – Number of lanes reduced from two to one, with the reduction extending 30 metres Northbound from the Stafford Street/ Friar Gate junction, on Ford Street.
- Option 1.2 – As above without Northbound on Stafford Street – Left lane changed to left turn only
- Options 2.1 and 2.2 – building on 1.1 above with changes to signal settings at Friar Gate junction
- Options 2.3 and 2.4 – building on 1.2 above with changes to signal settings at Friar Gate junction
- Option 2.5 – building on Option 2.4 with signal and physical changes to the Uttoxeter New Road roundabout
- Option 3 – building on Option 2.5 with an HGV Ban on Stafford Street.

4.2.6 Figure 13 summarises the impacts of each of these options on NOX emissions along Stafford Street compared to the Reference Case. These incremental tests identified that only options 2.5 and 3 achieved the levels of NOX emission reductions on Stafford Street required to address the exceedance issues. As a result, the banning of HGVs from Stafford Street was not taken forward. Therefore, the preferred traffic management scheme includes both physical civil engineering schemes and alterations in the existing traffic signal settings to limit the traffic that can utilise Stafford Street.

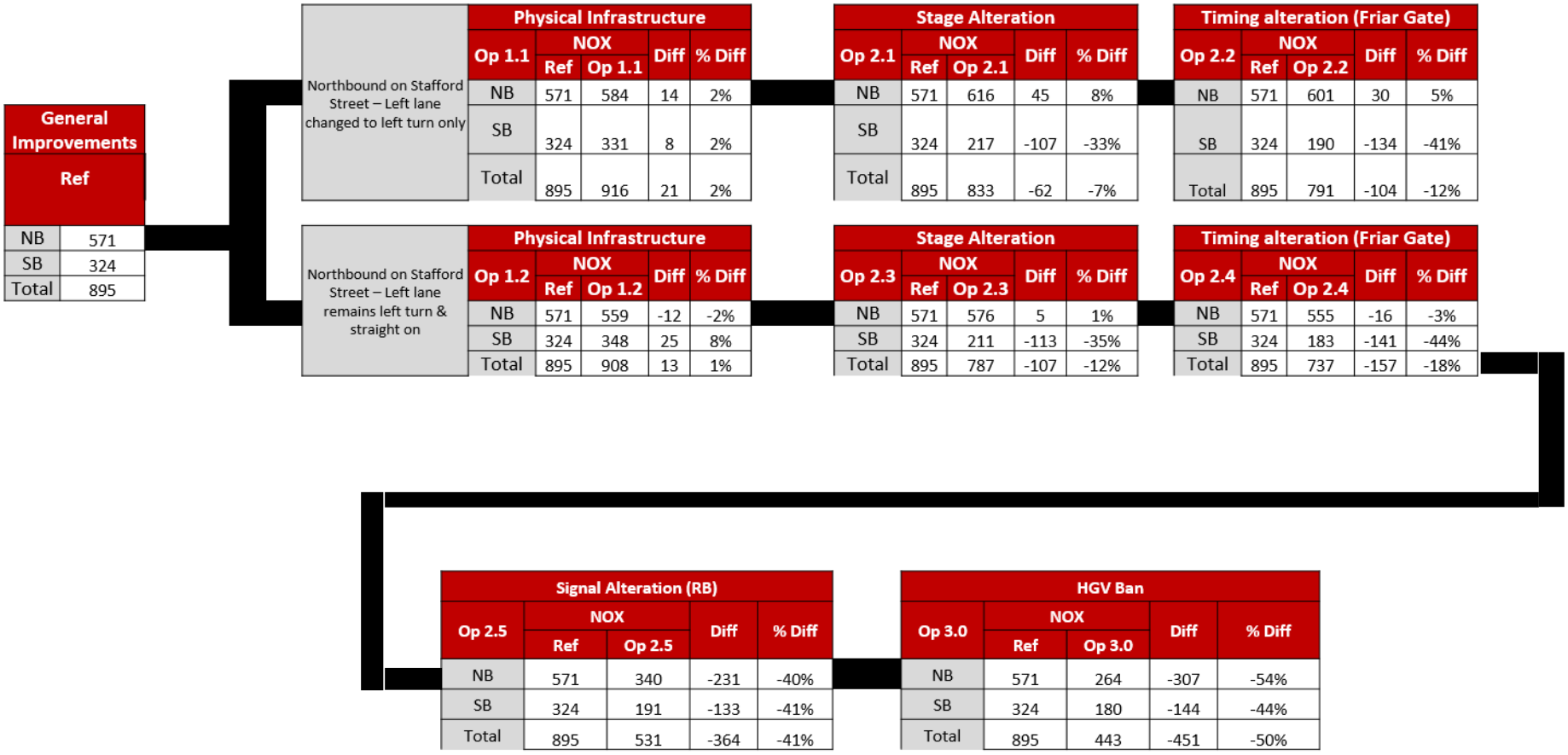
4.2.7 The analysis of the preferred traffic management scheme (scheme 2.5) indicated that there are a number of areas/routes that are adversely impacted by the implementation of the scheme. As a result, a series of further schemes were tested to minimise these impacts. The schemes tested are shown in Table 5 with details of these assessments provided in T5: Derby Roadside $NO_2$ Preferred Option Refinement Traffic Management Scheme Options in Appendix A of this report.

**Table 5. Traffic Management Scheme Options**

| Mitigation Resolution Options | | | | | |
|---|---|---|---|---|---|
| Key | Type | Location | Potential Options | | Time Periods |
| A | Area | New Zealand | 1 | 20 Mph Limit introduced along rat-running route. | AM, IP, PM |
| | | | 2 | Banned Turns into New Zealand form Uttoxeter Old Road. | AM, IP, PM |
| | | | 3 | Altered Signals to prioritise Uttoxeter Old Road Over Ashbourne Road (Westbound) | AM, IP, PM |
| B | Road | Bridge Street | 2 | Signals altered to prioritise Kedleston Road. | AM, PM |
| C | Road | Kedleston Road | 1 | Signals altered to prioritise Kedleston Road. | AM, PM |
| D | Road | Ashbourne Road | 1 | Altered Signals to prioritise Uttoxeter Old Road Over Ashbourne Road (Westbound) | AM (IP and PM Limited) |
| F | Road | Lara Croft Way | 1 | Signal prioritisation provided for trips circumnavigating the Southern extent of the Inner Ring Road. . | AM |
| H | Road | Infinity Park Way | 1 | Prioritise trips passing along the Outer Ring Road, altering signals at the junction with Victory Road and at the Spider Bridge. | AM, IP, PM |
| I | Road | Osmaston Road | 1 | Prioritise trips passing along the Outer Ring Road, altering signals at the junction with Victory Road and at the Spider Bridge. | AM, IP, PM |

4.2.8 This analysis was used by the Council to inform the selection of the Preferred Option which is detailed in the following elements of this report.

**Figure 13. Identification of the Preferred Option Test Summary**



## 4.3 Preferred Scheme

4.3.1 The primary focus of the Preferred Scheme is to use both the Stafford Street/Friar Gate/Ford Street and the Stafford Street/Mercian Way/Uttoxeter New Road signal controlled junctions at either end of Stafford Street to limit the levels of traffic using Stafford Street. The scheme introduces traffic management measures to manage the flow of traffic in and around Stafford Street including the roads closest to the exceedance location including:

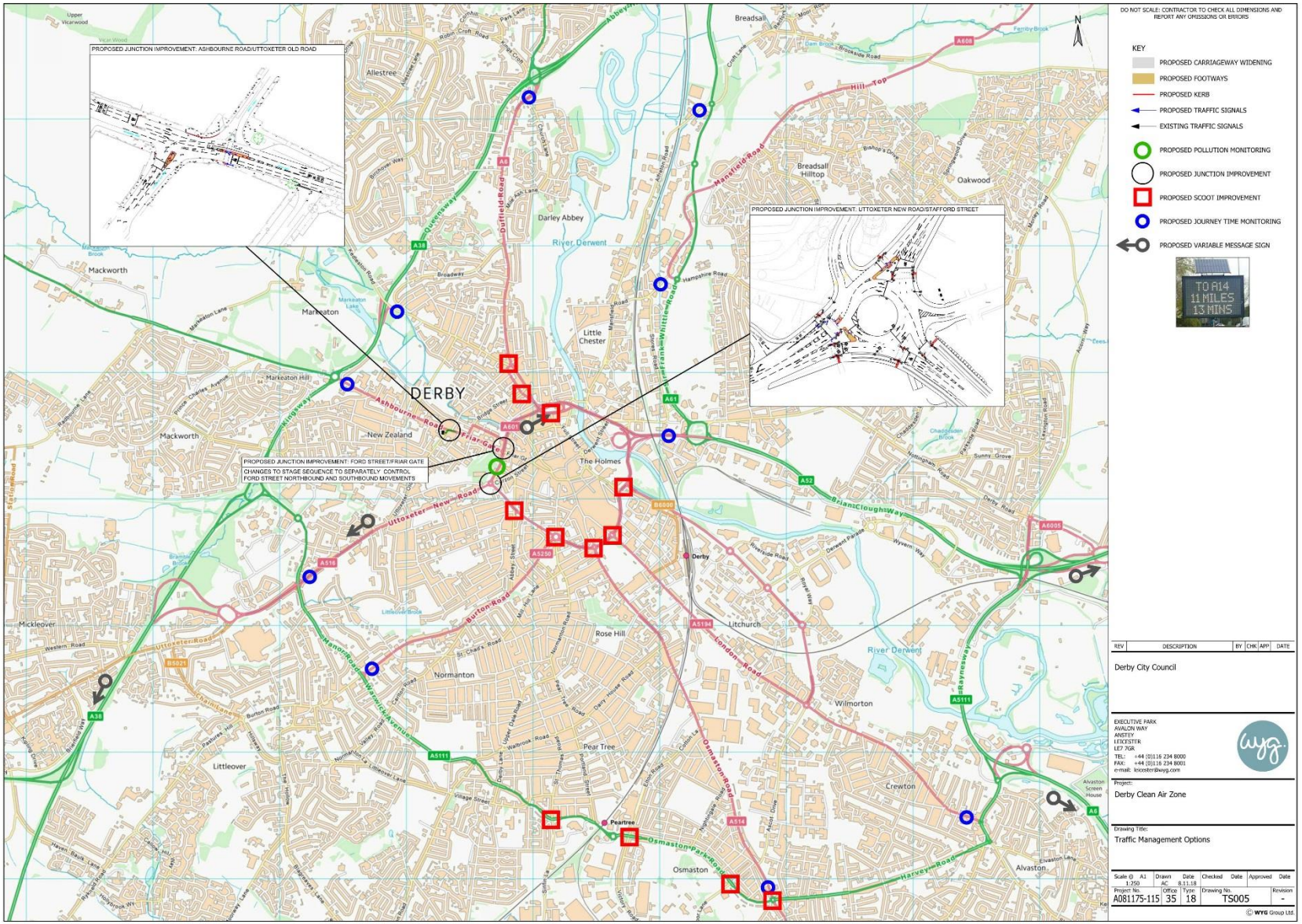
- changes to the junctions at either end of Stafford Street to limit traffic flow in the most sensitive area
- changes to improve capacity at the Ashbourne Road/Uttoxeter Old Road junction to help facilitate alternative route choices
- traffic management measures to support alternative routes such as Uttoxeter Old Road and provide a sustainable network management solution.

4.3.2 Wider network management also forms part of the package of measures to enable the focused traffic management measures to be more effective by facilitating the limiting of traffic flows on Stafford Street, without creating further exceedances. The wider network management measures include:

- Upgrade and extension of the UTMC network management system that manages traffic signals to help ensure there is a system in place that can manage the traffic flows and the road network to support the air quality agenda
- Signal alterations with strategies in place to prioritise air quality management
- Traffic volumes, fleet data and euro standards data collection via ANPR to feed back into the UTMC system and public communications.

4.3.3 The locations of the proposed interventions and initial scheme designs are shown in Figure 14. These proposals informed a Public Consultation exercise in Autumn 2018, which will enable further scheme refinement as part of the detailed design process, alongside associated survey work and LinSig assessments additional to this initial process.

**Figure 14. Preferred Scheme**



## 4.4 Highway Flow Impact of the Preferred Scheme

4.4.1 The predicted traffic flow impacts of the implementation of the Preferred Scheme are shown in Figures 15 to 20. Roads that are predicted to have a reduction in traffic flows during the peak and interpeak hours are shown in green with those that have an increase in traffic flows are shown in red.

4.4.2 The main predicted flow impacts of the scheme are as follows:

- Significant reduction in the use of Stafford Street realising the main objective of the scheme.
- Significant reductions in traffic on the western and northern parts of the Inner Ring Road between Uttoxeter New Road and the A52 at Eastgate with some of this traffic transferring to the southern and eastern sections of the Inner Ring Road where increases in traffic levels are predicted.
- Large reduction in traffic on Uttoxeter New Road and Ashbourne Road with significant proportions of this traffic transferring to other radial routes such as Kedleston Road and Duffield Road to access the city centre causing a resultant relatively small increase on sections of the A38.
- Significant increase in traffic on Uttoxeter Old Road which is being enhanced to be an alternative route to Stafford Street as part of the scheme.
- Minor changes to 'rat running' traffic routes through the New Zealand part of the city as a result of the changes in traffic flows, primarily the increases on Uttoxeter Old Road
- Wider increases in traffic on the A50 and A6 in the peak hours only as traffic diverts from travelling through the city centre to the Strategic Road Network that provides an outer southern and eastern bypass of the city. This is generally longer distance movements between the south east of the city and the west where the Strategic Road Network is the most appropriate route rather than the roads within the city centre.
- Peak hour increases in the use of the Outer Ring Road and also Infinity Way as radial routes into the City Centre change as a result of the scheme. As the development levels around Infinity Way increase the usage of this route for through traffic decreases and therefore the increases along this route are seen as a short-term issue.

4.4.3 Overall the Preferred Scheme is achieving its objective of significantly reducing traffic flow along Stafford Street which is the only predicted air quality exceedance location, as well as reducing overall traffic flows in the city centre as a whole.

4.4.4 The main impact areas are Uttoxeter Old Road, Kedleston Road and the southern and western sections of the Inner Ring Road which are considered further in the air quality modelling reporting.

