# Derby Urban Area Potential Core Strategy Sites

## Traffic Impact Assessment Report (Mitigation Scenarios 1-5)

Report for Derby City Council

October 2012

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# Document Control

| | |
|---|---|
| Project Title: | Derby Urban Area Modelling |
| MVA Project Number: | 100035 |
| Document Type: | Report |
| Directory & File Name: | B:\Project Files\C3A79700 - Derby PUA Cluster Testing\04 Reporting\Reports\20121003 Cluster Testing Modelling Final Report v2.Doc |

# Document Approval

| | |
|---|---|
| Primary Author: | Asseed Khan |
| Other Author(s): | William Hiscock |
| Reviewer(s): | Duncan Irons |

# Distribution

| Issue | Date | Distribution | Comments |
|---|---|---|---|
| 1 | 13/07/2012 | DCC | Mitigation Test 1 Results |
| 2 | 06/08/2012 | DCC | Mitigation Tests 2 and 3 Results |
| 3 | 20/08/2012 | DCC | Mitigation Tests 4 and 5 Results |
| 4 | 25/09/2012 | DCC | Draft inc DCC comments |
| 5 | 28/09/2012 | DCC | Final Report |
| 6 | 03/10/2012 | DCC | Final Report v2 |

# Contents



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# 1 Introduction

## 1.1 Background to study

1.1.1 The councils of Derby City, South Derbyshire and Amber Valley are working together to develop a comprehensive evidence base for their Core Strategies. As part of this evidence base Derby City Council have commissioned MVA to undertake an initial transport appraisal of the potential sites in and around the Derby Urban Area (DUA).

1.1.2 The purpose of this report is to consider the possible transport impacts of a number of potential housing sites in and around the Derby Urban Area (DUA). This information will be used by the Derby HMA authorities to assist in the determination of which sites should be included within their respective Core Strategies and what measures will have to be delivered to mitigate their impacts. The report includes sites which have been submitted to the HMA authorities for further consideration. Their inclusion in this report does not imply any preference for their allocation. Rather, owing to their specific scale and/or location, it was considered that an assessment of their particular transport impacts and associated mitigation measures would be a valuable element of the overall evidence base.

1.1.3 The following general assumptions for the modelling of the potential Derby Urban Area Core Strategy sites have been agreed:

- The assessment to be undertaken using the Derby Area Transport Model for the 2026 future year rather than the 2028 end date of the Core Strategy. The 2026 model is an existing model and acts as a reasonable proxy for the 2028 situation avoiding the costly requirement for the development of a new 2028 reference year for this assessment.
- The Reference Case is to include all employment growth up to 2026 derived from TEMPRO, however, residential growth within the Derby Urban Area excludes the potential Core Strategy sites.
- The Reference Case is to include the London Road Bridge scheme but excludes the grade separation of the junctions on the A38.
- General traffic growth as a result of increased car usage and car ownership levels to be included in the Reference Case.
- 85$^{th}$ percentile trip rates are to be used, to provide a worst case scenario.
- Development access points will assume no capacity constraint to ensure that all traffic can enter and exit the wider network; this implies that the development access strategy will be required to accommodate predicted development traffic generations.

1.1.4 Following an appraisal of the No mitigation Impact of the potential DUA Core Strategy, the mitigation measures are have been assessed in the following incremental scenarios:

- **Scenario 1: Smarter Choices and Public Transport Mitigation** – an assessment of the impacts of travel planning and smarter choices together with improved pedestrian and cycle access to public transport facilities and improved public transport provision to serve the potential Core Strategy sites (bus, Park and Ride).

- **Scenario 2: Local Highway Mitigation –** an assessment of the impacts of potential highway local mitigation schemes which range from bridge widening to new road links and a new rail station adjacent to Stenson Road. Two new bus services have also been tested as part of this mitigation package.
- **Scenario 3: A50 Access Improvements** – provision of a new junction on the A50 with no local highway improvements in place.
- **Scenario 4: Local Highway Mitigation and A50 Access Improvements –** a combination of scenarios 2 and 3.
- **Scenario 5: A38 Grade Separation –** scenario 4 plus the grade separation scheme for the A38 junctions.

## 1.2 Structure of this report

1.2.1 The remainder of this report is structured as follows:

- Chapter 2: Reference Case;
- Chapter 3: Potential Core Strategy sites - No Mitigation;
- Chapter 4: Mitigation Overview;
- Chapter 5: Mitigation Scenario 1;
- Chapter 6: Mitigation Scenario 2;
- Chapter 7: Mitigation Scenario 3;
- Chapter 8: Mitigation Scenario 4;
- Chapter 9: Mitigation Scenario 5; and
- Chapter 10: Conclusions and Recommendations.

# 2 Reference Case

## 2.1 Reference Case Land Use Assumptions

2.1.1 The 2026 Reference Case has been based on the TEMPRO growth forecasts for non-residential land use and the background growth resulting from the changes in economic circumstances of existing residents. The residential land use assumes all committed developments but no growth associated with the potential Core Strategy sites.

2.1.2 Non-residential land use growth within the Core Strategy area also includes committed schemes however, the overall growth levels reflect the employment growth derived from TEMPRO up to 2026.

2.1.3 Outside the immediate vicinity of the Derby Urban Area both residential and non-residential growth is in line with TEMPRO forecasts.

2.1.4 The background non-land use growth resulting from changes in economic circumstances of existing residents in the area which is predicted to increase car ownership levels and travel distances has been incorporated into the growth forecasts based on TEMPRO growth factors.

2.1.5 Table 2.1 presents peak hour highway trip matrices totals for the 2026 Reference Case and compares this against the 2006 Base Year totals.

**Table 2.1 Reference Case: Highway trip matrices totals**

| Time Period | 2006 Base | 2026 Reference Case | % Change |
|---|---|---|---|
| Morning Peak hour | 194,285 | 235,009 | 21% |
| Evening Peak hour | 193,179 | 242,059 | 25% |

2.1.6 This indicates that the overall peak hour highway trip growth between 2006 and the 2026 Reference Case is around 23%.

## 2.2 Committed Transport Schemes

2.2.1 The proposed Chellaston Link Road and the London Road Bridge scheme including the closure of Litchurch Lane have been included within the Reference Case as these are committed schemes. The grade separation of the A38 junctions has not been included in the reference case. In addition, a number of smaller transport schemes associated with committed development schemes have also been included in Reference Case transport modelling work.

## 2.3 Global Highway Indicators

2.3.1 The following section presents highway indicators for the whole of DATM to provide a way of gauging the overall impact of the predicted growth in movements should the potential Core Strategy sites not be implemented. A brief explanation of each indicator is provided below.

- **Average speed** - expressed as kilometres per hour for all traffic within the highway model simulation area for each peak period. Increased traffic levels should lead to more delays resulting in lower average speeds.
- **Over capacity queues** - Time spent queuing at junctions that are over capacity. As traffic levels increase we expect to see a growing number of junctions reaching capacity and the time spent queuing at these over capacity junctions increasing.

**Table 2.2 2026 Reference Case: Global Highway Indicators**

| Time Period | Average Speed (kph) | Over Capacity Queues (pcu hours) |
|---|---|---|
| Morning Peak hour | 38 | 772 |
| Evening Peak hour | 38 | 837 |

## 2.4 Carbon Emissions Indicator

2.4.1 The impact of each of the options on greenhouse gas emissions has been measured using the MVA Environmental Appraisal software, *ENEVAL*. This software provides an indication of the main carbon dioxide equivalent emission impacts caused by road traffic on a network wide basis. The ENEVAL results for different schemes have been compared to highlight how carbon dioxide equivalent emissions change by scenario.

2.4.2 The program uses link speeds, junction delay times and flow data from SATURN highway networks. As well as accounting for changes in traffic levels and speeds in forecast year networks, ENEVAL also takes into account changes in environmental effects over time.

2.4.3 For this study, ENEVAL emission rates were calibrated using Road Transport figures reported by the AeA in their '*Local and Regional $CO_2$ Emissions Estimates for 2005-2008*'. ENEVAL has been calibrated against base data for the simulation area. This calibration process ensured that ENEVAL produced results which provide a robust forecast of carbon dioxide emissions for each scenario. Table 2.3 provides a summary carbon dioxide equivalent values for the Reference Case.

**Table 2.3 Carbon Emissions Reference Case**

| Scenario | Annual $CO_2$ (tonnes) |
|---|---|
| 2026 Reference Case | 427,504 |

## 2.5 Global Public Transport Indicators

2.5.1 Table 2.4 presents modal share for the 2026 Reference Case.

**Table 2.4 Reference Case Modal Share 24 hr**

| Scenario | Car Mode Share | Public Transport Mode Share |
|---|---|---|
| 2026 Reference Case | 90.9% | 9.1% |

## 2.6 Volume / Capacity (V/C) plots

2.6.1 The following section of the report presents a series of highway plots which highlight the levels of congestion (volume/capacity ratios) at junctions in the Reference Case.

2.6.2 A V/C percentage of 85% is conventionally considered to be the threshold beyond that the junction approaches it's effective traffic capacity. As V/C ratios increase above this level, there is an increasing likelihood of that drivers will observe perceptible increases in delays and queues at junctions which may affect their travel behaviour or routing patterns. . It will be these links/junctions which will be of most concern to the highway authorities. A V/C ratio in excess of 100% indicates that the junction is operating beyond its theoretical traffic capacity.

2.6.3 Figures 2.1 and 2.2 provide morning and evening peak V/C plots for the Reference Case that forms the baseline assessment for this study.