**Figure 15. Flow Impact of Preferred Scheme – AM Peak**

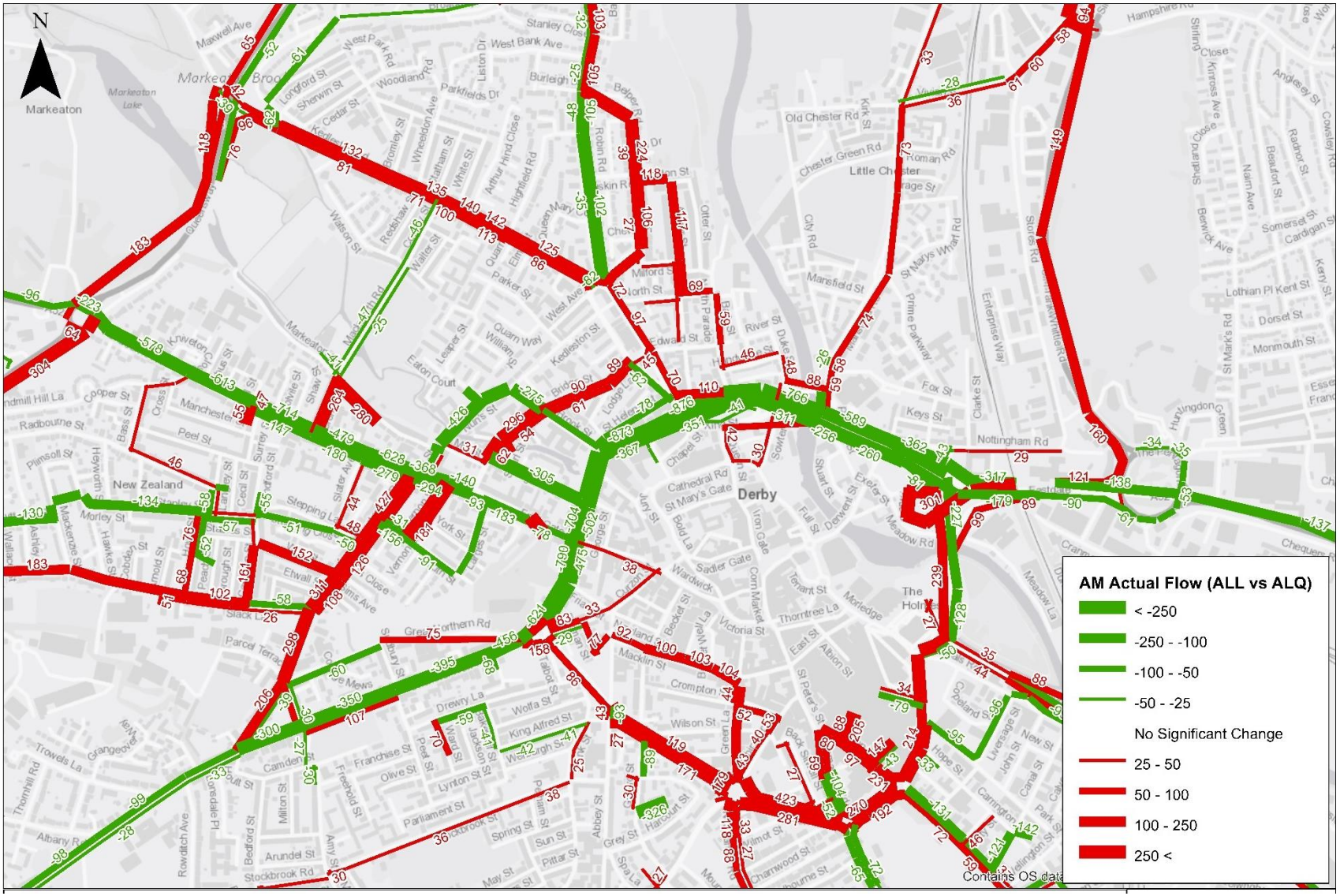


**Figure 16. Flow Impact of Preferred Scheme – AM Peak**

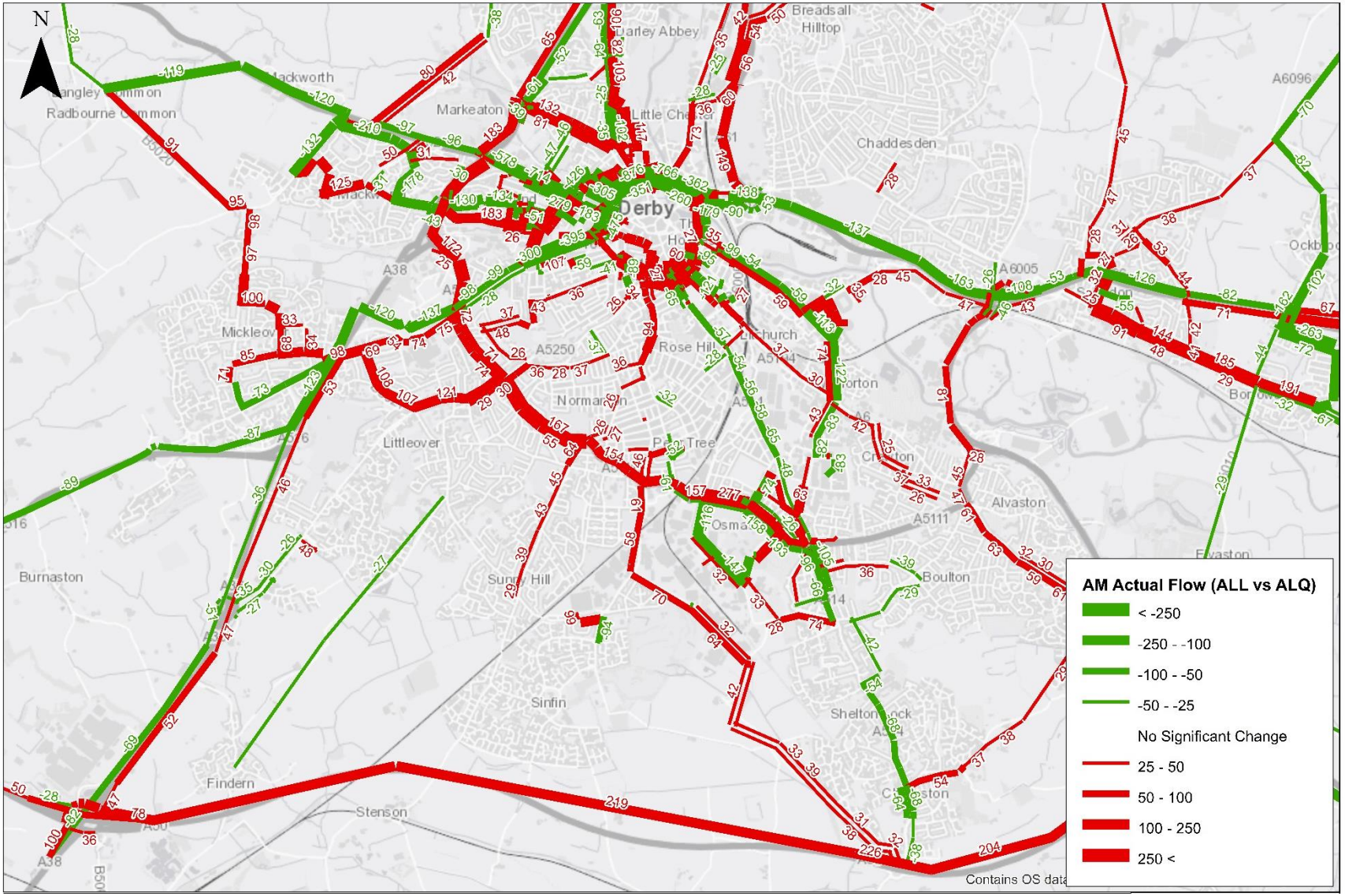


**Figure 17. Flow Impact of Preferred Scheme – Inter Peak**

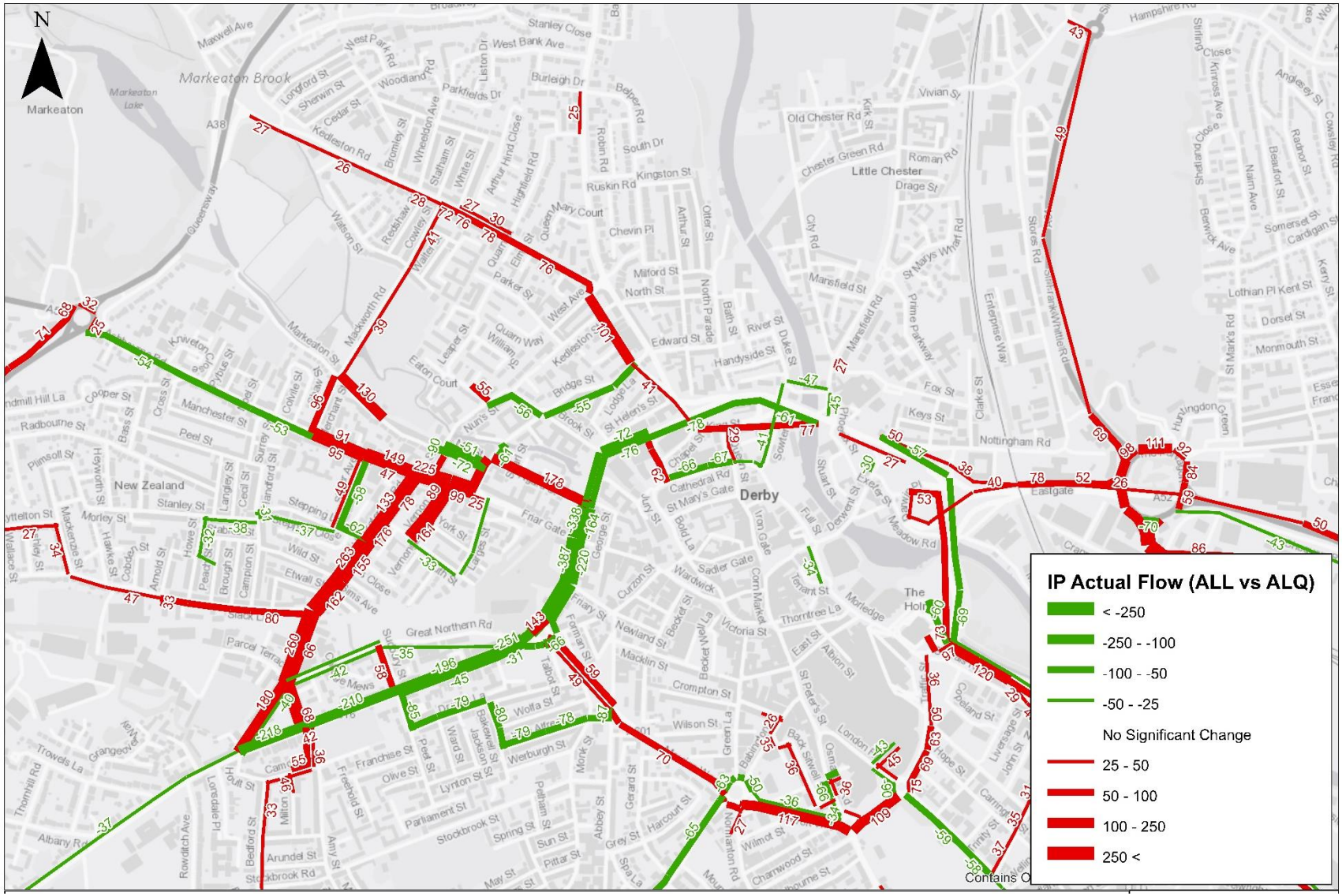


**Figure 18. Flow Impact of Preferred Scheme – Inter Peak**

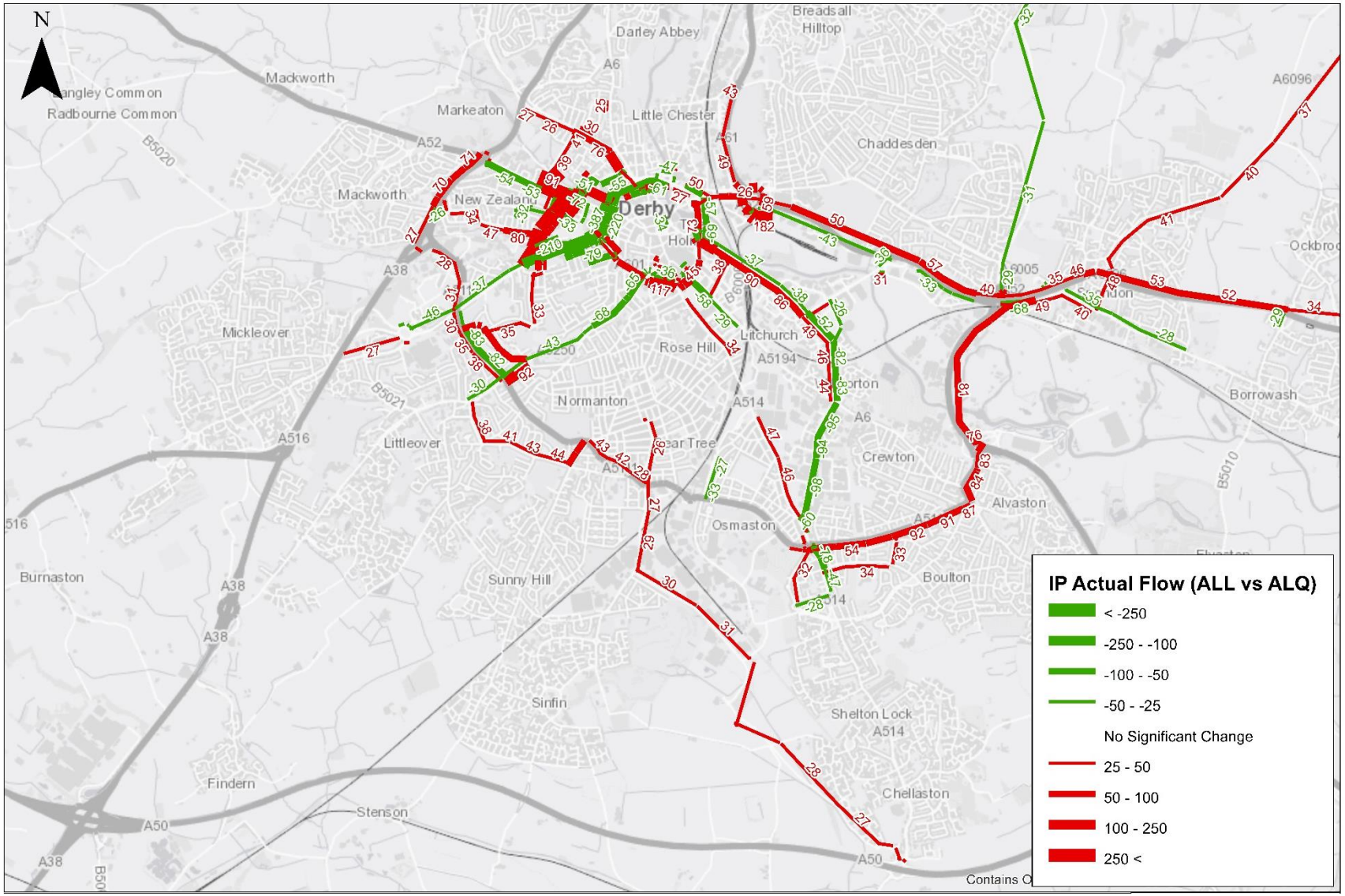


**Figure 19. Flow Impact of Preferred Scheme – PM Peak**

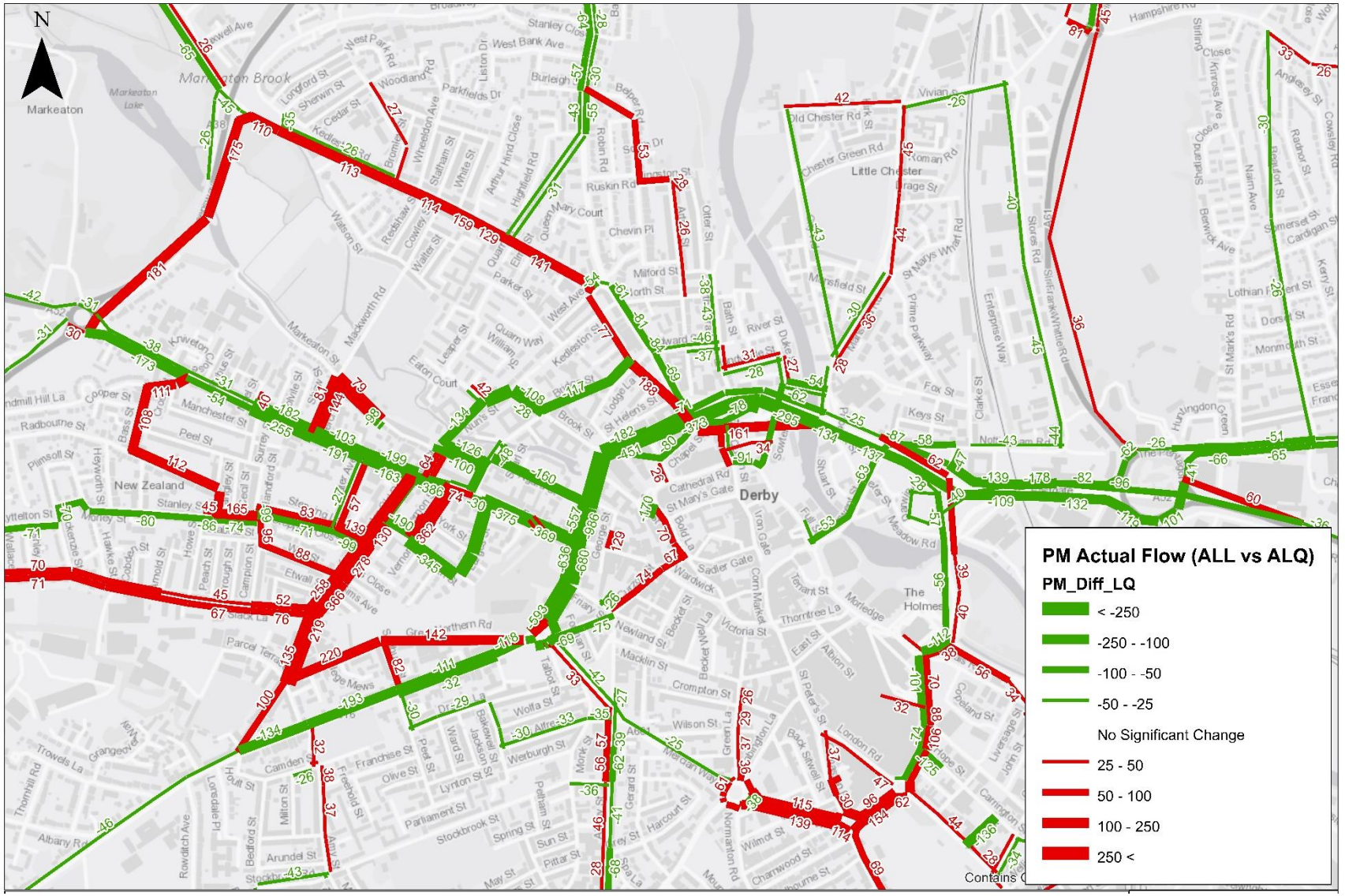
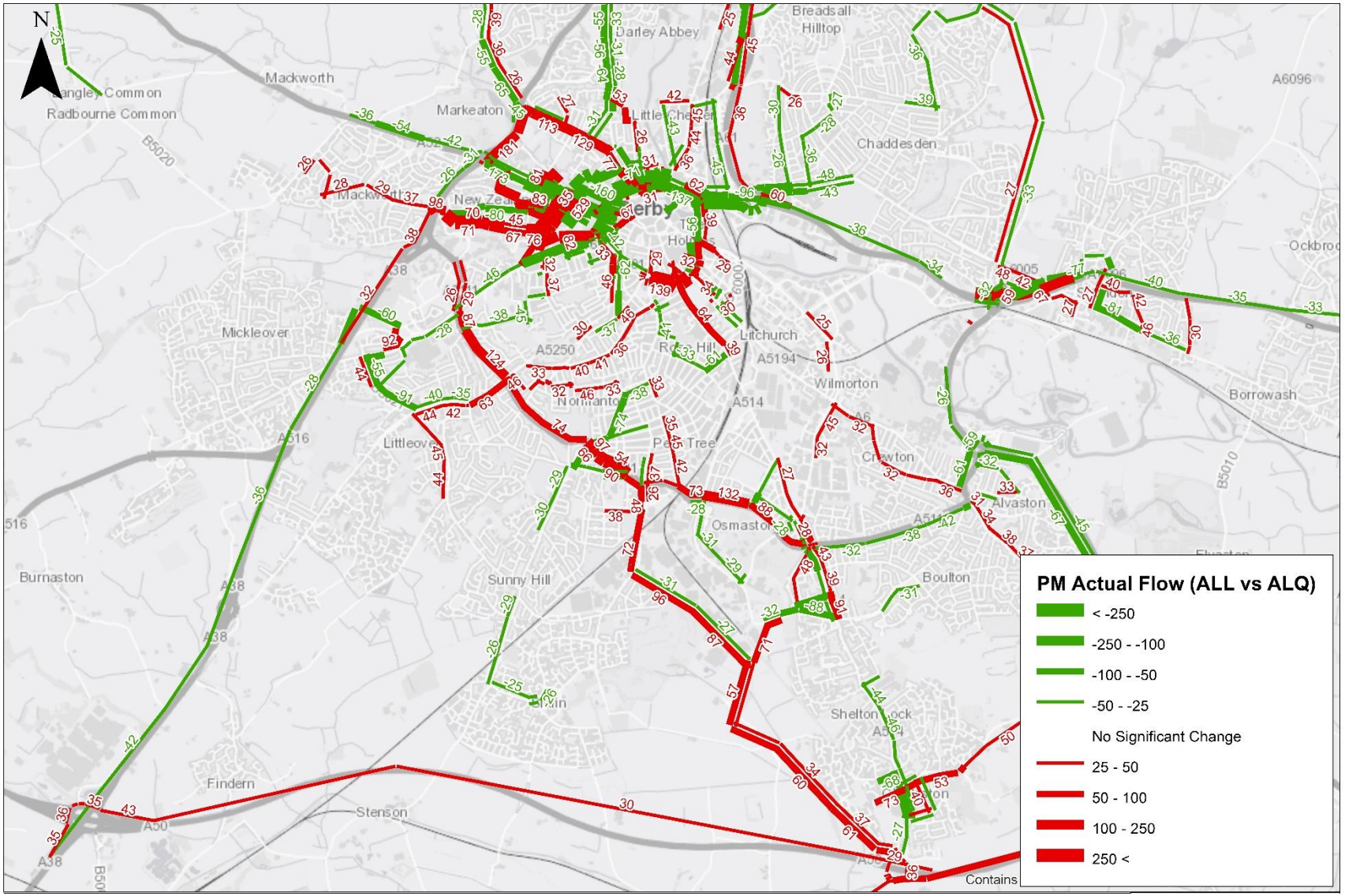


**Figure 20. Flow Impact of Preferred Scheme – PM Peak**



## 4.5 AADT Flow Change

4.5.1 AADT flows have been generated from the hourly information output from the DATM models for input into the Ricardo Air Quality models. The AADT traffic flows are based on the three hourly models provided above and local factors derived from recent traffic count data.

4.5.2 Figure 21 outlines the predicted change in AADT flows between the Preferred Scheme and the Reference case, the PCM routes are also highlighted by a black dotted line. The general changes in AADT replicate the hourly changes outlined earlier as expected.

4.5.3 In most cases the PCM routes see a reduction in AADT flow as movements through the city centre decrease. The main exceptions to this are the A514 to the south and the Derby Outer Ring Road both of which are covered in more detail in the Air Quality reporting.

4.5.4 The city centre changes in AADT flow are shown in Figure 22. The most significant changes are deemed to be routes that have a change of greater than 5,000 movements. The most significant changes relate to:

- Stafford Street – reduction in AADT which is the objective of the scheme