**Figure 2.1 2026 Reference Case V/C - Morning Peak**

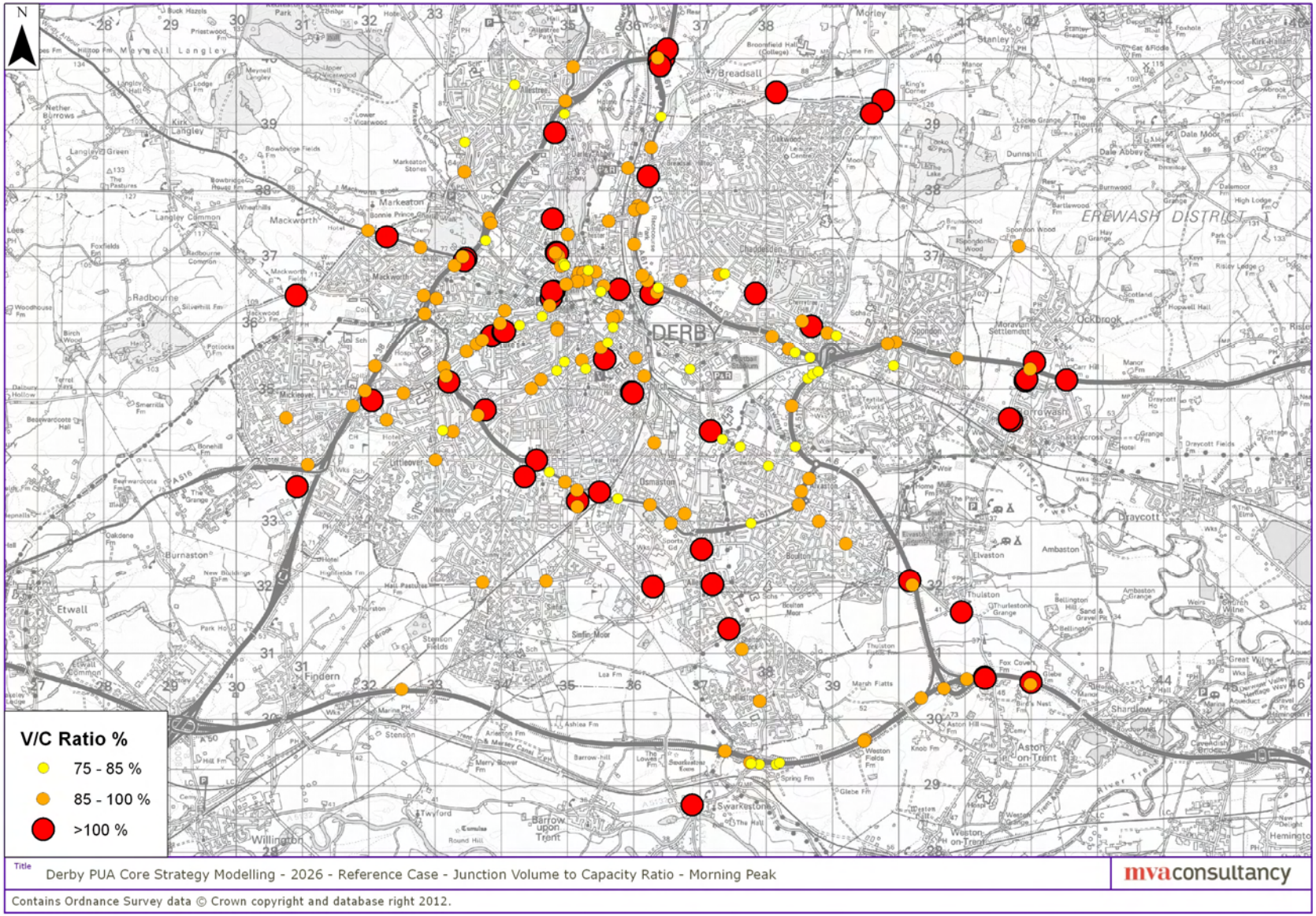
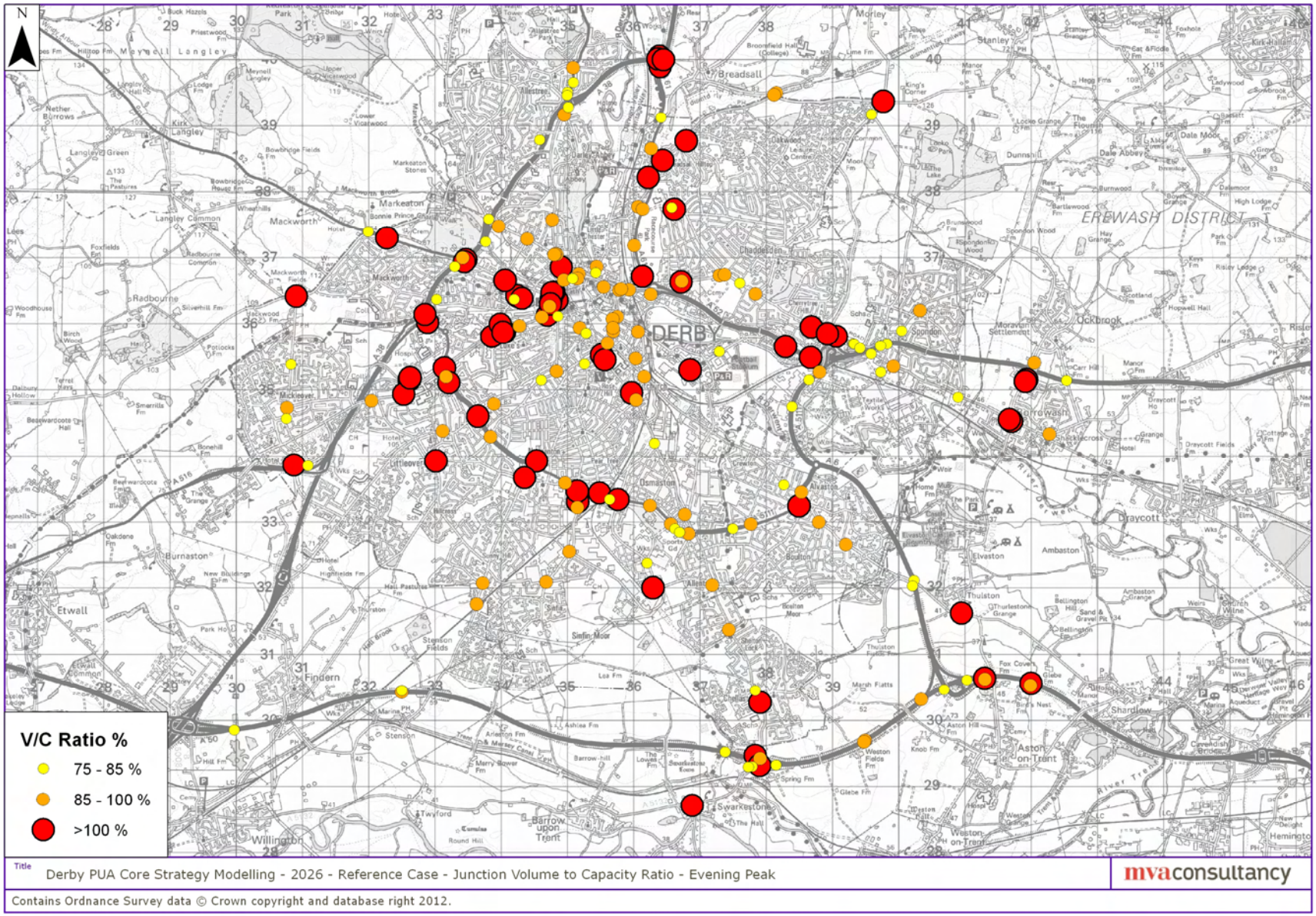


**Figure 2.2 2026 Reference Case V/C - Evening Peak**



2.6.4 This shows there are large numbers of junctions throughout the network that are at or above operational capacity in peak hours by 2026 even without the additional traffic generated by the potential Core Strategy sites. The main areas of severe congestion are:

- along and within the Warwick Avenue and Manor Road sections of the Ring Road;
- The western routes into the city centre from the A38 (A516 and A52);
- The A608 to the north of the city;
- The A52 to the east;
- The A514 to the south;
- The A38 non-grade separated junctions; and
- The A50 Trunk Road junctions with the A6 and A514.

# 3 Potential DUA Core Strategy Sites - No Mitigation

## 3.1 Potential DUA Core Strategy Land Use Assumptions

3.1.1 The potential Core Strategy land use scenario is built on the Reference Case and includes the initial residential sites that are proposed in and adjacent to the Derby Urban Area. The potential sites that are assessed in this study are shown in Table 3.1 and graphically in Figure 3.1.

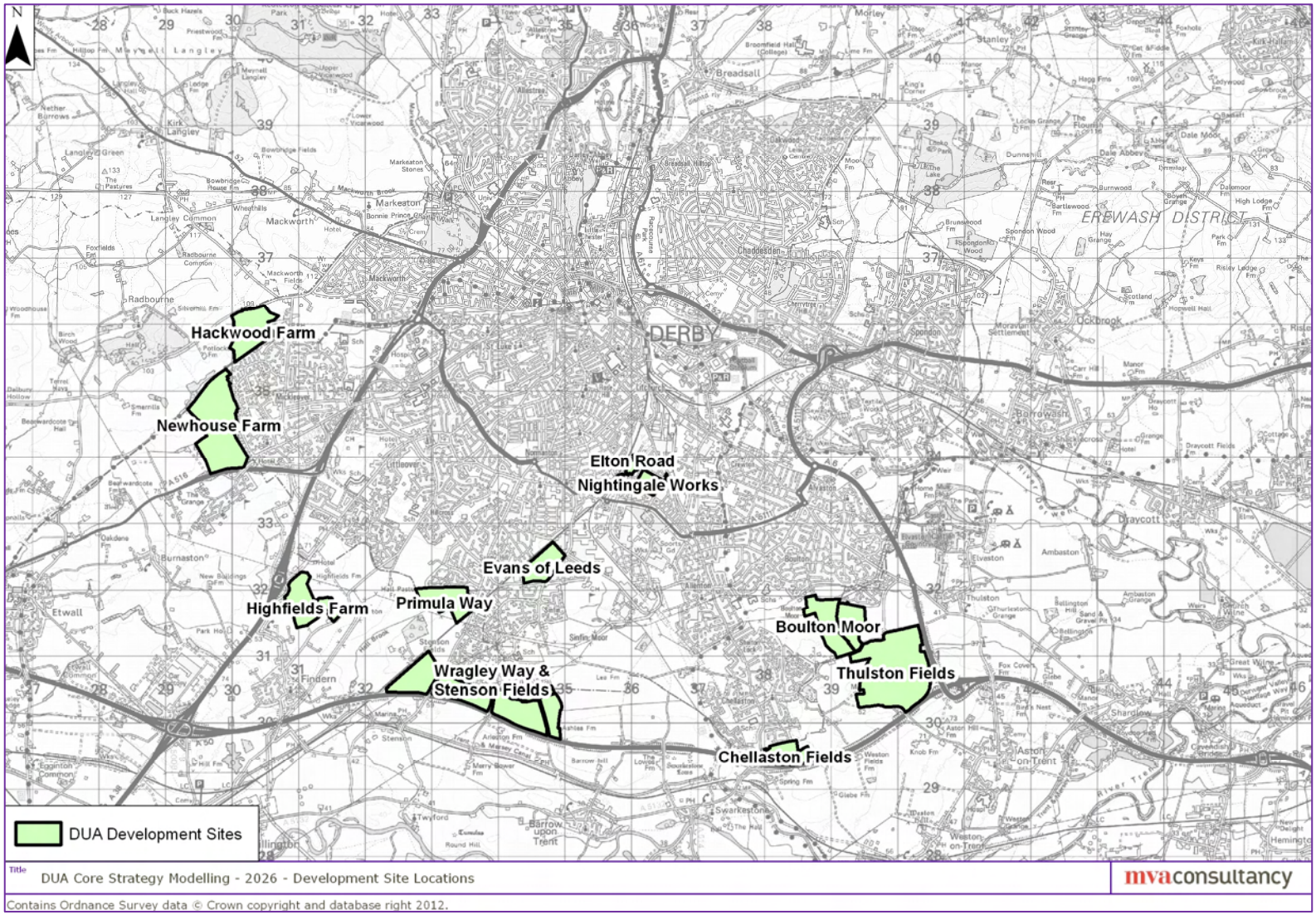
**Table 3.1 Potential Core Strategy Site Allocations**

| Development | Residential Units |
|---|---|
| Boulton Moor | 1,500 |
| Thulston Fields | 2,100 |
| Chellaston Fields | 500 |
| Wragley Way | 1,856 |
| West of Stenson Road | 542 |
| Primula Way | 511 |
| Newhouse Farm | 1,495 |
| Nightingale works | 400 |
| Elton Road | 100 |
| Hackwood Farm | 800 |
| Evans of Leeds | 600 |
| Highfieds Farm | 656 |
| **Totals** | **11,060** |

3.1.2 A total of over 11,000 residences are proposed in and around the Derby Urban Area the majority of which are located on at present undeveloped sites between the edge of the urban area and the A50 and to the west of the A38.

3.1.3 Only a small number of the dwellings are on previously developed sites within the urban area (Evans of Leeds, Elton Road, Nightingale works) reflecting the lack of available land within the existing urban area.

**Figure 3.1 Derby Urban Area Potential Core Strategy: Housing Sites**



## 3.2 Committed Transport Schemes

3.2.1 The potential Core Strategy No Mitigation scenario has no further improvements to either the highway or public transport networks over those included in the Reference Case. Development accesses have been modelled with significant capacity to ensure that all the development traffic can enter the network and therefore it is assumed that an access strategy will be designed to cope with the traffic generations associated with the development.

## 3.3 Potential Core Strategy Sites – Highway Trip Generations

3.3.1 The highway trip generations for potential DUA Core Strategy sites have been based on 85th percentile vehicle generations derived from the TRICS database. This approach provides a potential worst case scenario for the impact of the development sites on the highway network. These are shown in Table 3.2 Residential Development . The vehicle generations for each of the potential DUA Core Strategy sites are provided in Table 3.3.