- Uttoxeter Old Road – increase in AADT as the scheme enhances this route as an alternative to Stafford Street

Figure 21. AADT Flow Change (PCM Routes)

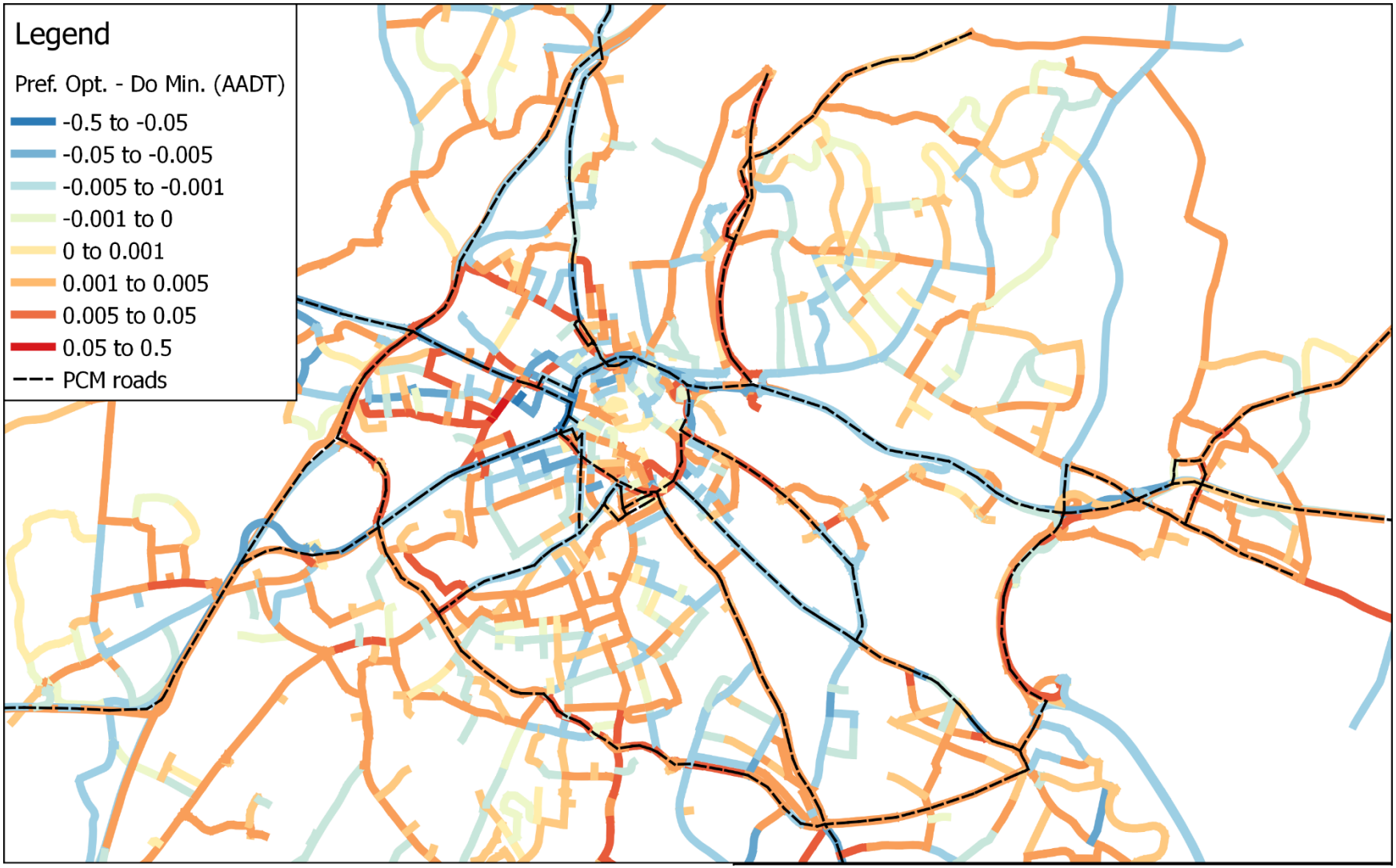


Figure 22. AADT Flow Change – City Centre Area

# 5. 2020 CHARGING CAZ BENCHMARK TEST

## 5.1 Overview

5.1.1 The chapter below presents the traffic impacts of a Benchmark CAZ D scheme encompassing all routes within Derby's Outer Ring Road.

5.1.2 The traffic assessment of this Benchmark Scheme builds on the 2020 Forecast scenario discussed previously and all the analysis in this chapter compares the Benchmark scenario with this 2020 Forecast scenario.

## 5.2 Overview of the Benchmark Charging CAZ D Scheme

5.2.1 The area of the Benchmark Ring Road CAZ D scheme is bounded by the Outer Ring Road, but not including the Outer Ring Road (i.e. A61 Sir Frank Whittle Road, A52 Brian Clough Way, A5111 Raynesway, Shardlow Road, Harvey Road, Osmaston Park Road, Newdigate Street, Kenilworth Avenue, Warwick Avenue, Manor Road, Kingsway, A38 Queensway, Abbey Hill). This area is shown in Figure 23.

5.2.2 The boundary has been chosen for the following reasons:

- to utilise the existing Outer Ring Road network as the boundary for the majority of the zone:
- in order to ensure drivers are given alternative routes to avoid travelling through the zone if necessary.
- to ensure that the alternative routes are on suitable roads i.e. the strategic road network.
- to minimise any issues regarding displaced traffic.

5.2.3 A608 Mansfield Road is the boundary of the zone as this forms part of the strategic road network for traffic travelling in a northeast bound direction.

5.2.4 The Derby City Council boundary between A38 and A61 forms the boundary of the zone in order to ensure the zone stays within the DCC administrative area

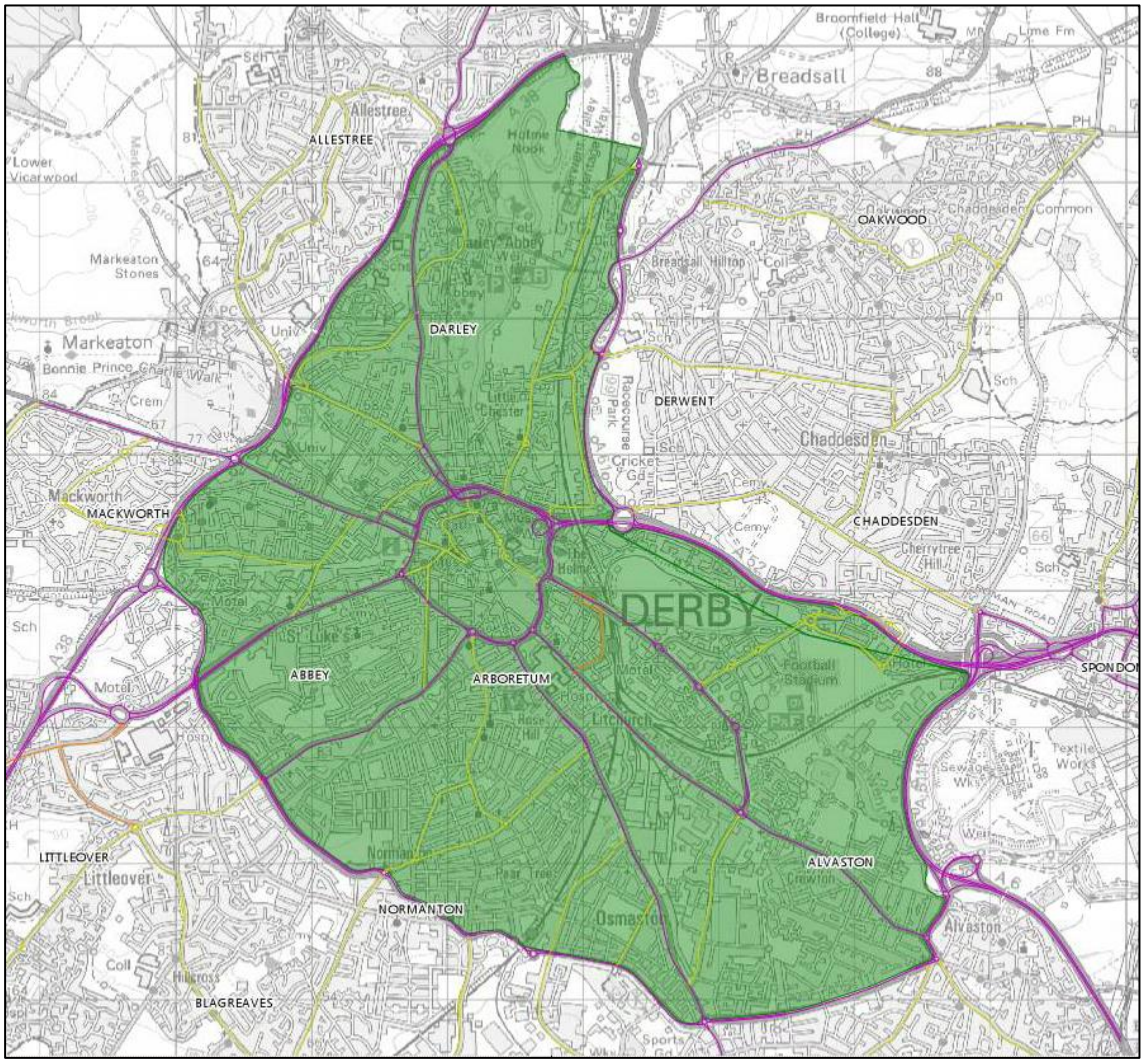
5.2.5 The compliant and non-compliant vehicle splits have been adjusted to reflect the situation should a charging CAZ scheme be implemented. These adjustments have been based on information supplied by JAQU.

5.2.6 The tariff levels that have been applied are based on those provided by JAQU for the London Charging scheme. They include:

- Cars, Taxis, LGVs: £12.50 per day
- HGVs, Buses: £100 per day.

5.2.7 This benchmark test has been run through the full DATM model so that any driver demand responses that may occur as a result of the Preferred Scheme are included in the predicted impacts of the scheme.

**Figure 23. Coverage of Benchmark CAZ D scheme, the area within the outer ring road**



## 5.3 Highway Flow Impact of the Benchmark Charging CAZ D Scheme

5.3.1 The predicted traffic flow impacts of the Benchmark CAZ D scheme are shown in Figures 24 to 29. Roads that are predicted to have a reduction in traffic flows during the peak and interpeak hours are shown in green with those that increase in red.

5.3.2 The main predicted flow impacts of the scheme are as follows:

- Non-compliant vehicles that pass through the CAZ area tend to divert to either the Outer Ring Road or the A50/A6 corridors resulting in an increase in vehicles along these routes.
- There is an increase in compliant vehicles passing through the city centre as these routes become more attractive due to the removal of the non-compliant vehicles.
- There is also an increase in traffic 'rat running' through the core of the city centre due to changes in traffic routeing affecting the congestion on specific parts of the network.
- There is an overall reduction in traffic volumes within the CAZ area.
- There is an increase in vehicles on Stafford Street, however, the levels of non-compliant vehicles have been significantly reduced with approximately 93% of the vehicles compliant on Stafford Street in the CAZ D scenario compared to 68% in the 2020 Reference Case.

5.3.3 Overall the Benchmark CAZ D option reduces the levels of non-compliant vehicles within the city centre area, however these vehicles are displaced to the Outer Ring Road and also the A50, rather than passing through the City Centre.