**Table 3.2 Residential Development Vehicle Trip Rates**

| Type | Units | Morning Peak hour | | Evening Peak hour | |
|---|---|---|---|---|---|
| | | Arrivals | Departures | Arrivals | Departures |
| Residential | Per dwelling | 0.177 | 0.523 | 0.463 | 0.296 |

**Table 3.3 Potential Core Strategy Sites Vehicle Trip Generations**

| Development | Units | Morning Peak hour | | Evening Peak hour | |
|---|---|---|---|---|---|
| | | Arrivals | Departures | Arrivals | Departures |
| Boulton Moor | 1,500 | 266 | 785 | 695 | 444 |
| Thulston Fields | 2,100 | 372 | 1,098 | 972 | 622 |
| Chellaston Fields | 500 | 89 | 262 | 232 | 148 |
| Wragley Way | 1,856 | 329 | 971 | 859 | 549 |
| West of Stenson Road | 542 | 96 | 283 | 251 | 160 |
| Primula Way | 511 | 90 | 267 | 237 | 151 |
| Newhouse Farm | 1,495 | 265 | 782 | 692 | 443 |
| Nightingale works | 400 | 71 | 209 | 185 | 118 |
| Elton Road | 100 | 18 | 52 | 46 | 30 |
| Hackwood Farm | 800 | 142 | 418 | 370 | 237 |
| Evans of Leeds | 600 | 106 | 314 | 278 | 178 |
| Highfields Farm | 656 | 116 | 343 | 304 | 194 |

| Totals | 11,060 | 1,960 | 5,784 | 5,121 | 3,274 |
|---|---|---|---|---|---|

3.3.2 The development sites are predicted to result in around 8,000 additional highway trips on the local network compared to the reference case. This is a rise of around 3% in vehicle movements compared to the 2026 reference case.

3.3.3 DATM derives the mode split between highway and PT based on the comparative overall (generalised) costs of travelling between origin and destination by a range of modes. This includes Park and Ride as well as movements using bus and rail.

3.3.4 It is assumed that the larger sites will comprise local facilities such as schools, local centres and recreational facilities and that these will be developed to serve the local community and therefore any trips to these land uses will remain internal to the site and will not affect the wider transport networks.

## 3.4 Global Highway Indicators

3.4.1 The following section presents highway indicators for the whole of the Derby Urban Area to provide a way of gauging the overall impact of the predicted growth in movements should the potential DUA Core Strategy residential sites be implemented. A brief explanation of each indicator is provided below.

- **Average speed** - expressed as kilometres per hours for all traffic within the highway model simulation area. Increased traffic levels should lead to more delays resulting in lower average speeds.
- **Over capacity queues (pcu-hrs)** - Time spent queuing at junctions that are over capacity. As traffic levels increase we expect to see a growing number of junctions reaching capacity and the time spent queuing at these over capacity junctions increasing.
- **Total Travel Time (pcu-hrs) –** Overall travel time for all trips during the peak hours.
- **Total Travel Distance (pcu-kms) –** Overall travel distance for all trips during the peak hours.
- **Severity Index**- this indicator has been developed by MVA and takes account of the length of the roads affected by congestion, number of vehicles affected by congestion and also the level of congestion. This indicator is a number (without a unit) and gives a realistic indication of levels and severity of congestion in any particular scenario. This index only shows severity along the roads which are at, above or approaching capacity.
- **Environmental Indicators** – carbon emissions predicted from the highway model outputs.

**Table 3.4 Global Highway Indicators – No mitigation**

| Time Period | Morning Peak | | | Evening Peak | | |
|---|---|---|---|---|---|---|
| | Reference Case | Core Strategy (no mit.) | % Change | Reference Case | Core Strategy (no mit.) | % Change |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Average Speed** | 38 | 36 | -5.3% | 38 | 35 | -7.9% |
| **Over Capacity Queues** | 772 | 1,290 | 67% | 837 | 1,448 | 73% |
| **Total Travel Time** | 14,849 | 16,544 | 11% | 15,566 | 17,524 | 13% |
| **Total Travel Distance** | 566,599 | 594,231 | 5% | 583,652 | 617,280 | 6% |
| **Severity Index** | 322 | 352 | 9% | 211 | 258 | 22% |

3.4.2 Average speeds across the network fall as congestion and queues increase. During the peak hours, average speeds drop by 2 to 3 kph between the Reference Case and the potential Core Strategy scenario.

3.4.3 The levels of congestion on the highway network, increases significantly during the peak hours by around 70% with the additional traffic generation associated with the potential Core Strategy. This is significantly greater than the level of traffic increase as the developments are loading onto an already congested network.

3.4.4 In all of the global indicators the evening peak provides the worst case scenario. This is especially evident with the Severity Index which increases by 22% during this period. This is likely to be due to the increased levels of localised congestion in the Reference case in the evening peak compared to the morning peak which results in a greater overall impact when the additional flows associated with the potential Core Strategy sites.

## 3.5 Carbon Emissions Indicator

3.5.1 The impact of each of the options on greenhouse gas emissions has been measured using the MVA Environmental Appraisal software, *ENEVAL*. This software provides an indication of the main carbon dioxide equivalent emission impacts caused by road traffic on a network wide basis. The ENEVAL results for different schemes have been compared to highlight how carbon dioxide equivalent emissions change by scenario.

3.5.2 Table 3.5 provides a summary of the change in carbon dioxide equivalent values as a result of the potential Core Strategy.

**Table 3.5 Carbon Emissions – No mitigation**

| | Reference Case | No Mitigation | Change from Reference | % Change from Reference |
|---|---|---|---|---|
| **Annual $CO_2$ (tonnes)** | 427,504 | 437,582 | 10,078 | 2.4% |

3.5.3 The potential DUA core strategy developments increase the levels of Carbon associated with transport by a limited amount.

## 3.6 Global Public Transport Indicators

3.6.1 Table 3.6 presents 24 hour modal share for the 2026 Reference Case and potential DUA Core Strategy scenario.

**Table 3.6 Modal shares Car and Public Transport – no mitigation**

| Scenario | Car Share | Public Transport Share |
|---|---|---|
| **2026 Reference Case** | 90.9% | 9.1% |
| **2026 Core Strategy** | 90.9% | 9.1% |

3.6.2 Overall public transport modal share is not predicted to change significantly as a result of the implementation of the potential DUA Core Strategy.

## 3.7 Highway Impacts

3.7.1 The following section of the report presents a series of highway plots that highlight the main impacts of the potential DUA Core Strategy compared to the Reference Case on a geographical basis. The plots that are provided include;

- **Flow Change** – Predicted changes in traffic flow levels on the highway network.
- **Volume/ Capacity plots** – these show the levels of congestion at junctions with the potential DUA Core Strategy sites and the change in congestion relative to the Reference Case.

### Flow Change

3.7.2 The levels of flow change on the network between the Reference Case and potential DUA Core Strategy no mitigation scenarios are shown in Figures 3.2 and 3.3. Predicted increases in traffic flow are shown in red.

3.7.3 As expected due to the location of the developments the majority of the flow increases are on routes to the south of Derby City. These routes include non-major radial routes as traffic tends to find 'rat runs' when the main road routes become congested.

3.7.4 There are only minor increases along the routes that were identified as being congested in the Reference Case especially the Ring Road. This indicates that these routes have reached saturation and only limited additional movements can be accommodated. Development traffic using these routes is likely to result in the redistribution of existing traffic to other more minor routes.

3.7.5 The A50 shows an increase in traffic during both peaks, this could be a combination of development traffic and also existing traffic rerouting to find the least congested route into the City Centre some of which may come from the Ring Road.

**Figure 3.2 Traffic Flow increase between the Reference Case and potential Core Strategy sites no mitigation scenarios – AM Peak**

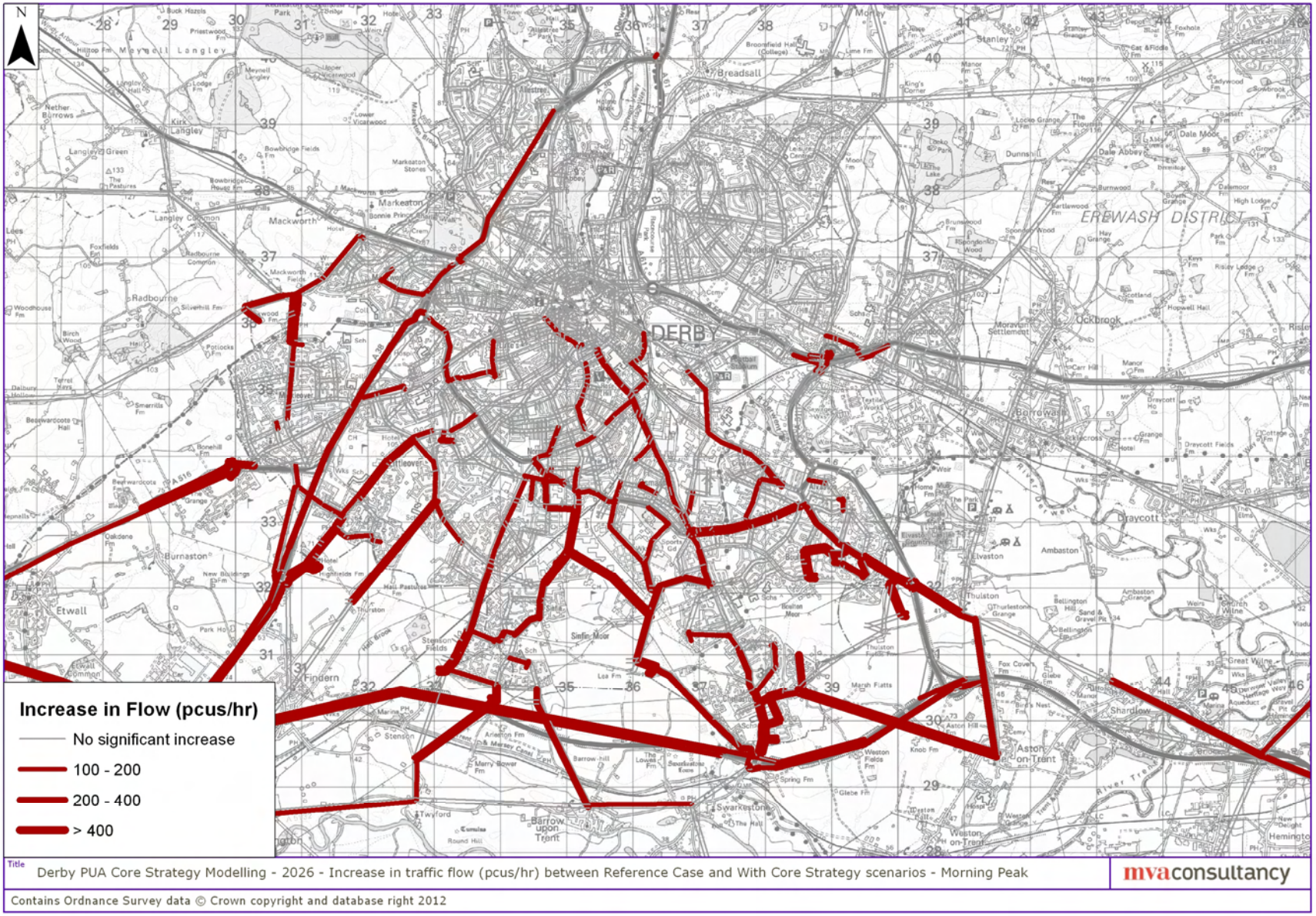
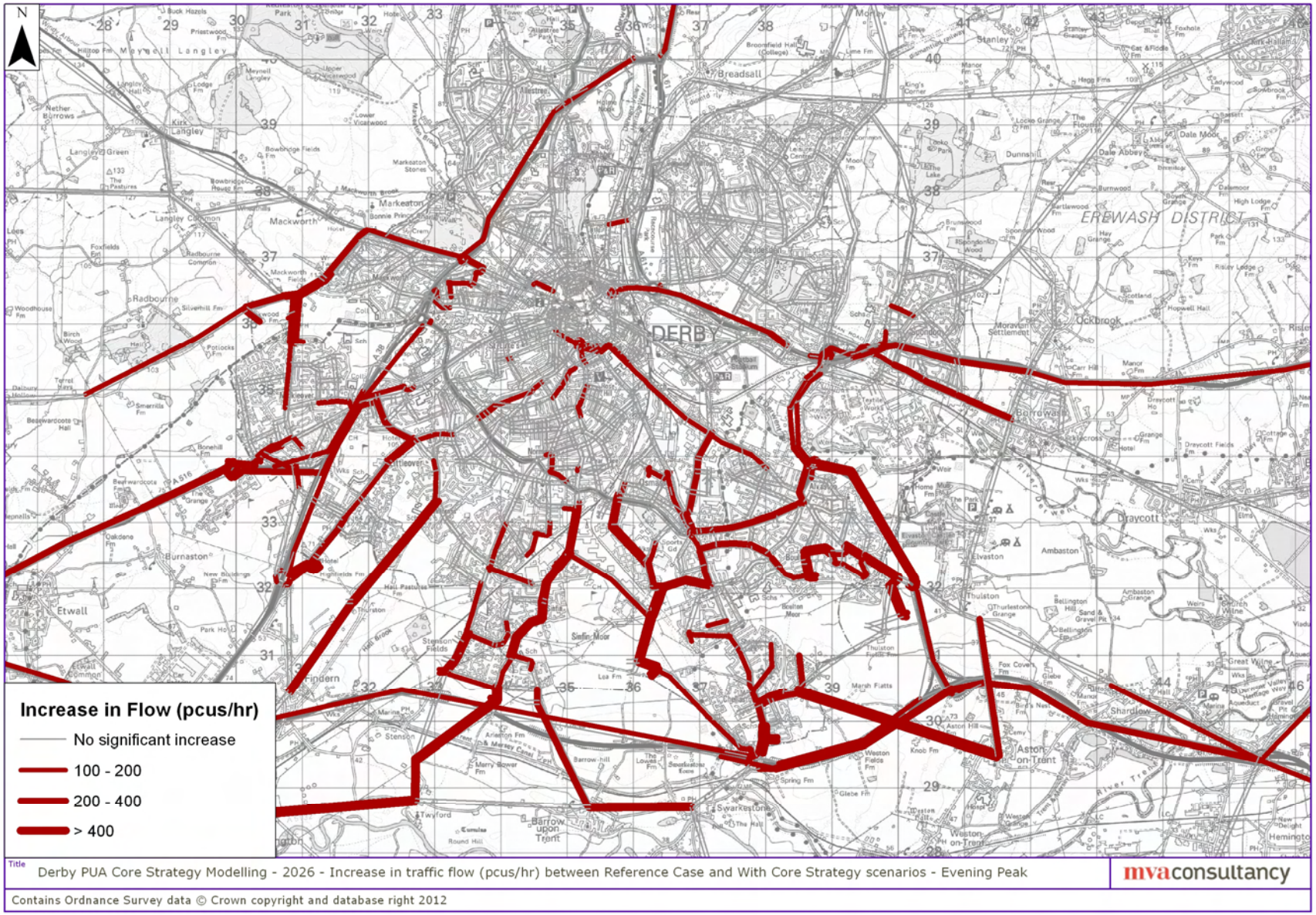