Figure 24. Flow Impact of Benchmark CAZ D – AM Peak

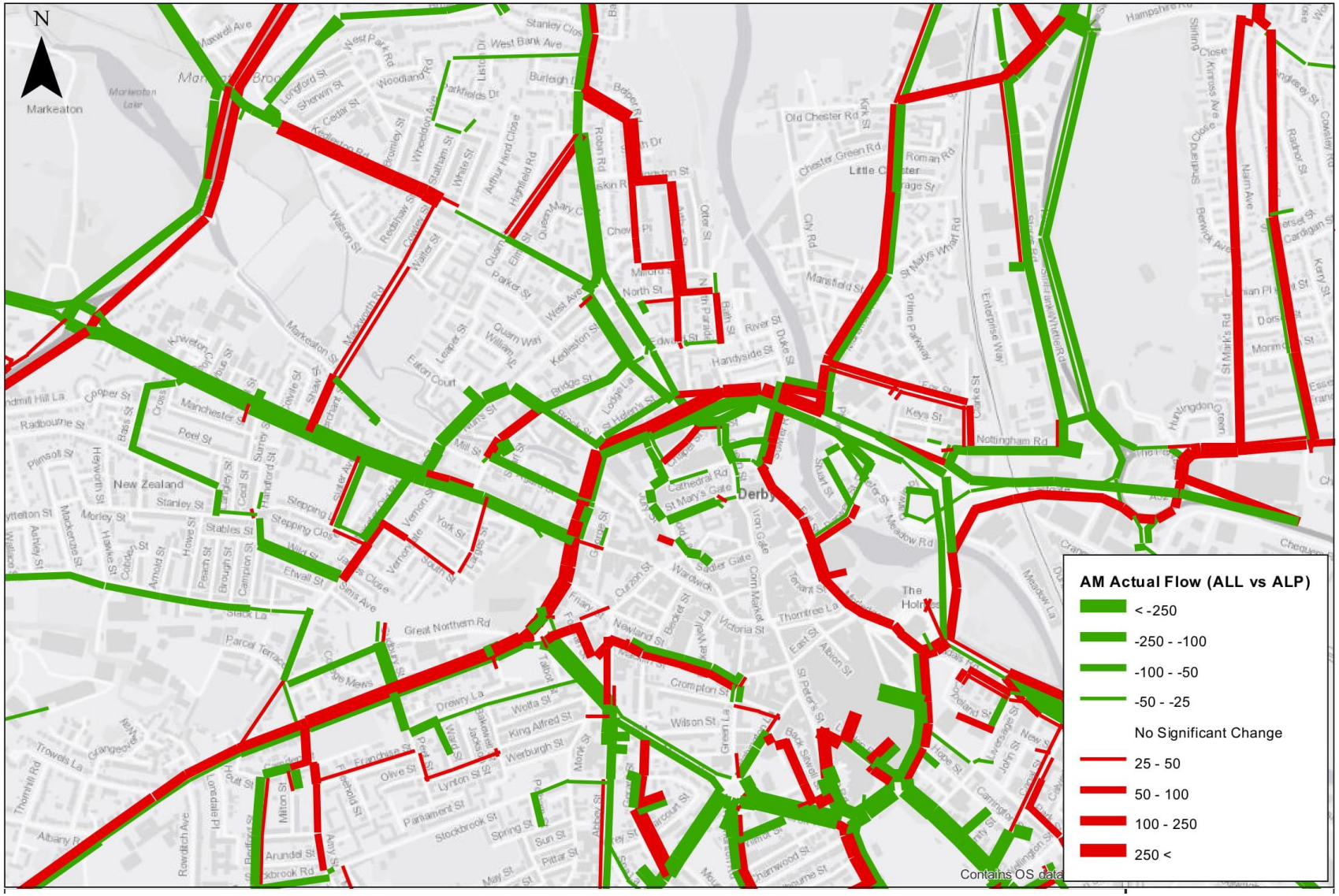


Figure 25. Flow Impact of Benchmark CAZ D – AM Peak

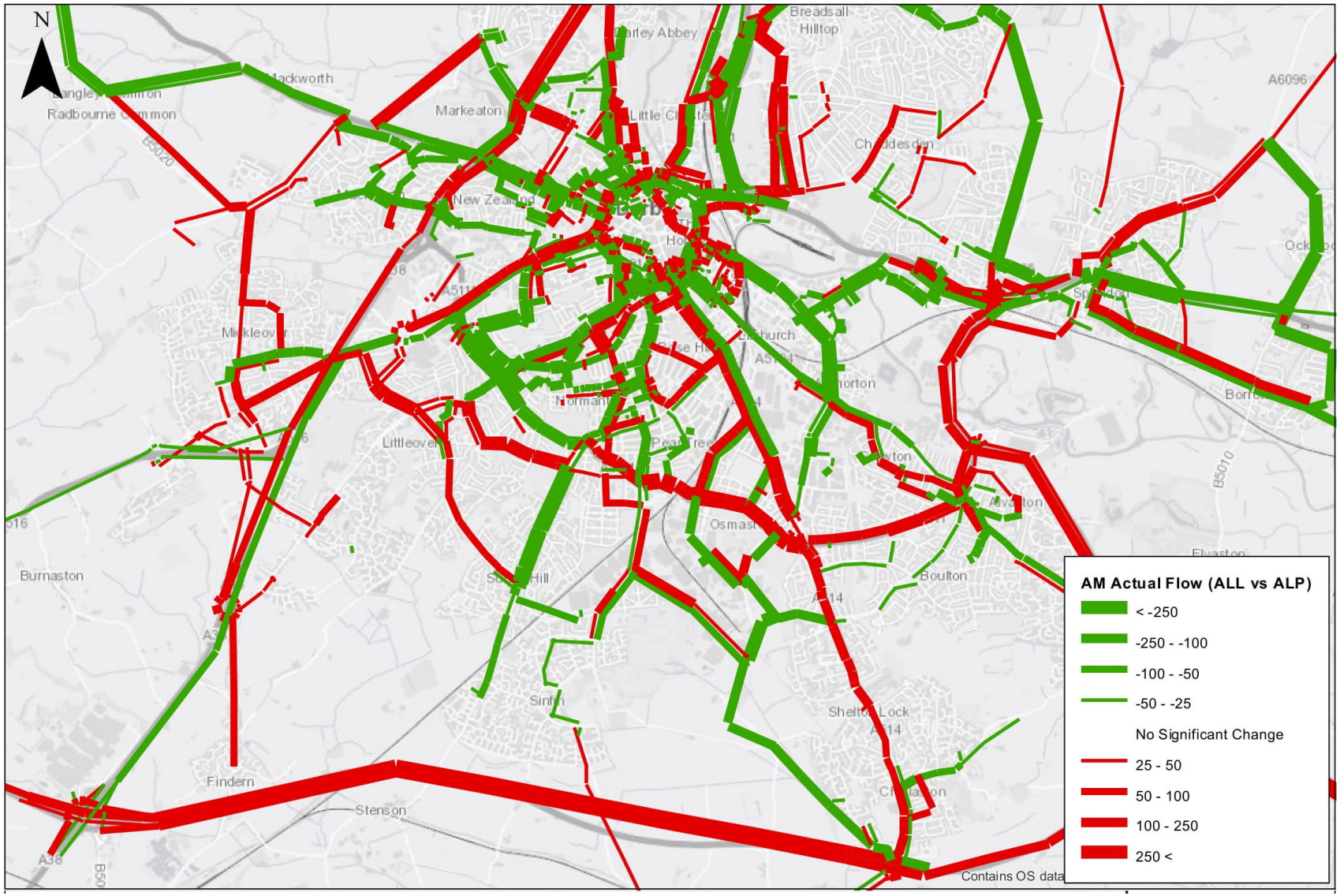


**Figure 26. Flow Impact of Benchmark CAZ D – Inter Peak**

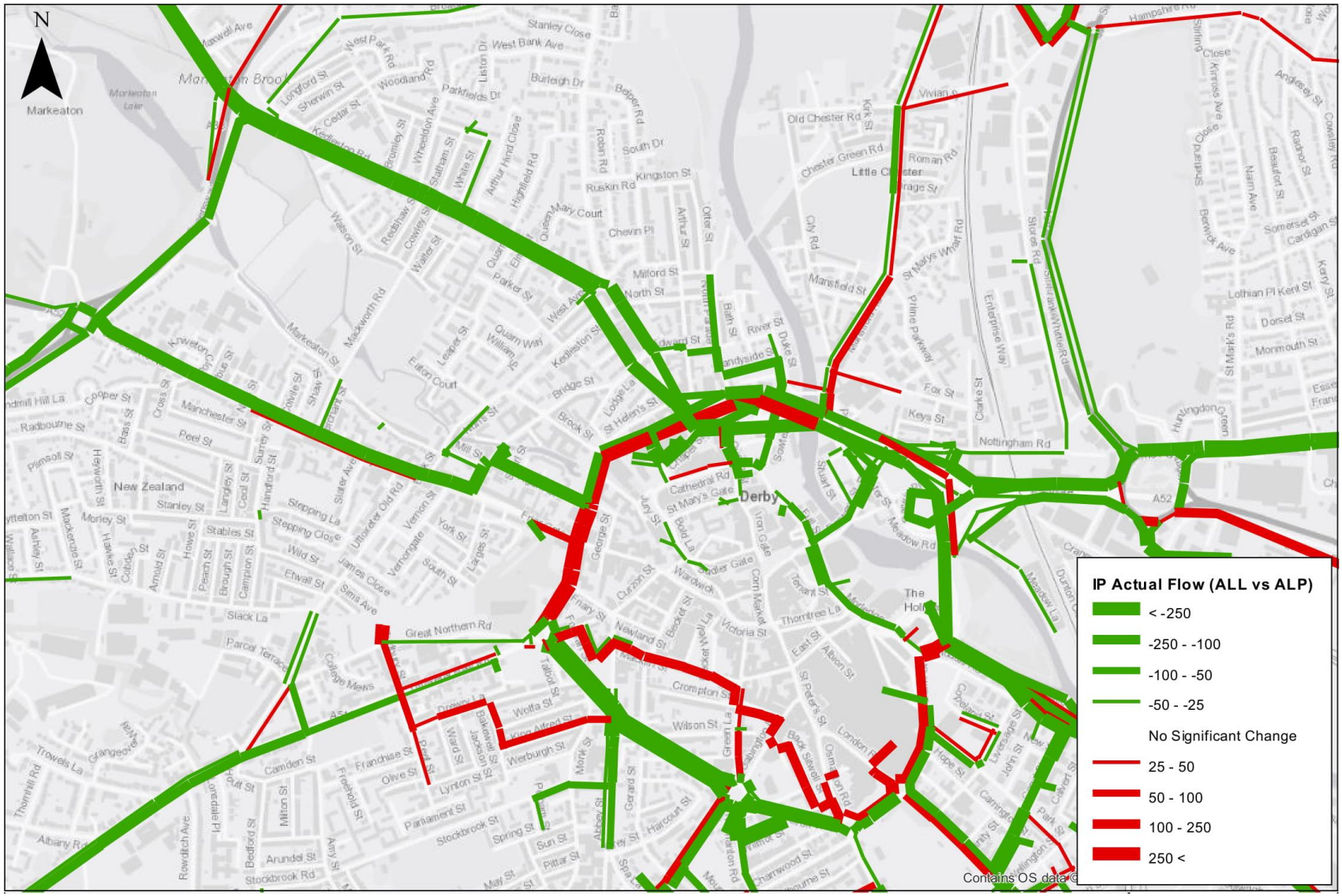


**Figure 27. Flow Impact of Benchmark CAZ D – Inter Peak**

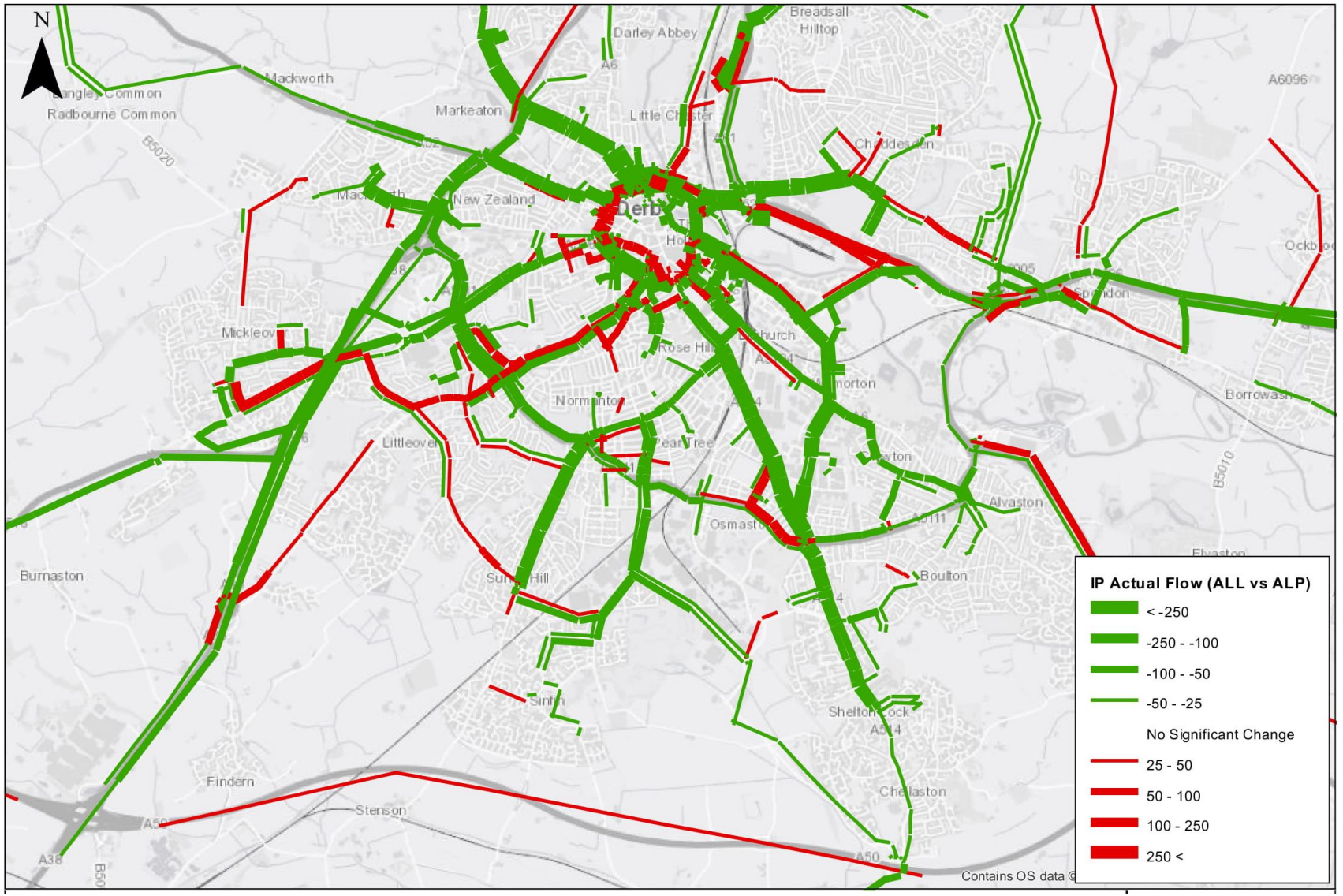


**Figure 28. Flow Impact of Benchmark CAZ D – PM Peak**

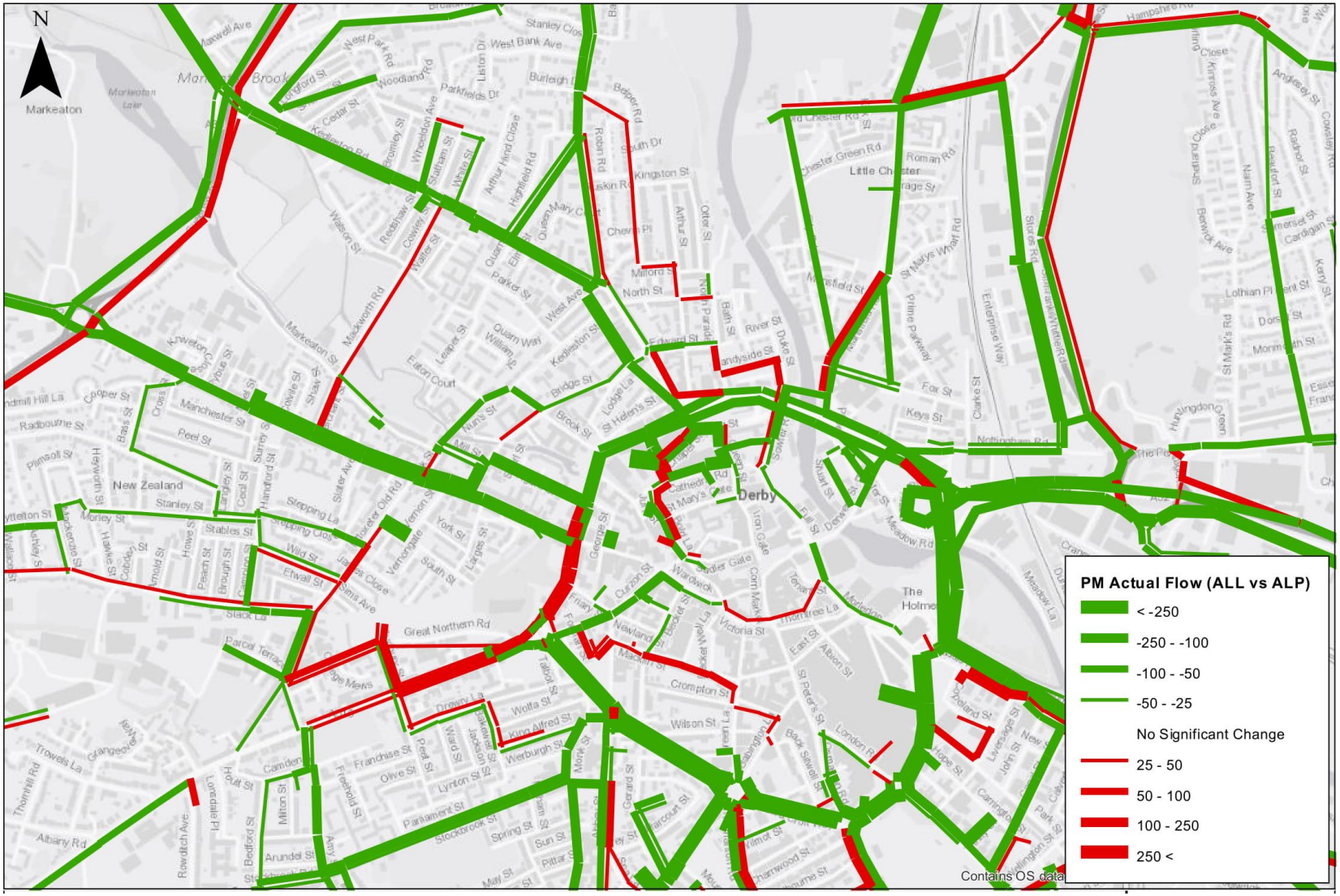
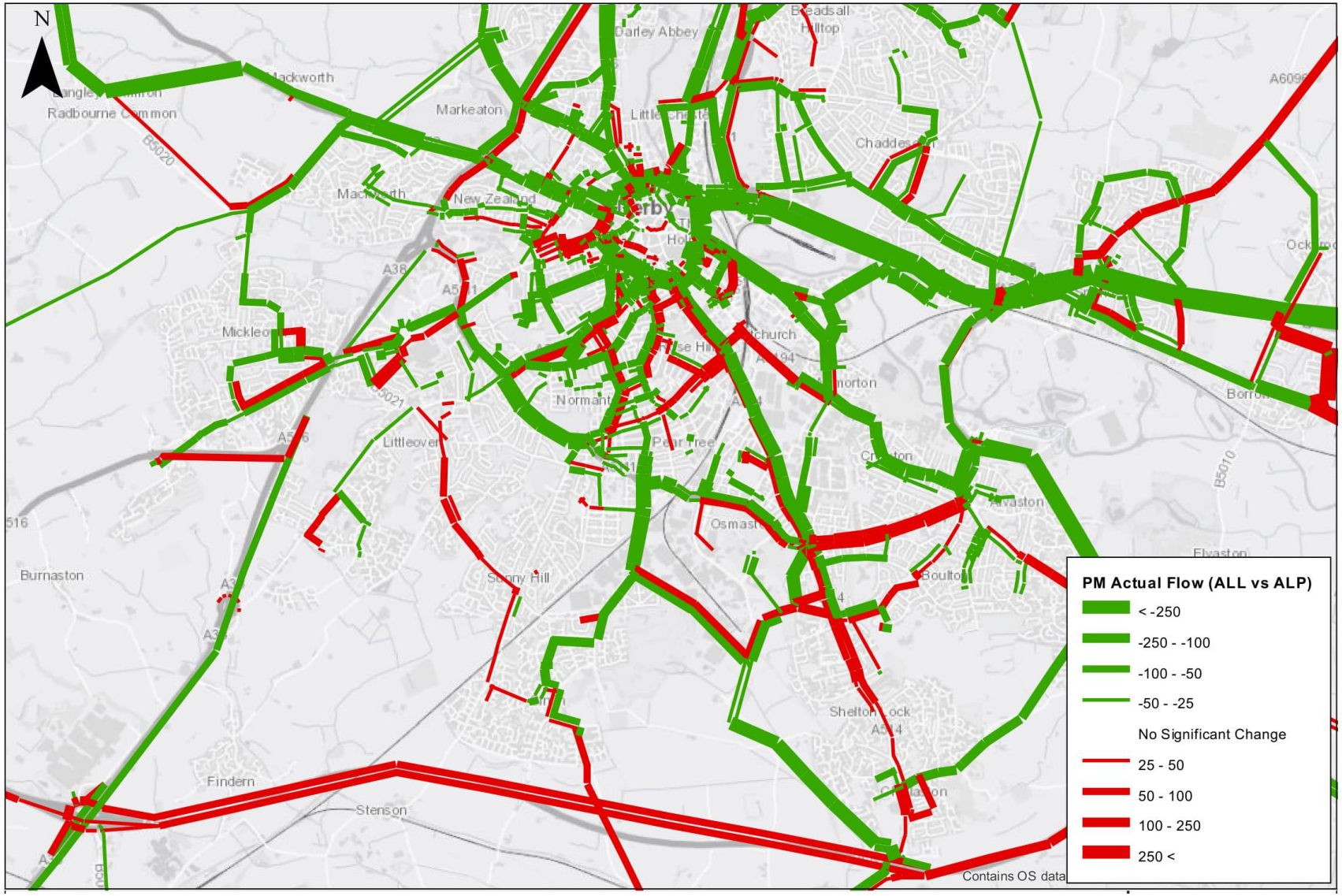


Figure 29. Flow Impact of Benchmark CAZ D – PM Peak



# 6. 2020 CAZ D 0% UPGRADE SENSITIVITY TEST

## 6.1 Overview

6.1.1 The chapter below presents the traffic impacts of the CAZ D 0% Upgrade Sensitivity Test as requested by JAQU, encompassing all routes within Derby's Outer Ring Road.

6.1.2 The traffic assessment of this scheme is a comparison between the 2020 Forecast scenario discussed previously and a variation on the CAZ Benchmark Test, which used compliance splits assumptions provided by JAQU.

## 6.2 Overview of the CAZ D 0% Upgrade Sensitivity Test

6.2.1 The area of the 'CAZ D 0% Upgrade Sensitivity Test' is identical to that in the Benchmark Ring Road CAZ D scheme, as described in 5.2.