**Figure 3.3 Traffic Flow increase between the Reference Case and potential Core Strategy no mitigation scenarios – PM Peak**



### 3.8 Volume / Capacity (V/C) plots

3.8.1 A V/C percentage of 85% is conventionally considered to be the threshold beyond that the junction approaches it's effective traffic capacity. As V/C ratios increase above this level, there is an increasing likelihood of that drivers will observe perceptible increases in delays and queues at junctions which may affect their travel behaviour or routing patterns. . It will be these links/junctions which will be of most concern to the highway authorities. A V/C ratio in excess of 100% indicates that the junction is operating beyond its theoretical traffic capacity.

3.8.2 Figures 3.4 and 3.5 are V/C plots for the potential DUA Core Strategy no mitigation scenario in the morning and evening peaks. Figures 3.6 to 3.9 show the change in congestion compared to the Reference Case. The junctions that are pushed over 85% V/C by the movements associated with the potential Core Strategy sites and those that are already over 85% V/C are presented separately.

3.8.3 With the potential Core Strategy sites in place the majority of main radial routes within Derby become congested, however, the main increases in congestion are away from the main radial routes as the development traffic increases cause movements to divert away from the congested areas onto other less major routes.

3.8.4 Smaller increases in congestion do occur on routes that were already close to their ultimate capacity. However once the congestion levels reach a limiting point that severely affect journey times traffic tends to relocate therefore limiting the levels of congestion that occurs on these routes.

**Figure 3.4 Potential DUA Core Strategy no mitigation junction volume to capacity ratios - AM Peak**

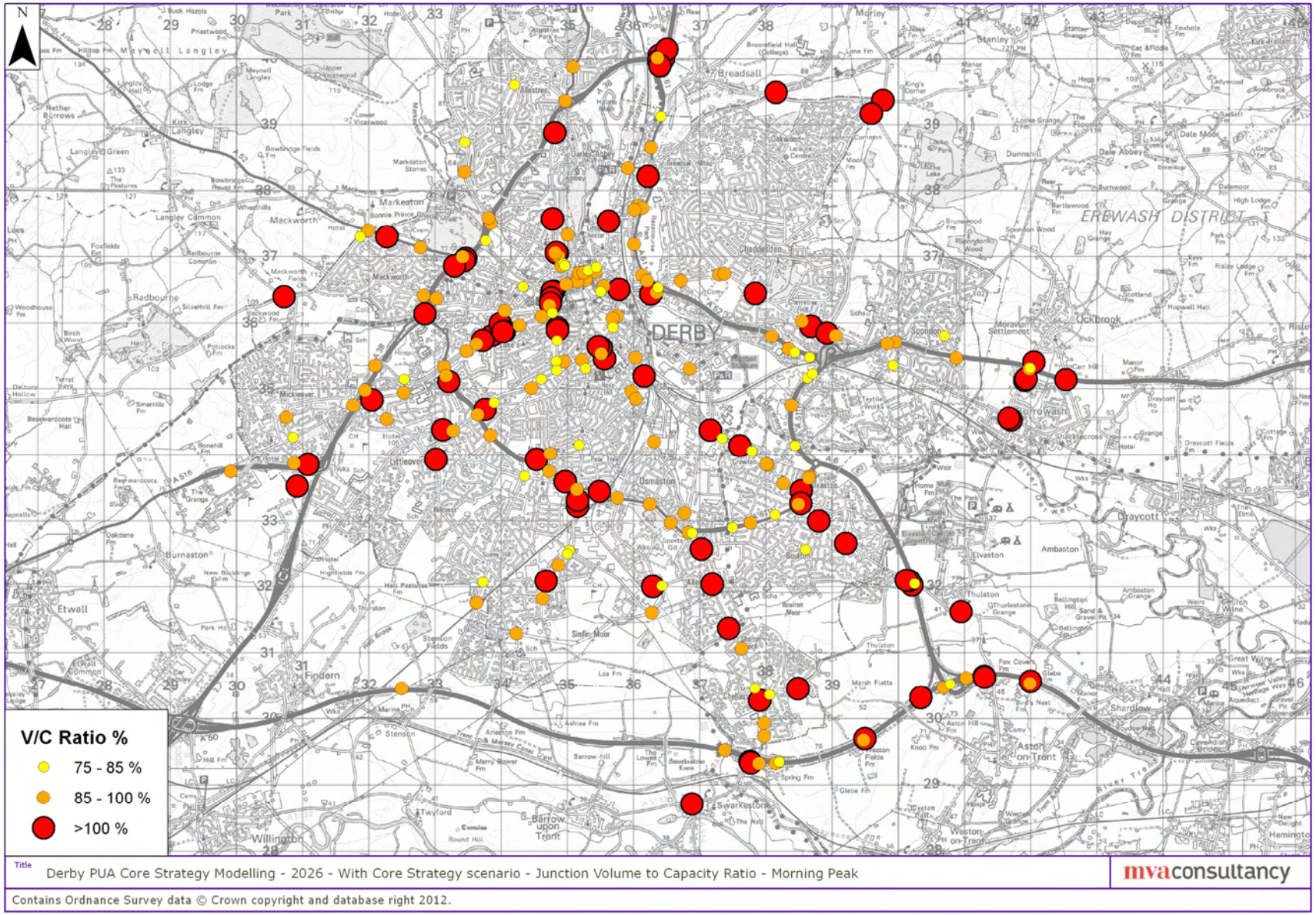


**Figure 3.5 Potential DUA Core Strategy junction no mitigation volume to capacity ratios – PM Peak**

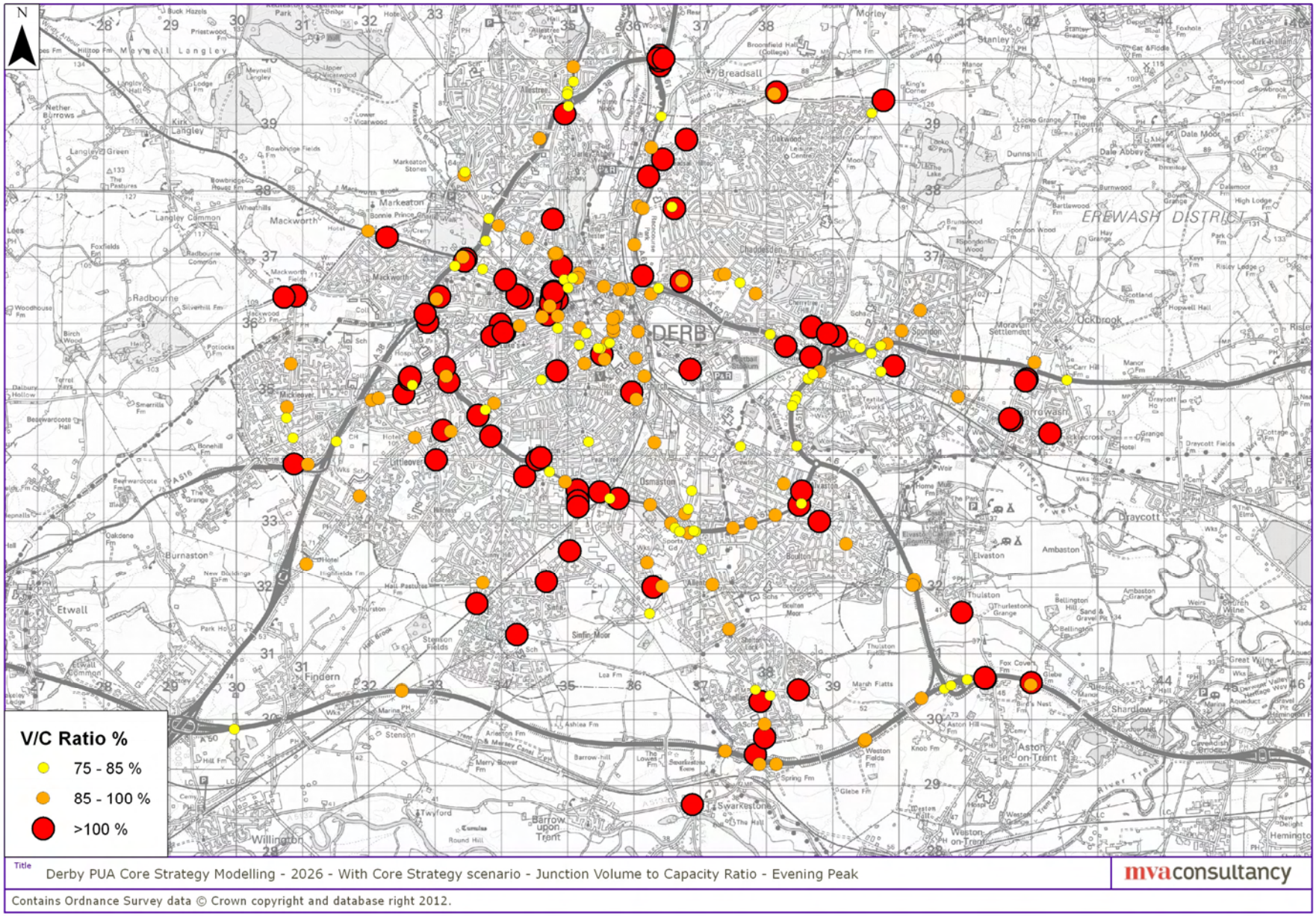
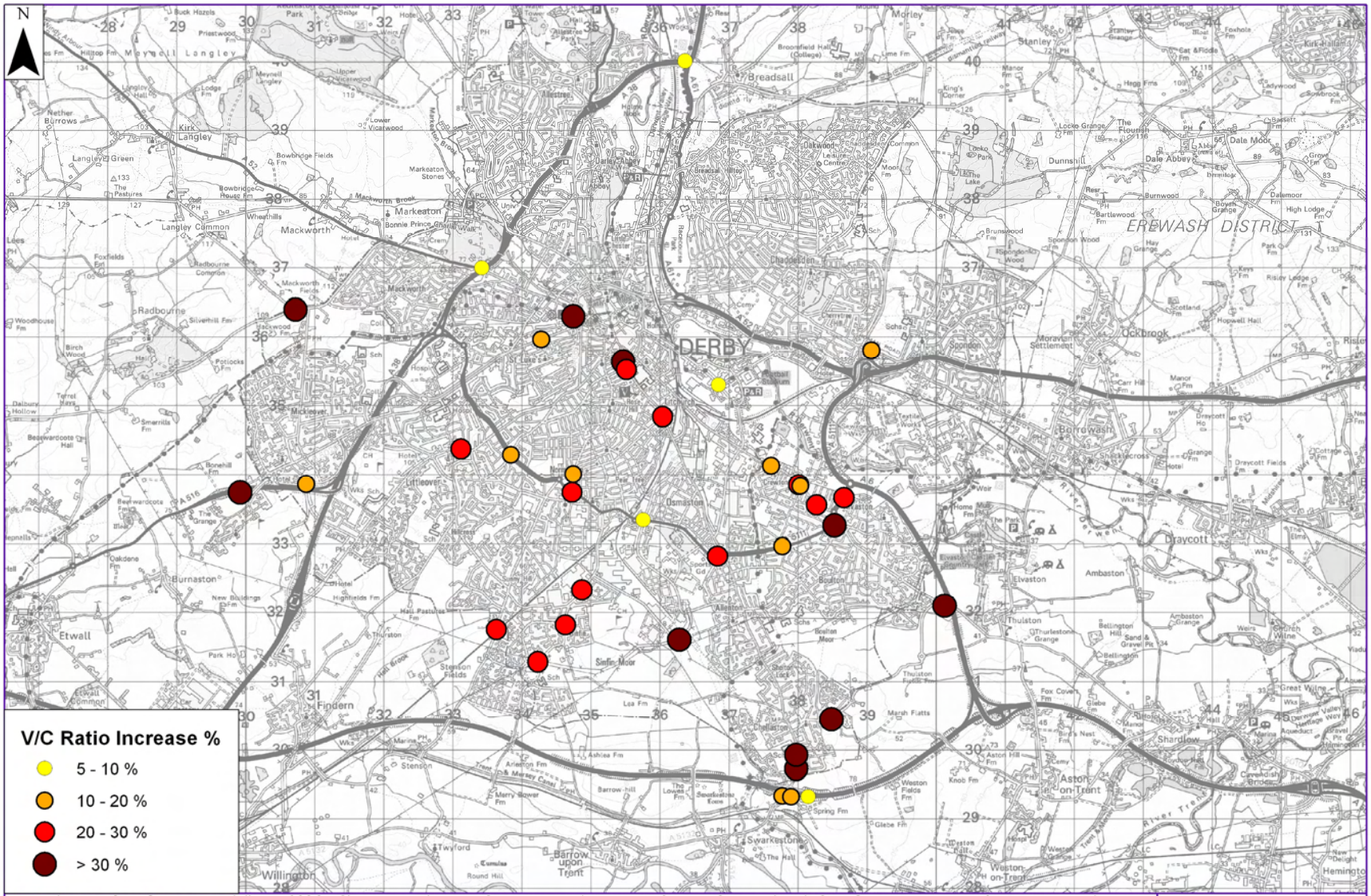


**Figure 3.6 Increase in Congestion between Reference Case and potential Core Strategy no mitigation scenarios for junctions with a V/C less than 85% in the Reference Case and greater than 85% in the potential Core Strategy no mitigation scenario – AM Peak**




Title Derby PUA Core Strategy Modelling - 2026 - Change in Volume to Capacity ratio between Reference Case and With Core Strategy scenarios for junctions with V/C less than 85% in Reference Case and greater than 85% in With Core Strategy scenario - Morning Peak

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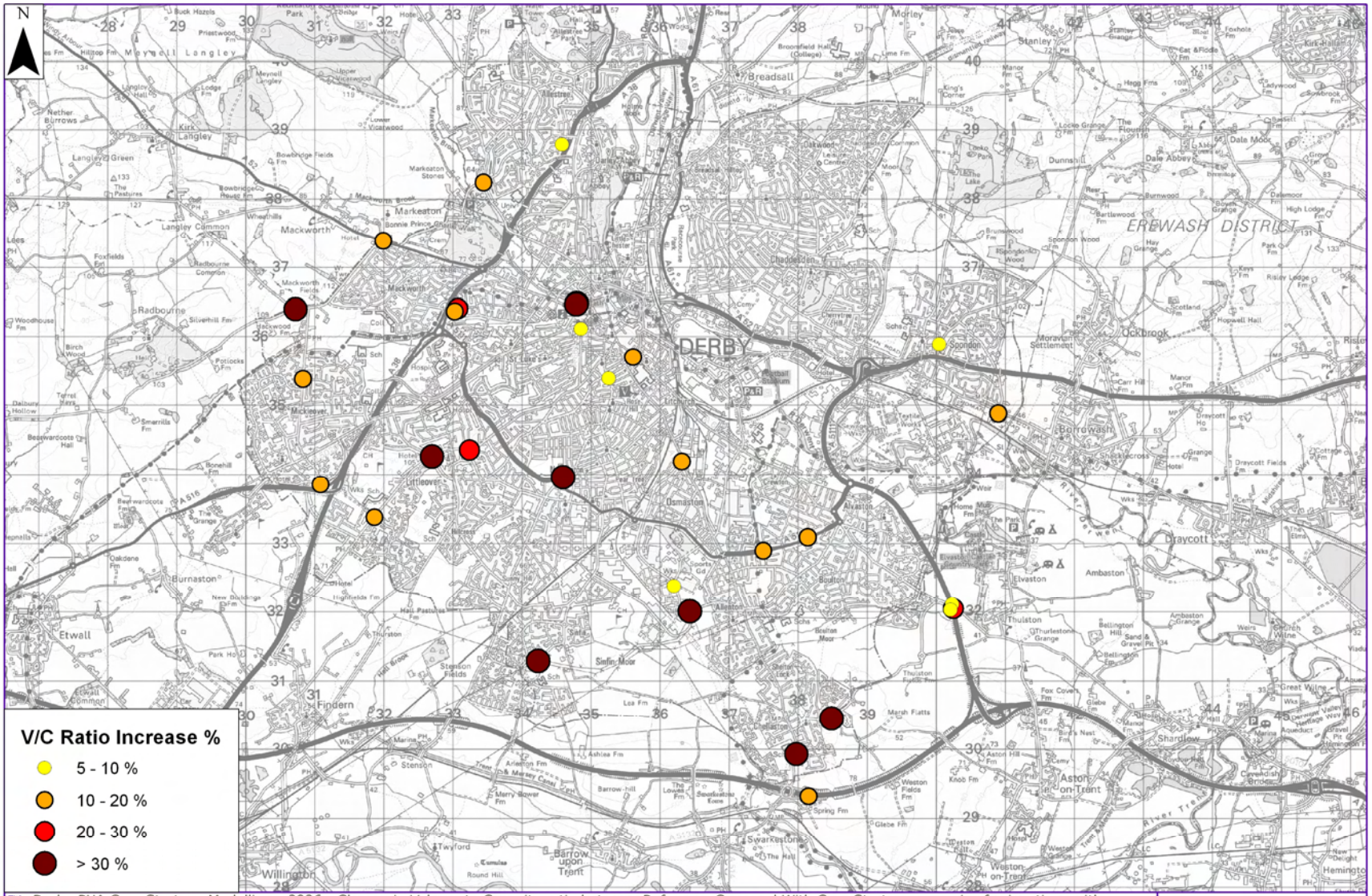
**Figure 3.7 Increase in Congestion between Reference Case and with potential Core Strategy no mitigation scenarios for junctions with a V/C less than 85% in the Reference Case and greater than 85% in the potential Core Strategy scenario no mitigation –PM Peak**




Title Derby PUA Core Strategy Modelling - 2026 - Change in Volume to Capacity ratio between Reference Case and With Core Strategy scenarios for junctions with V/C less than 85% in Reference Case and greater than 85% in With Core Strategy scenario - Evening Peak

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**Figure 3.8 Increase in Congestion between Reference Case and the potential Core Strategy no mitigation scenarios for junctions with a V/C ratio greater than 85% in the Reference Case – AM Peak**