6.2.2 The 0% upgrade variant implements the CAZ tariff charges into the network. The adoption of compliant vehicles because of CAZ implementation remains unaltered at 0%. Thus, the compliance ratio is identical to that modelled in the 2020 forecast model. This reflects the worst-case scenario regarding the uptake of cleaner, compliant, vehicles in response to the charging CAZ.

6.2.3 Subsequently the scenario dictates that no existing non-compliant vehicles are upgraded to compliance and that all non -compliant commuters opt to either pay the charge, divert or do not make a journey. This allows for the consideration of implications, within the original compliance assumptions, if the Benchmark test is overly optimistic.

6.2.4 As per the CAZ D test, the 0% upgrade sensitivity test has been run through the full DATM model (Under the name ALT).

## 6.3 Highway Flow Impact of the 2020 CAZ D 0% Upgrade Test

6.3.1 The introduction of the CAZ area, with zero upgrade, leads to a significant alteration in flows across the city compared to the reference case. These flows are displayed in Figures 30 to 36. Roads that are predicted to have a reduction in traffic flows during the peak and interpeak hours are shown in green with those that increase are shown in red.

6.3.2 The main predicted flow impacts of the scheme are as follows:

- Significant alterations to trips are seen within both the Outer Ring Road and across the wider area as routings divert to avoid the high cost city centre, when compared against the 2020 forecast baseline. This redistribution is broadly like that seen in the CAZ D Benchmark test.
- Within the AM peak we see a reduction in the number of vehicles on the Outer Ring Road, compared to the 2020 forecast baseline, and a change to the radial routes within the CAZ zone. The number of compliant trips within the CAZ area remains comparable to the 2020 forecast, as the compliance ratio remains unchanged between the two scenarios.
- The reduction in the number of non-compliant trips, from forecast to 0%, within the CAZ zone, leads to an easing of congestion on certain paths, leading to routeing alterations.
- Within the AM period, this reduction in non-compliant trips is not as extensive as that seen in the CAZ D test. Instead the 0% test is subject to inter-CAZ non-compliant trips, meaning routes whose origin and destination both reside within the CAZ zone. This leads to a minimum reduction in actual flow between the 2020 forecast and the 0% JAQU models.
- In contrast, within the IP period, this redistribution does result in a net decrease within both the CAZ area and the surrounding city. The same can be said for the PM peak, where we also see increased usage of the Outer Ring Road, A50 or A52 as non-compliant trips move to circumnavigate the CAZ zone.
- Across all periods, there is an increase in traffic finding alternative routes on minor roads through the core of the city centre due to changes in traffic routing affecting the congestion on specific parts of the network.
- There is an overall reduction in traffic volumes within the CAZ area.

6.3.3 Overall the CAZ D 0% Upgrade Sensitivity option reduces the levels of non-compliant vehicles within the City Centre area, however these vehicles are displaced to the Outer Ring Road and the A50 rather than passing through the City Centre.