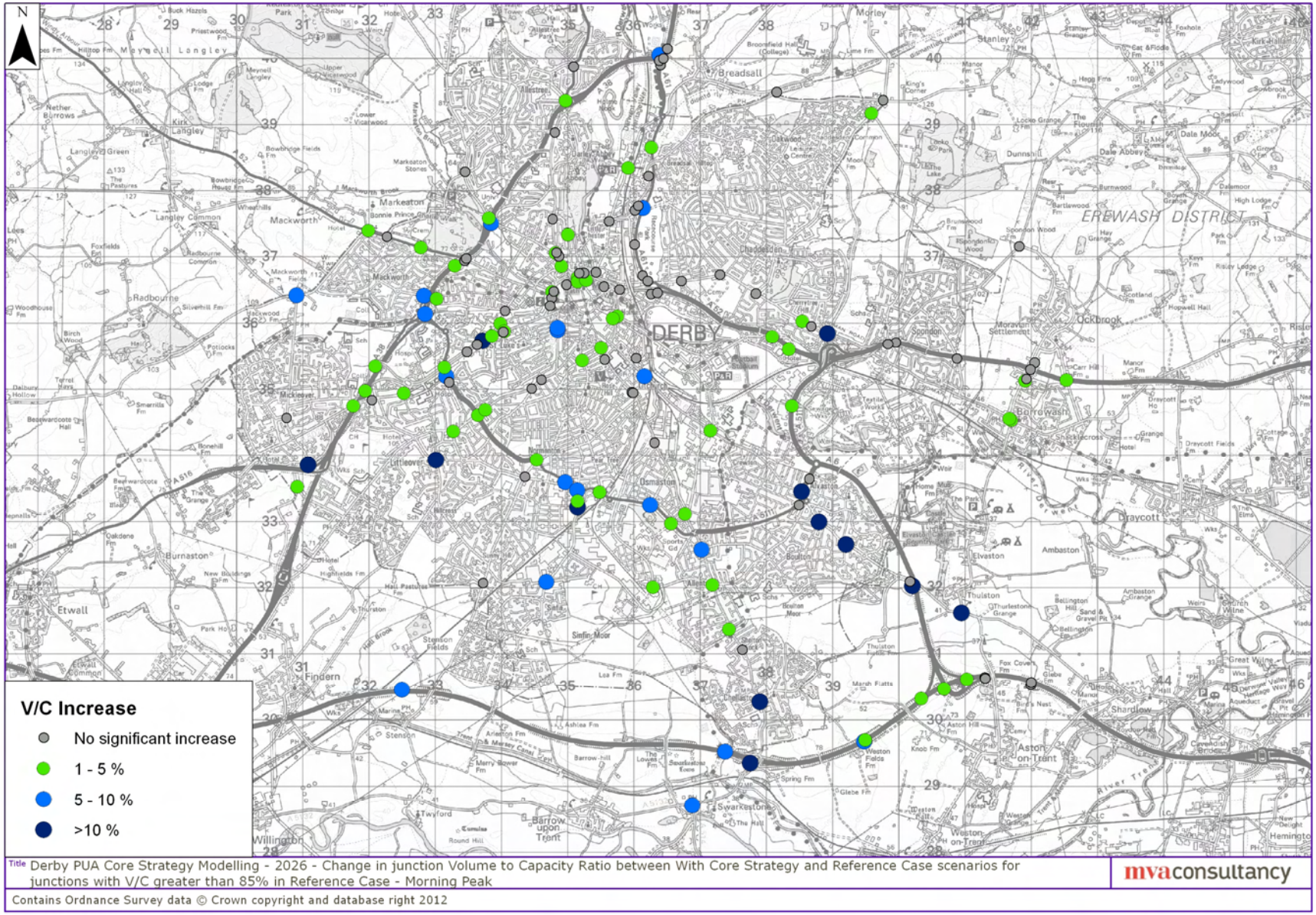
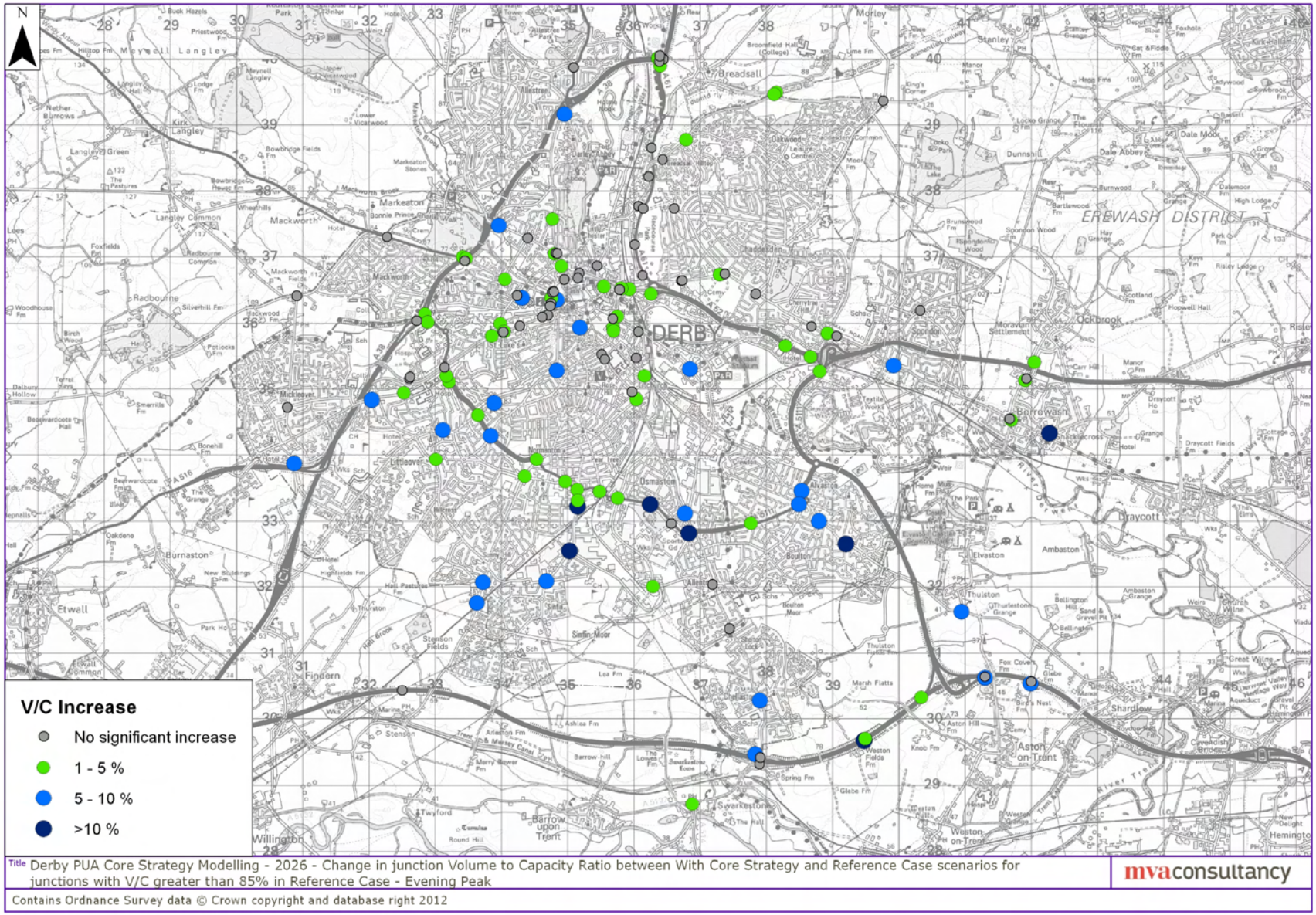


**Figure 3.9 Increase in Congestion between Reference Case and the potential Core Strategy no mitigation scenarios for junctions with a V/C ratio greater than 85% in the Reference Case – PM Peak**



# 4 Mitigation Overview

## 4.1 Introduction

4.1.1 The previous sections reported the impact of the proposed potential DUA Core Strategy sites in the absence of any transport mitigation. This chapter provides an overview of the transport mitigation strategy, which aims to reduce overall congestion levels back to Reference Case levels in order to minimise the impact of the potential Core Strategy sites.

## 4.2 Methodology Overview

4.2.1 The transport mitigation has been undertaken in a five stage process as shown below. The rationale for adopting this approach is to ensure the full potential of multi-modal solutions are explored prior to the investigation of highway options.

- **Scenario 1: Smarter Choices and Public Transport mitigation** – an assessment of the impacts of travel planning and smarter choices together with improved pedestrian and cycle access to public transport facilities and improved public transport provision to serve the potential Core Strategy sites (bus, P&R).
- **Scenario 2: Local Highway Mitigation –** an assessment of the impacts of potential highway local mitigation schemes which include the South Derby Link Road and a new rail station adjacent to Stenson Road.
- **Scenario 3: A50 Access Improvements** – provision of a new junction on the A50 with no local highway improvements in place.
- **Scenario 4: Local Highway Mitigation and A50 Access Improvements –** a combination of scenarios 2 and 3.
- **Scenario 5: A38 Grade Separation –** scenario 4 plus the grade separation schemes for the A38 junctions.

## 4.3 Smarter Choices and Public Transport Mitigation

4.3.1 The implementation of a series of targeted smarter choice packages have also been assessed for each potential DUA Core Strategy site.

4.3.2 As DATM does not automatically adjust demand to account for smarter choices mitigation measures, our approach to modelling targeted Smarter Choices for the potential Core Strategy sites has used a two-step process. Firstly, a shift to public transport has been modelled by reducing the length of zone connectors in the PT model, thus reducing costs and increasing modal share. Secondly, factors have been applied to car user classes within the highway matrices to reduce car trips within a radius of 5km.

### Enhanced Access to Public Transport

4.3.3 During the Smarter Choices process, a review of public transport connections and walk links associated with potential DUA Core strategy sites was undertaken. All sites have access to public transport via the highway access, however for some sites there are opportunities to provide enhanced links direct to bus services through pedestrian only links to adjacent areas already served by public transport. A direct walk link to public transport has been assumed between the Newhouse Farm development and the Mickleover residential area.

4.3.4 The public transport mitigation was designed to improve public transport usage at all the potential Core Strategy sites to ensure that sites have frequent public transport services that serve the right locations.

4.3.5 The aim of the public transport strategy was to ensure that each potential Core Strategy site had access to at least a 20 minute public transport service. The enhancements to public transport services have been provided by Derby City Council and are shown in Table 4.1.

**Table 4.1 Public Transport Mitigation – service improvements**

| Development | Improvement |
|---|---|
| Newhouse Farm / Hackwood Farm | A brand new service connecting the site with City Centre with a 20 minutes frequency. |
| Boulton Moor and Thulston Fields | A new 15 minutes frequency bus service serving the development and connecting it with the City Centre. Up to five minutes journey time savings via bus priority measures along London Road. |
| Chellaston Fields | Enhancement to the existing bus service. Two minutes journey time savings through bus priority along Osmaston Road. |
| Wragley Way / Stenson Fields | Frequency enhancements to existing bus service. |
| Highfields Farm | Frequency enhancements to existing bus service. |
| Evans of Leeds | Frequency enhancements to existing bus service. |

### New Bus Services

The following new bus services have been tested as part of the mitigation test 2:

- MickMack Express Busway – comprising of two services joining Mickleover and Mackworth with Derby City Rail Station.

### Bus Priority

4.3.6 Bus speeds within DATM are based on congested highway speeds taken from the SATURN model. It is recognised that the time taken for a bus to traverse a link will be a function of the time it takes a car to traverse the link. Buses will travel along the link at lower average speeds than cars, as they will need to stop to pick up and set down passengers. Therefore, the bus speeds on links have been calculated by multiplying the car speed by a factor. The factor which is applied to the car speed has been calibrated by comparing modelled journey times with timings taken from timetables.

4.3.7 Specific corridors targeted by bus journey time savings as part of the potential Core Strategy mitigation included:

- Two minutes journey time savings along Osmaston Road.
- Up to five minutes journey time savings along London Road

### Park and Ride

4.3.8 The following park and ride services have also been modelled as part of this mitigation test:

- Boulton Moor;
- City Hospital; and
- Newhouse Farm.

### New Rail Station

4.3.9 A new railway station near Stenson Road has also been tested as part of mitigation test 2. The modelled rail service frequency has been limited to half hourly service in each direction (towards the City and away from the City). A rail based park and ride is also modelled as part of the new rail station.

## 4.4 Local Highway Mitigation

4.4.1 The following local highway schemes have been included in mitigation test 2:

- Completion of South Derby Link Road; and
- Widening of Stenson Road Railway bridge to allow 2 way working.

## 4.5 Strategic Highway Mitigation

4.5.1 The following strategic highway schemes have been modelled:

- New junction at the A50 via Deep Dale Lane – tested in mitigation tests 3,4 and 5.
- Grade separation of A38 junctions with the A61, the A52 and the A5111. This scheme has only been tested in mitigation test 5.

# 5 Mitigation Scenario 1 - Smarter Choices and Public Transport

## 5.1 Introduction

5.1.1 This chapter presents the main outputs from the Smarter Choice and Public Transport Mitigation measures.

## 5.2 Modal Implications

### Overall Impact of Smarter Choice and Public Transport Mitigation

5.2.1 The following table summarises the overall reduction in highway trips as a result of Smarter Choices and Public Transport mitigation measures. These represent the relocation of trips to walk and cycle modes for trips up to 5km as well as transfers to public transport.

**Table 5.1 Highway Person Trip Reduction for potential Core Strategy sites - Mitigation Scenario 1**

| Site | Reduction in Vehicle Generations | | Percentage Reduction | |
|---|---|---|---|---|
| | AM Peak | PM Peak | AM Peak | PM Peak |
| Boulton Moor | -126 | -58 | -12% | -5% |
| Thulston Fields | -132 | -96 | -9% | -6% |
| Chellaston Fields | -83 | -60 | -24% | -16% |
| Wragley Way | -83 | -89 | -6% | -6% |
| West of Stenson Road | -28 | -19 | -7% | -5% |
| Primula Way | -26 | -17 | -7% | -4% |
| Newhouse Farm | -130 | -188 | -12% | -17% |
| Nightingale works | -40 | -23 | -14% | -8% |
| Elton Road | -4 | -2 | -6% | -3% |
| Hackwood Farm | -76 | -37 | -14% | -6% |
| Evans of Leeds | -27 | -18 | -6% | -4% |
| Highfields Farm | -48 | -30 | -10% | -6% |

| Site | Reduction in Vehicle Generations | | Percentage Reduction | |
|---|---|---|---|---|
| | AM Peak | PM Peak | AM Peak | PM Peak |
| **Totals** | **-803** | **-637** | **-10%** | **-8%** |

5.2.2 The overall reduction in development vehicle trips that is predicted as a result of the smarter choices and public transport mitigation is between 8% and 10% of the overall generation of the sites.

5.2.3 In addition to the direct reductions in development vehicle generations, the increases in frequency, bus priority and Park and Ride result in some non-development trips transferring to public transport modes. This increases the congestion relief impacts of the mitigation strategy.

### Change to Public Transport and Slow Modes

5.2.4 Table 5.2 provides an estimate of the ultimate modes of the person trips transferred from car modes. The developments have been clustered together as they are served by the same public transport routes and therefore the change in public transport usage for a specific development cannot be distinguished.

**Table 5.2 Public Transport and Slow Mode increase as a result of Smarter Choices and Public Transport mitigation.**

| Site | Increase in PT Usage | | Increase in Slow Modes | |
|---|---|---|---|---|
| | AM Peak | PM Peak | AM Peak | PM Peak |
| **Boulton Moor/Thulston Fields** | 38 | 34 | 220 | 120 |
| **Chellaston Fields** | 10 | 8 | 73 | 52 |
| **Wragley Way/Stenson Fields** | 5 | 4 | 78 | 85 |
| **Highfields Farm** | 11 | 5 | 37 | 25 |
| **Newhouse Farm** | 1 | 1 | 129 | 187 |
| **Hackwood Farm** | 16 | 16 | 60 | 21 |
| **Evans of Leeds** | 78 | 62 | 28 | 12 |
| **Primula Way / West of Stenson Road** | 9 | 8 | 45 | 28 |

5.2.5 The public transport mitigation measures have the greatest impact for the Evans of Leeds site and the Boulton Moor/Thulston Fields sites. The Boulton Moor/Thulston Fields sites are accessed by a new 15 minute service which significantly enhances the accessibility to public transport from this area. These sites (Boulton Moor and Thulston Fields) also benefit from bus priority along London Road.

5.2.6 The Newhouse Farm and Wragley Way/Stenson Fields sites do not benefit greatly from the public transport mitigation with limited usage of the new service accessing Newhouse Farm.

5.2.7 In terms of 'slow modes' the greatest impact of the smarter choices measures is associated with Newhouse Farm and Boulton Moor/ Thulston Fields due to the improved accessibility to the facilities in the adjacent areas of Mickleover and Chellaston. It should be noted that these are also some of the highest generating sites and therefore the potential for change is greater.

### Mode Share

5.2.8 The following tables present car and public transport mode shares for the potential Core Strategy sites with and without the Smarter Choices mitigation.

**Table 5.3 Modal Share potential Core Strategies sites – Mitigation Scenario 1**

| Site | Modal Shares No Mitigation | | Modal Shares Smarter Choice Mitigation | | Approximate Change in PT Mode Share |
|---|---|---|---|---|---|
| | Car | PT | Car | PT | |
| Boulton Moor/Thulston Fields | 97% | 3% | 96% | 4% | +1% |
| Chellaston Fields | 91% | 9% | 89% | 10% | +1% |
| WW/Stenson Fields | 99% | 1% | 99% | 1% | +0% |
| Highfields Farm | 97% | 3% | 96% | 4% | +1% |
| Newhouse Farm | 100% | 0% | 100% | 0% | +1% |
| Hackwood Farm | 97% | 3% | 96% | 4% | +1% |
| Evans of Leeds | 87% | 13% | 81% | 19% | +6% |
| Primula Way / West of Stenson Road | 97% | 3% | 96% | 4% | +1% |

5.2.9 The change in overall mode share for the sites to public transport is generally limited to around 1%. The Evans of Leeds site has the greatest transfer to public transport reflecting the improvement to bus services and its location relative to the city centre which makes buses more attractive as a transport mode.

5.2.10 Table 5.4 shows the range of forecast patronage for the proposed park and ride sites.

**Table 5.4 Daily Patronage Figures for Park and Ride Sites – Mitigation Scenario 1**

| | Boulton Moor | City Hospital | Newhouse Farm |
|---|---|---|---|
| **24 Hours Patronage** | 146 - 312 | 170 – 787 | 5 – 14 |

5.2.11 The wide range of forecast patronage at Boulton Moor and City Hospital is due to a number of factors, including:

- The assumed catchment area;
- The levels of bus priority associated with the bus route into the city; and
- the availability of other P&R sites.

5.2.12 It is recommended that further work is undertaken on a city wide P&R strategy to establish more precise forecasts. However for a robust assessment of the mitigation of the potential DUA Core Strategy sites the lower level of patronage forecast has been adopted.

5.2.13 The patronage at Newhouse Farm is insignificant and, therefore, it is recommended that this service is not included in the subsequent mitigation tests.

## 5.3 Global Indicators

5.3.1 The following section presents highway indicators for the whole of the Core Strategy Area to provide a way of gauging the overall impact the potential Core Strategy sites and the impacts of the Smarter Choices mitigation on the full ACS area. A brief explanation of each indicator is provided below.

- **Average Speed** - expressed as kilometres per hour for all traffic within the highway model simulation area. Increased traffic levels should lead to more delays resulting in lower average speeds.
- **Over Capacity Queues** - Time spent queuing at junctions that are over capacity. As traffic levels increase we expect to see a growing number of junctions reaching capacity and the time spent queuing at these over capacity junctions increasing.
- **Total Travel Time (pcu-hrs) –** Overall travel time for all trips during the peak hours.
- **Total Travel Distance (pcu-kms) –** Overall travel distance for all trips during the peak hours.
- **Severity Index**- this indicator has been developed by MVA and takes account of the length of the roads affected by congestion, number of vehicles affected by congestion and also the level of congestion. This indicator is a number (without a unit) and gives a realistic indication of levels and severity of congestion in any particular scenario. This index only shows severity along the roads which are at, above or approaching capacity.
- Environmental Indicators – carbon emissions predicted from the highway model outputs.

Table 5.5- Global Highway Indicators – Mitigation Scenario 1

| | AM Peak | | | |
|---|---|---|---|---|
| | **Reference Case** | **Core Strategy (no mitigation)** | **Mitigation Scenario 1** | **% Mitigated** |
| **Average Speed** | 38 | 36 | 37 | 30% |
| **Over Capacity Queues** | 772 | 1,290 | 1,120 | 33% |
| **Total Travel Time** | 14,849 | 16,544 | 16,035 | 30% |
| **Total Travel Distance** | 566,599 | 594,231 | 586,847 | 27% |
| **Severity Index** | 322 | 352 | 345 | 25% |
| | **PM Peak** | | | |
| | **Reference Case** | **Core Strategy (no mitigation)** | **Mitigation Scenario 1** | **% Mitigated** |
| **Average Speed** | 38 | 35 | 36 | 17% |
| **Over Capacity Queues** | 837 | 1,448 | 1,323 | 21% |
| **Total Travel Time** | 15,566 | 17,524 | 17,171 | 18% |
| **Total Travel Distance** | 583,652 | 617,280 | 611,102 | 18% |
| **Severity Index** | 211 | 258 | 252 | 13% |

5.3.2 The level of congestion mitigation that is predicted to be achieved by the Smarter Choices and Public Transport mitigation is higher in the morning peak (between 30 and 33%), this reflects the greater number of vehicle trips that are extracted from the network during this period as there is a greater proportion of more localised trips that are capable of transferring to pedestrian and cycle modes than there are in the evening peak.

## 5.4 Carbon Emissions Indicator

5.4.1 The impact of each of the options on greenhouse gas emissions has been measured using the MVA Environmental Appraisal software, *ENEVAL*. This software provides an indication of the main carbon dioxide equivalent emission impacts caused by road traffic on a network wide basis. The ENEVAL results for different schemes have been compared to highlight how carbon dioxide equivalent emissions change by scenario.

5.4.2 Table 5.6 provides a summary of the change in carbon dioxide equivalent values as a result of the Smarter Choice Mitigation.

**Table 5.6 Carbon Emissions – Mitigation Scenario 1**

| | Reference Case | Core Strategy No Mitigation | Mitigation Scenario 1 | % Mitigation |
|---|---|---|---|---|
| **Annual $CO_2$ (tonnes)** | 427,504 | 437,582 | 431,197 | 63% |

5.4.3 The smarter choices and public transport mitigation has a significant impact in addressing the additional carbon emissions as a result of the potential Core Strategy sites. This is due to the levels of transfer to more sustainable transport modes.

## 5.5 General Highway Impacts

5.5.1 The following section of the report presents a series of highway plots which highlight the impact that Smarter Choice Mitigation has on reducing the transportation impacts of the potential Core Strategy sites. The following indicators are provided;

- **Flow Change –** Predicted changes in traffic flow levels on the highway network.
- **Volume/ Capacity plots –** these show the levels of congestion at junctions in 2026 with first set of mitigation measures (smarter choices and PT) in place and also the change in congestion relative to the No Mitigation Scenario.

### Flow Change

5.5.2 The levels of flow reduction on the network as a result of the Smarter Choice and Public Transport Mitigation are shown in Figures 5.1 and 5.2.

5.5.3 These plots show that the reductions in vehicle flows are widespread throughout the network, with the vast majority of routes incurring a reduction of less than 50 vehicles.

5.5.4 The mitigation package is forecast to reduce traffic flow along:

- A50;
- Osmaston Road;
- London Road;
- Sections of A38; and
- T12 Link Road.

5.5.5 The impact of the mitigation measures (in terms of flow reduction) is more significant in the AM peak than the PM peak.