**Figure 30. Flow Impact of 0 % JAQU – AM Peak**

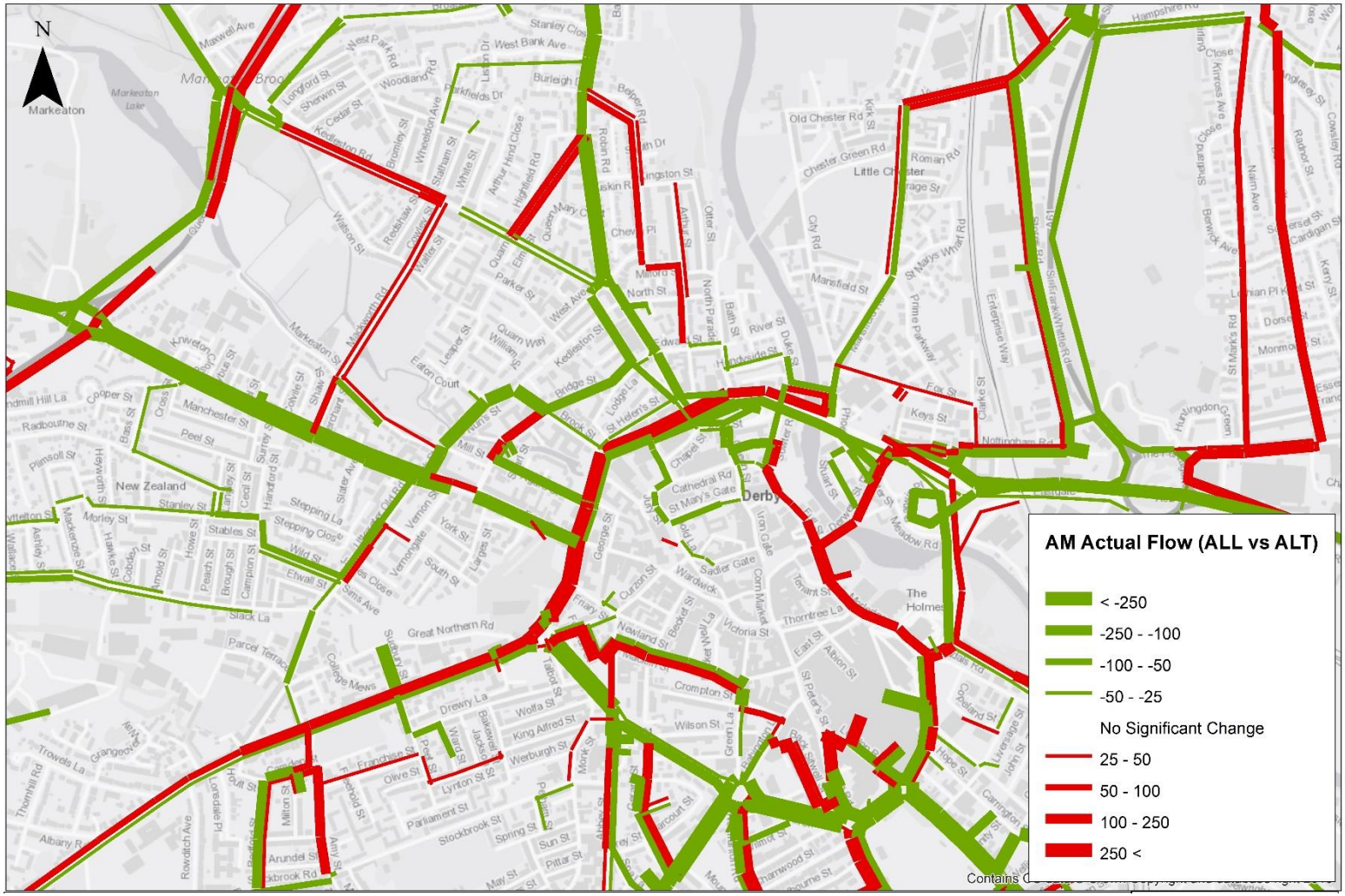


**Figure 31. Flow Impact of 0 % JAQU– AM Peak**

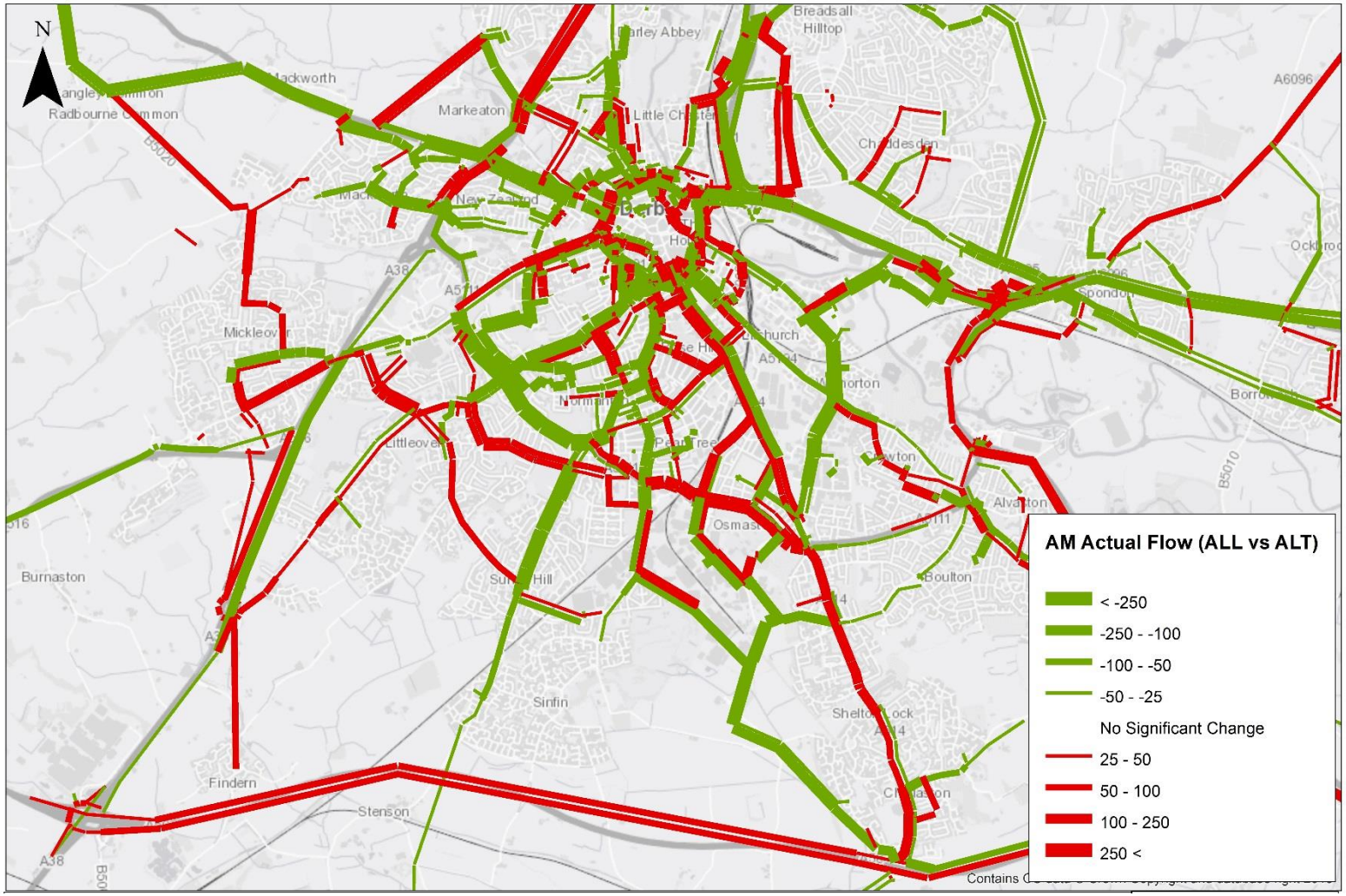


**Figure 32. Flow Impact of 0 % JAQU – Inter Peak**

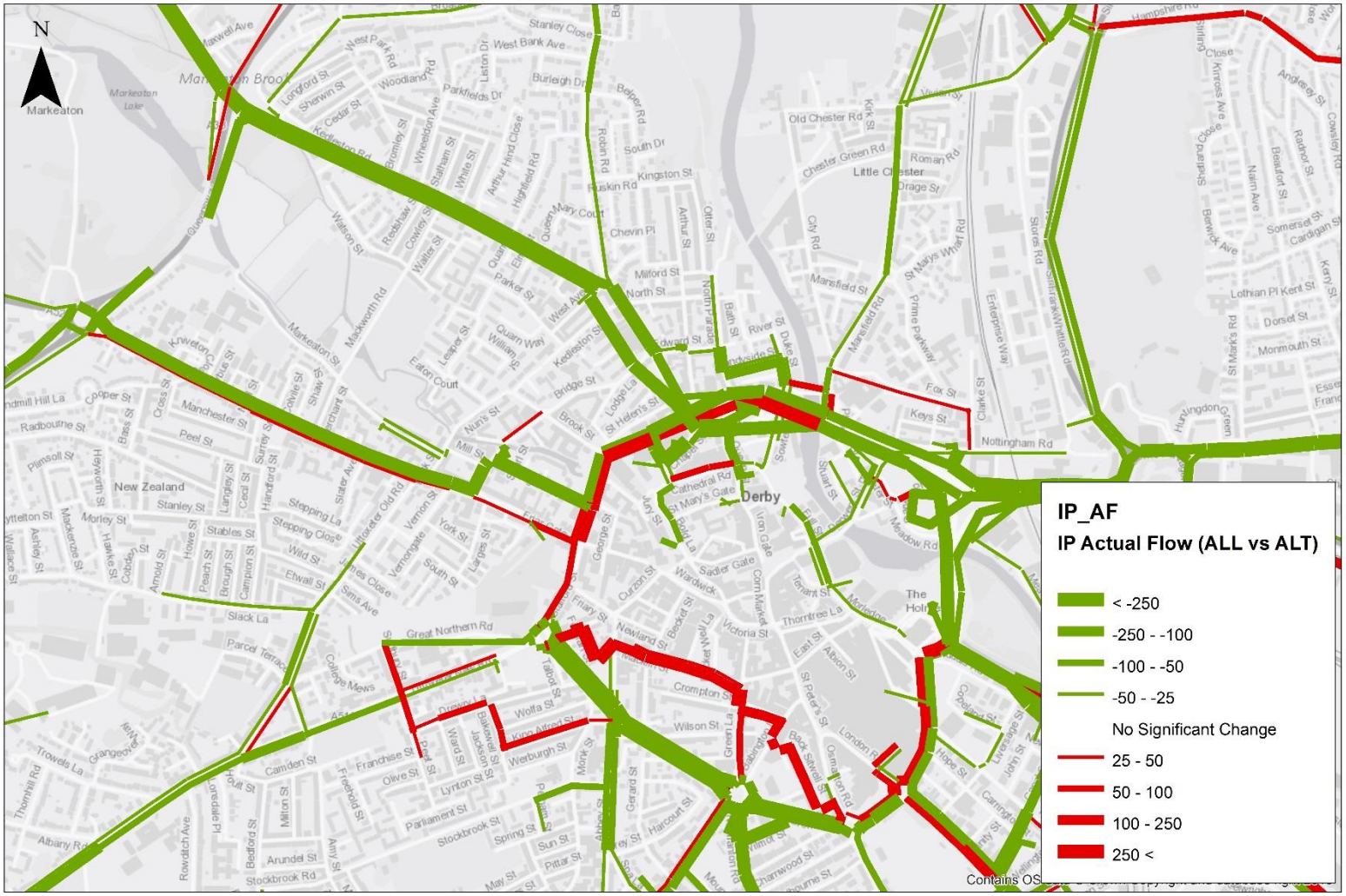


**Figure 33. Flow Impact of 0 % JAQU – Inter Peak**

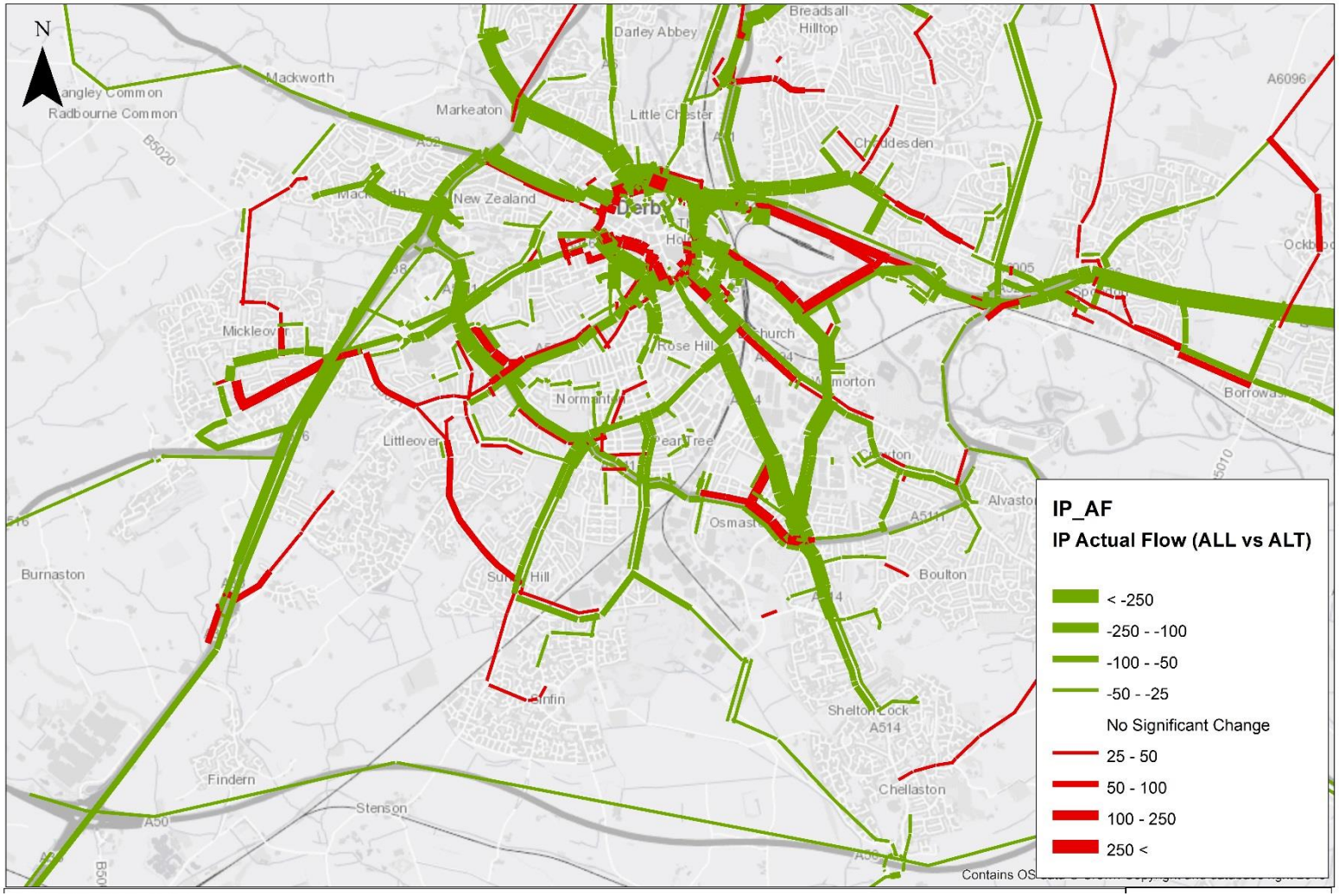


**Figure 34. Flow Impact of 0 % JAQU – PM Peak**

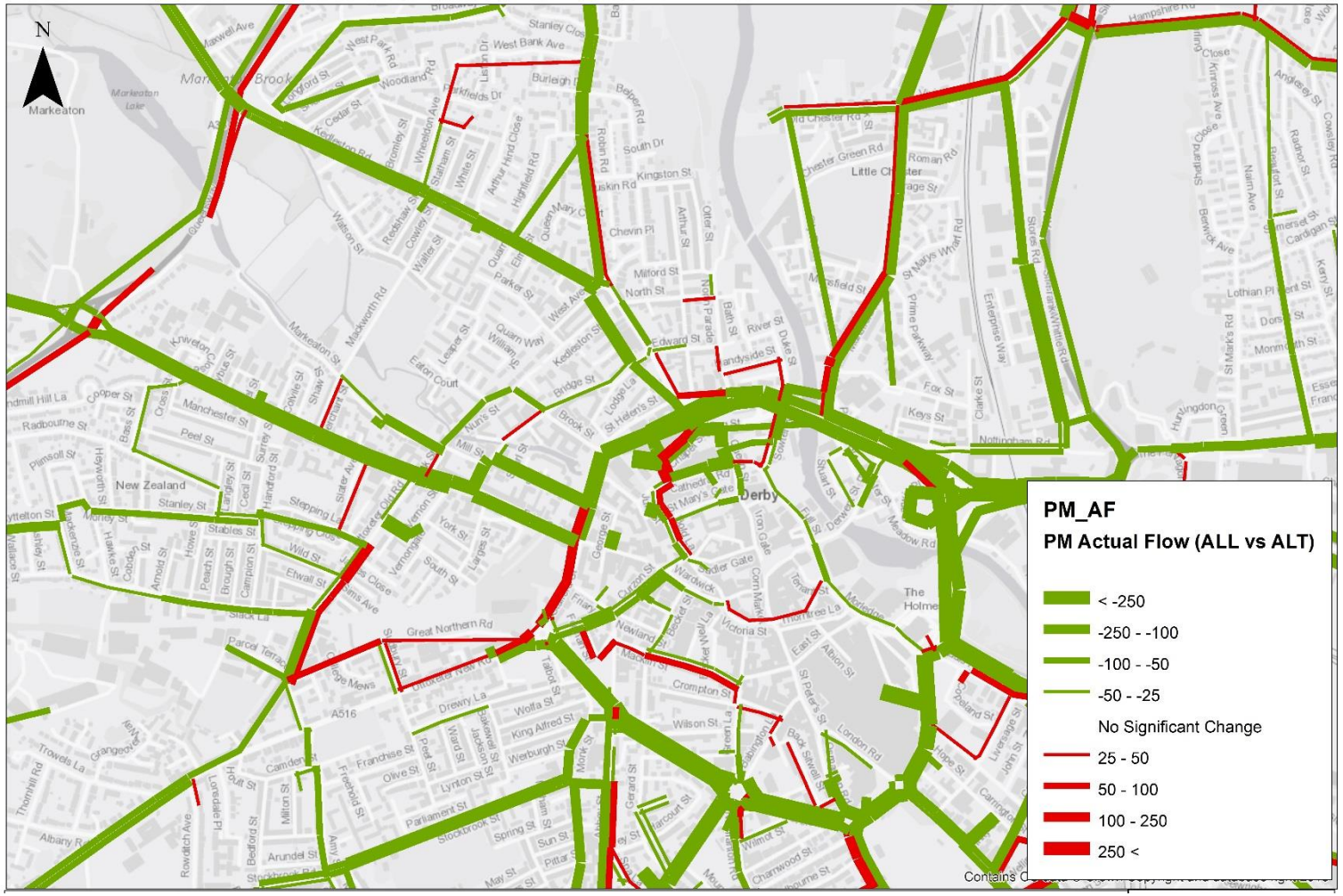
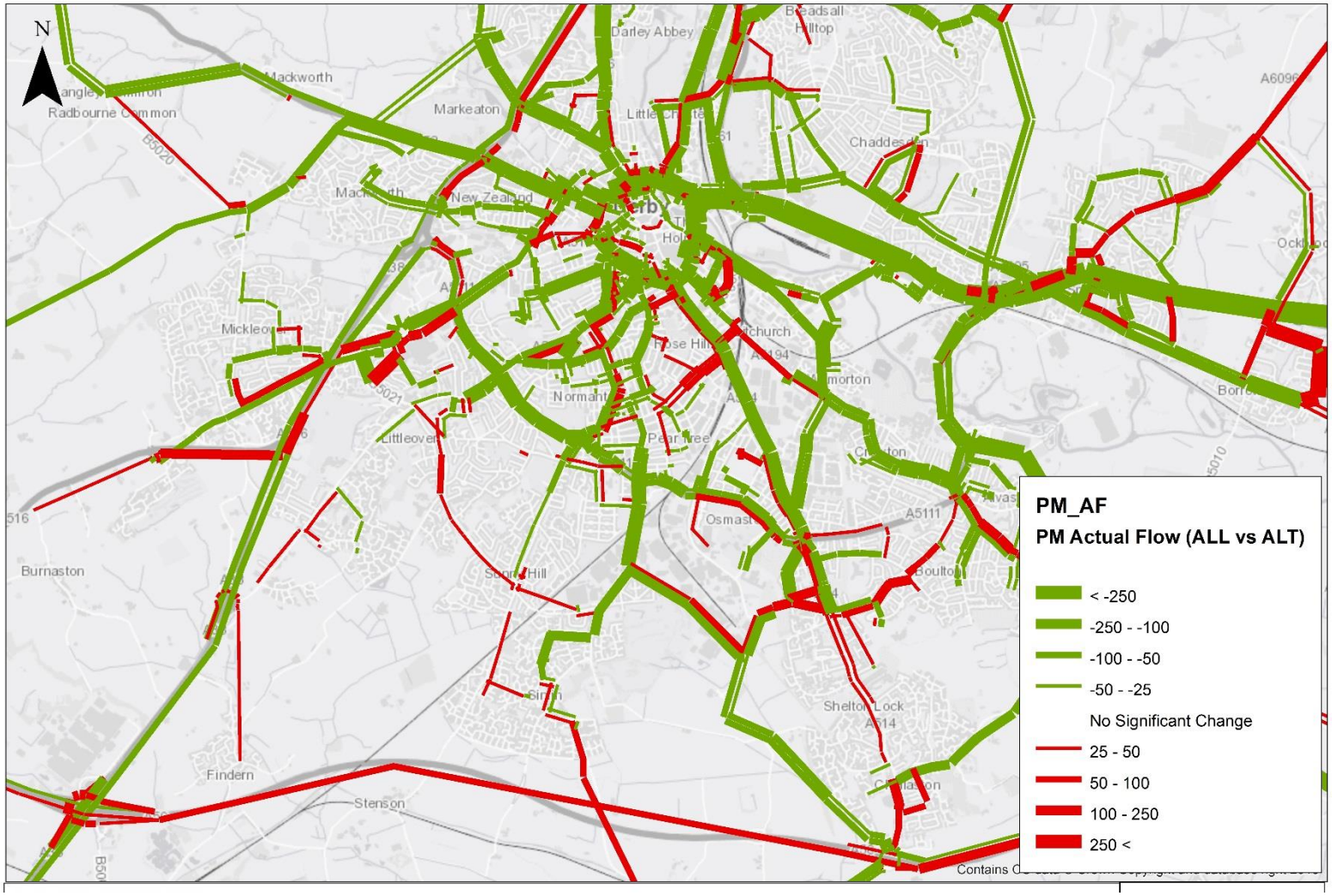


**Figure 35. Flow Impact of 0 % JAQU – PM Peak**



# 7. 2025 REFERENCE CASE

## 7.1 Overview

7.1.1 The A38 Grade Separation scheme will significantly upgrade the capacity at three existing roundabout junctions at A38/A5111 Kingsway, A38/A52 Markeaton roundabout and A38/A61 Little Eaton junction. At present these junctions experience heavy congestion especially in peak hours with significant rat-running on local roads to avoid delays. The Grade Separation scheme, planned by Highways England for completion during 2024, is forecast to have a significant impact on the traffic routeing within the local area by drawing traffic from the local roads back onto the strategic road network. The resultant changes in flow are also expected to have an impact on air quality levels.

7.1.2 To provide an indication of the impact of the A38 Grade Separation may have on air quality we have developed a further Reference Case year of 2025 based on the 2020 core scenario with the following adjustments:

- Highway Networks updated to include the A38 improvements as per the latest scheme plans.
- The land use assumptions and resultant trip demand matrices have been updated to reflect traffic growth relating to development completions to 2025 constrained to forecasts from Tempro 7.2.

## 7.2 Flow Change between 2020 and 2025 Reference Cases

7.2.1 Figures 36 to 38 show the change in traffic flows between the 2020 and 2025 reference cases. Overall there is a small increase in the overall demand in the transport model as a result of growth from the additional development however the main impacts shown are the result of the implementation of the A38 grade separation scheme by Highways England.

7.2.2 The main impact of the A38 grade separation is a significant increase in the levels of traffic on the A38 due to the congestion relief resulting from the increases in capacity at these three improved junctions. This results in an overall reduction in traffic passing through Derby City Centre especially on routes to the south and east of the city.

7.2.3 The routes leading from the improved junctions tend to incur an increase in traffic. This results from traffic that currently avoids these routes, due to the levels of congestion on the A38, transferring to them as they are predicted to provide the best route to their final destination.

7.2.4 The AM peak show the least clear pattern of changes with a wider selection of routes incurring increases in traffic. This is the result of this peak being the busiest in terms of movements to and from the city centre. The majority of the additional increases are the result of vehicles that currently 'rat run' through residential areas returning to the primary routes, as traffic transfers to the A38 from these residential / minor routes.

Figure 36. Flow Change between 2020 and 2025 Reference Cases – AM Peak

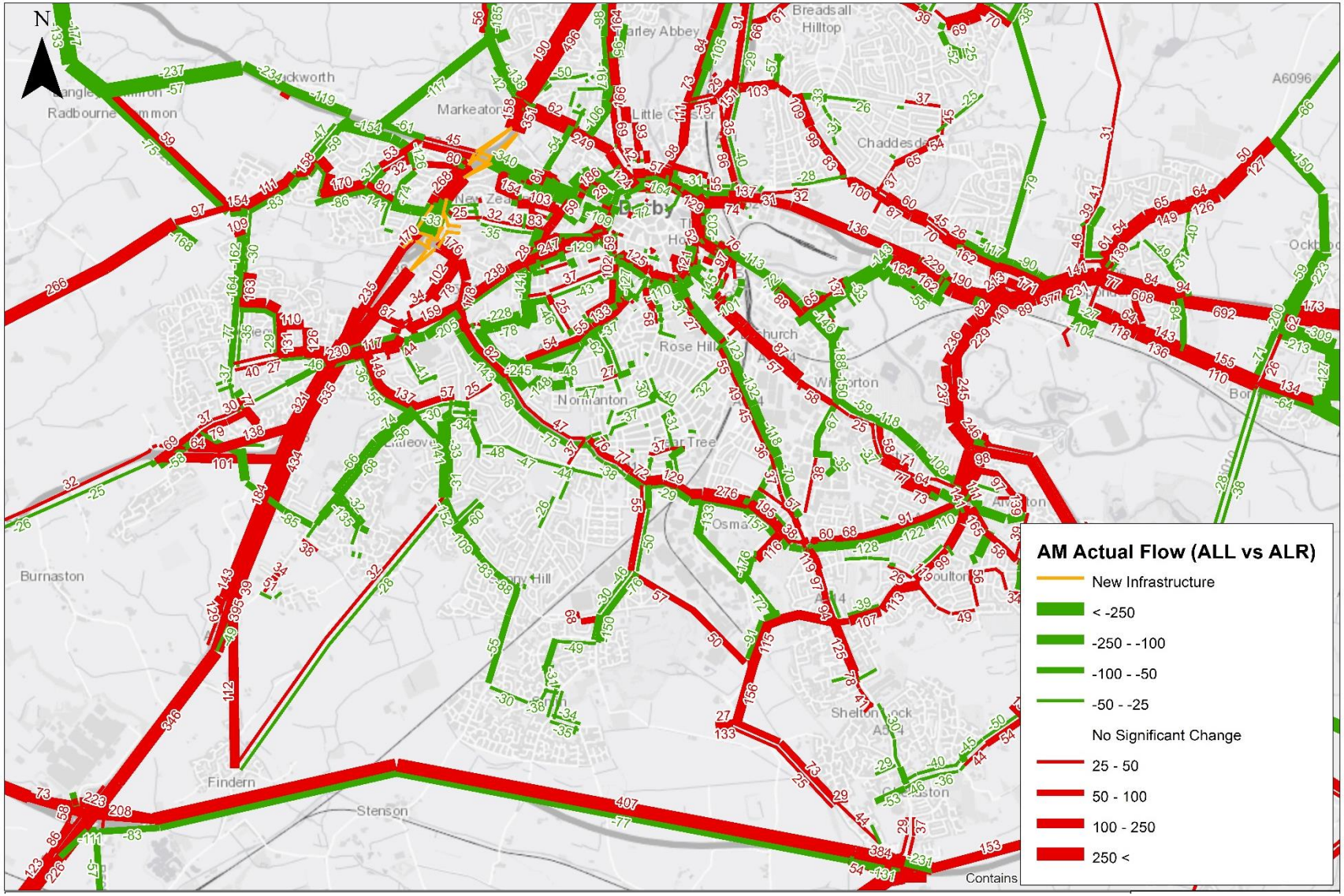


**Figure 37. Flow Change between 2020 and 2025 Reference Cases – Inter-Peak**

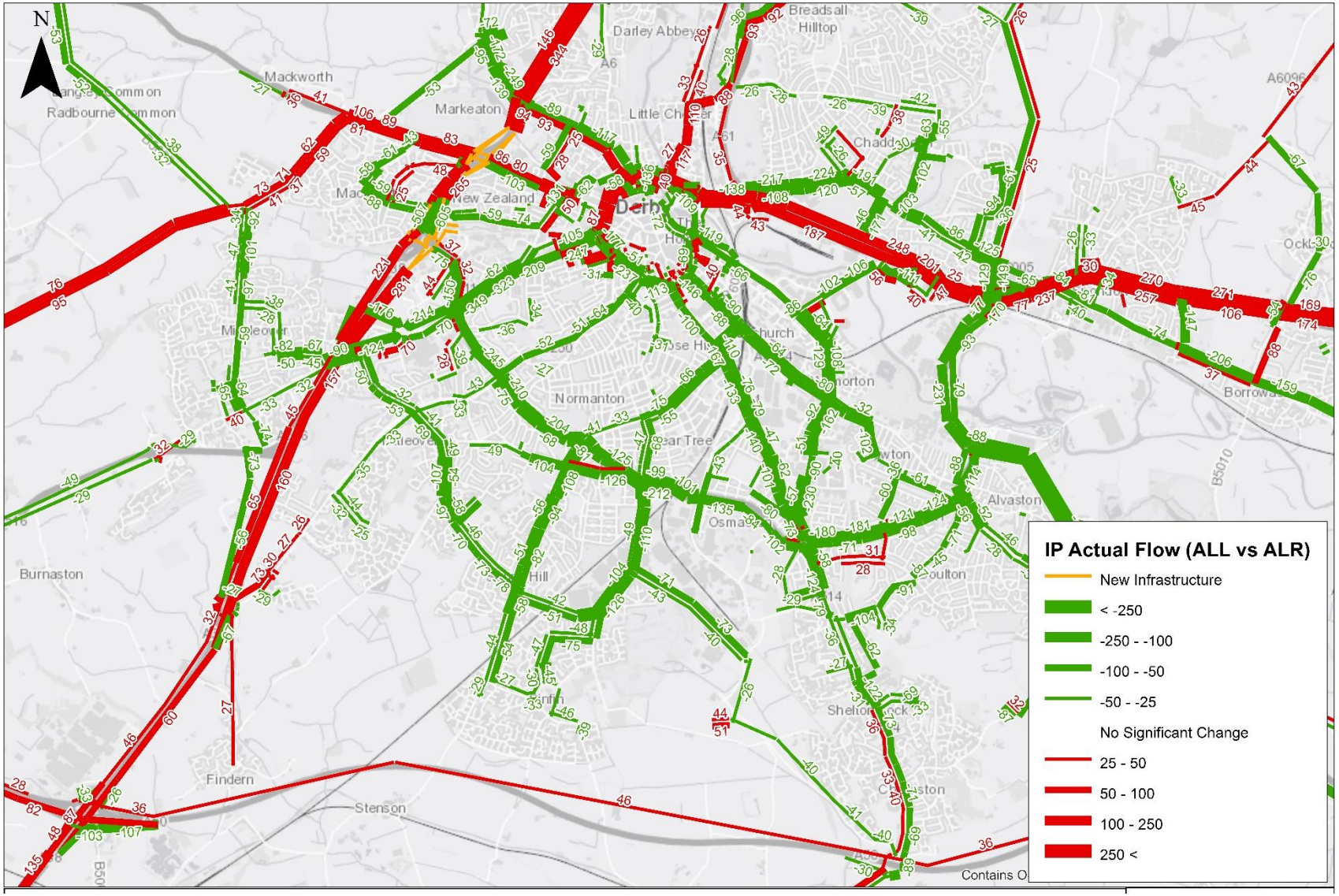
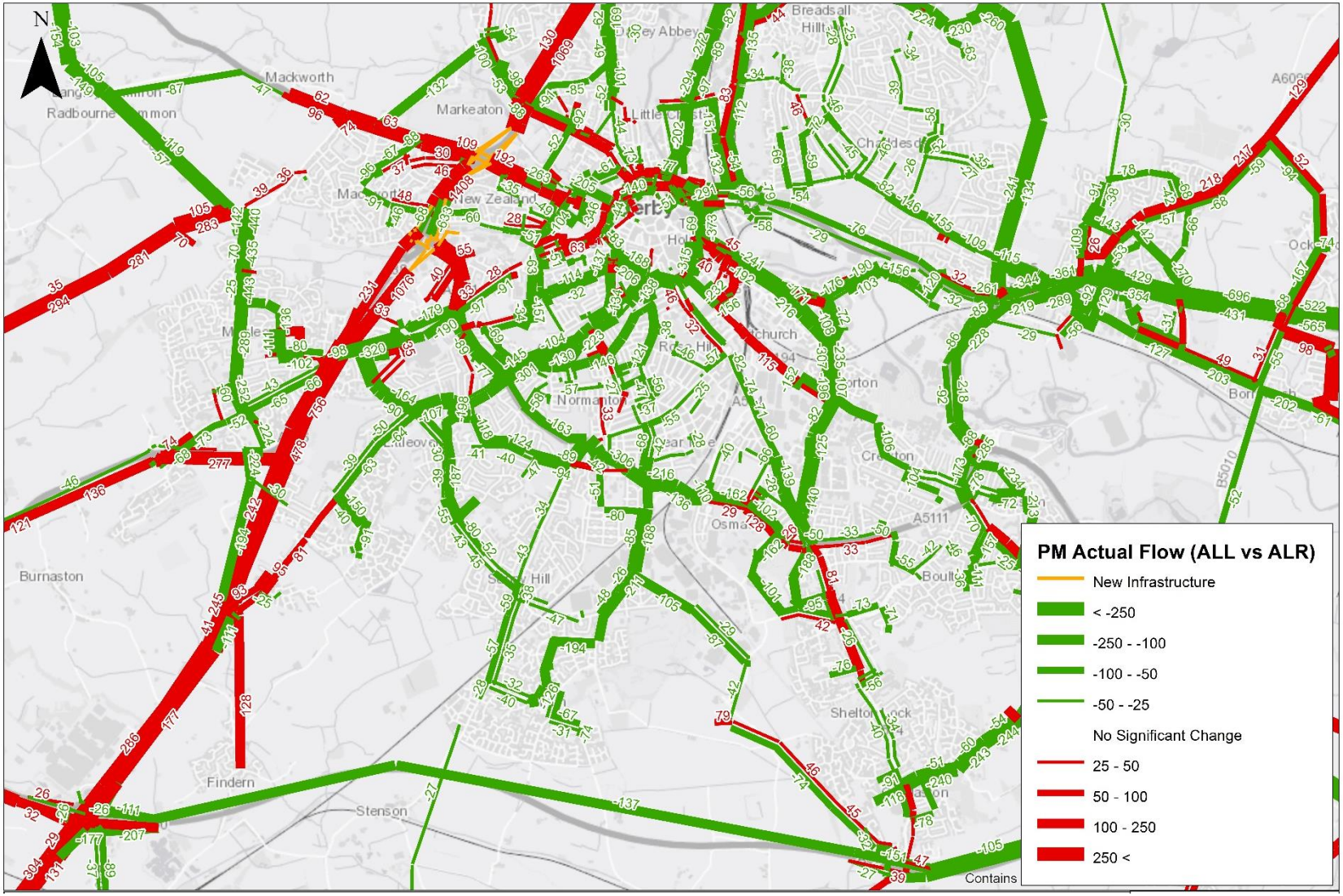


**Figure 38. Flow Change between 2020 and 2025 Reference Cases – PM Peak**



# 8. OVERALL CONCLUSIONS

## 8.1 The Preferred Scheme

8.1.1 Derby City's Preferred Scheme is aimed at addressing the air quality issues at locations where the required limit of NOX is predicted to be exceeded in 2020 using the local air quality models developed by Ricardo. The only location where the NOX levels exceeded the threshold identified by JAQU is on Stafford Street which forms part of the western section of Derby's Inner Ring Road.

8.1.2 The primary focus of the Preferred Scheme is to use both the Stafford Street/Friar Gate and the Mercian Way/Uttoxeter New Road signal controlled junctions at either end of Stafford Street to restrict the levels of traffic using Stafford Street. The scheme introduces traffic management measures to manage the flow of traffic in and around Stafford Street including the roads closest to the exceedance location, including:

- changes to the junctions at either end of Stafford Street to limit traffic flow in the most sensitive area
- changes to improve capacity at the Ashbourne Road/Uttoxeter Old Road junction to help provide alternative route choices
- traffic management measures to support alternative routes such as Uttoxeter Old Road.

8.1.3 Overall the Preferred Scheme is achieving its objective of significantly limiting traffic flow along Stafford Street which is the only predicted air quality exceedance location, as well as reducing overall traffic flows in the City Centre.

8.1.4 AADT flows have been generated from the hourly information output from the DATM models for input into the Ricardo Air Quality models. In general, the changes in AADT replicate the hourly changes outlined earlier as expected.

8.1.5 In most cases the PCM routes see a reduction in AADT flow as movements through the city centre decrease. The main exceptions to this are the A514 to the south and the Derby Outer Ring Road both of which are covered in more detail in the Air Quality reporting.

8.1.6 The most significant changes in AADT flow relate to:

- Stafford Street – reduction in AADT which is the objective of the scheme
- Uttoxeter Old Road – increase in AADT as the scheme enhances this route as an alternative to Stafford Street

8.1.7 T5: Derby Roadside NO2 Preferred Option Refinement provides further details of the significant additional analysis undertaken to ensure that the Preferred Option will not result in the creation of new exceedances. T5: Derby Roadside NO2 Preferred Option Refinement should be read in conjunction with this report.

## 8.2 Benchmark Charging CAZ D

8.2.1 The area of the Benchmark Ring Road CAZ D scheme is bounded by the Outer Ring Road, but not including the Outer Ring Road (i.e. A61 Sir Frank Whittle Road, A52 Brian Clough Way, A5111 Raynesway, Shardlow Road, Harvey Road, Osmaston Park Road, Newdigate Street, Kenilworth Avenue, Warwick Avenue, Manor Road, Kingsway, A38 Queensway, Abbey Hill).

8.2.2 Overall the Benchmark CAZ D option reduces the levels of non-compliant vehicles within the city centre area, however these vehicles are displaced to the outer ring road and also the A50 rather than passing through the city centre.

## 8.1 CAZ D 0% Upgrade Sensitivity Test

8.1.1 As per the benchmark test, the CAZ D 0% Upgrade Sensitivity test leads to a net reduction in the number of non-compliant vehicles utilising the CAZ area in comparison to the baseline 2020 forecast scenario. These vehicles are instead displaced to the Outer Ring Road and surrounding network.

Such redistribution within the IP and PM periods leads to a reduction in total trips utilising the CAZ zone. Within the AM peak, the overall number of trips doesn't alter a vast amount however the routes used change due to the reduction in non-compliant vehicles within the CAZ zone. In all peaks this trip redistribution results in the emergence of altered routeing, with the use of minor roads shifting, as congestion patterns change.

## 8.2 2025 With A38 Grade Separation

8.2.1 The A38 Grade Separation scheme will significantly upgrade the capacity at three existing roundabout junctions which at present experience heavy congestion especially in peak hours. The Grade Separation scheme, planned by Highways England for completion during 2024, is forecast to have a significant impact on the traffic routeing within the local area by drawing traffic from the local roads back onto the strategic road network.

8.2.2 The main impact of the A38 grade separation is a significant increase in the levels of traffic on the A38. This results in an overall reduction in traffic passing through Derby City Centre especially on routes to the south and east of the city. The resultant changes in flow are also expected to have an impact on air quality levels.

# Appendix A T5: Derby Roadside NO2 Preferred Option Refinement Traffic Management Scheme Options