**Figure 5.1 Reduction in Highway Flows due to Mitigation Scenario 1 - AM Peak**

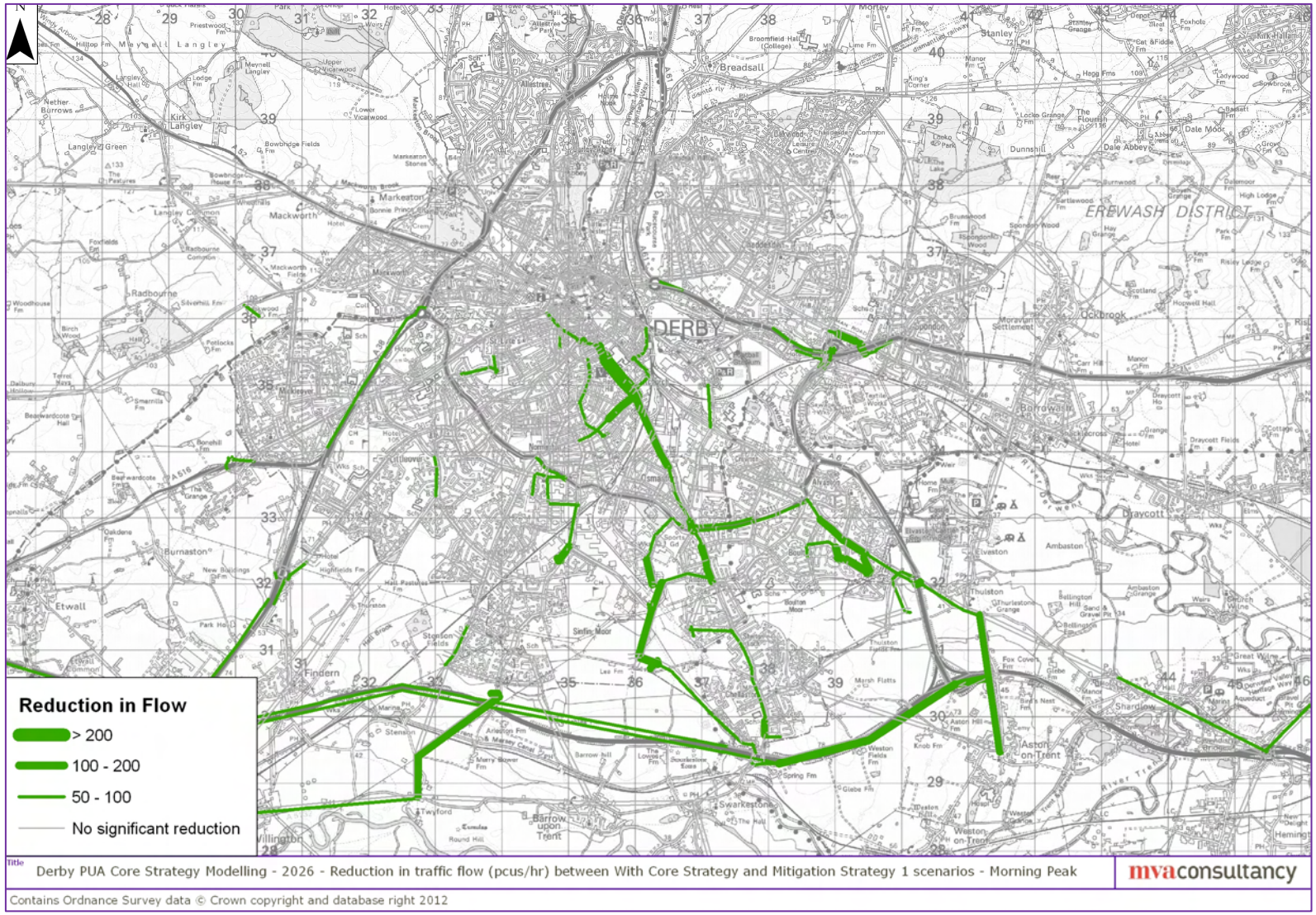
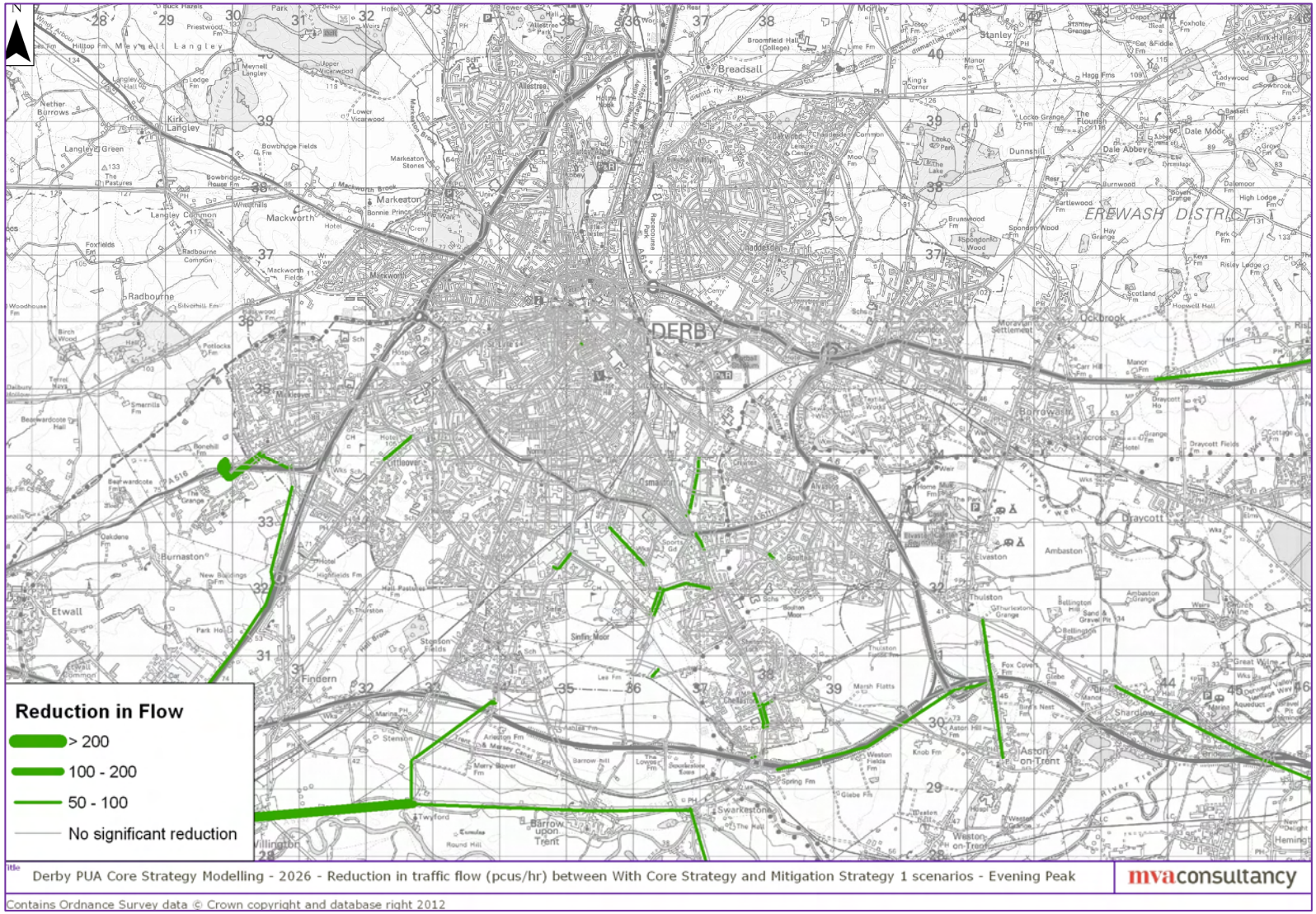


**Figure 5.2 Reduction in Highway Flows due to Mitigation Scenario 1 - PM Peak**



## 5.6 Volume / Capacity (V/C) plots

5.6.1 A V/C percentage of 85% is conventionally considered to be the threshold beyond that the junction approaches it's effective traffic capacity. As V/C ratios increase above this level, there is an increasing likelihood of that drivers will observe perceptible increases in delays and queues at junctions which may affect their travel behaviour or routing patterns. . It will be these links/junctions which will be of most concern to the highway authorities. A V/C ratio in excess of 100% indicates that the junction is operating beyond its theoretical traffic capacity.

5.6.2 Figures 5.3 and 5.4 show the reduction in congestion as a result of the smarter choices and public transport mitigation compared to the no mitigation scenario.

5.6.3 The majority of the junctions only receive a small reduction in congestion as a result of the mitigation, less than 5%. However, the following areas have been identified as having a number of junctions with a significant reduction in congestion levels as a result of the mitigation package.

- The A514 radial route into Derby City Centre;
- The A516 Uttoxeter New Road; and
- Along the Connecting Derby scheme.

5.6.4 The residual congestion plots for the AM and PM peaks can be seen in Figures 5.5 and 5.6 respectively. These plots identify junctions which are forecast to be congested with the mitigation package in place.

**Figure 5.3 Reduction in congestion between the potential Core Strategy no mitigation scenario and Mitigation 1 for junctions with greater than 85% V/C ratio in the potential Core Strategy no mitigation scenario – AM Peak**

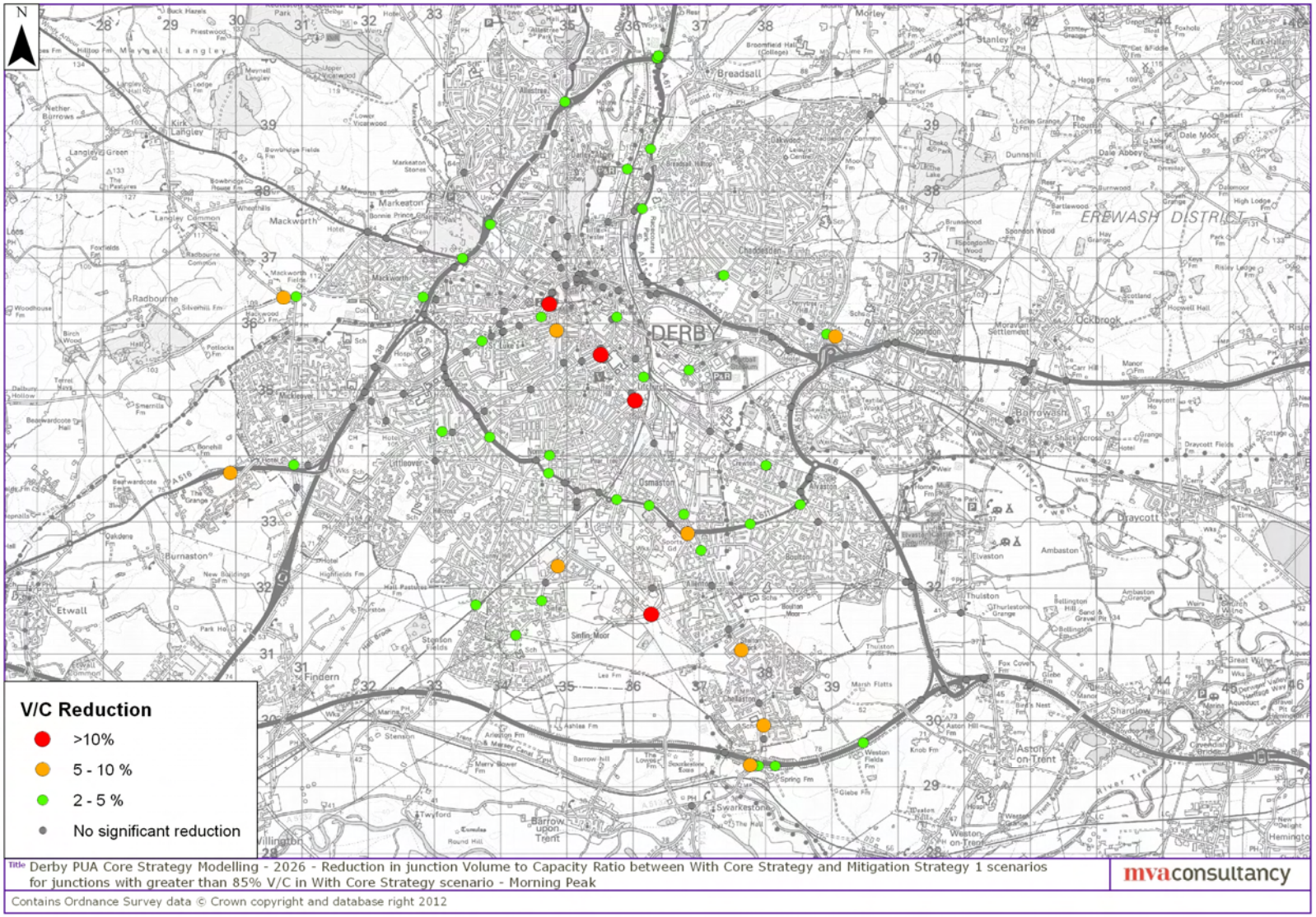


**Figure 5.4 Reduction in congestion between with potential Core Strategy no mitigation scenario and Mitigation 1 for junctions with greater than 85% V/C ratio in the potential Core Strategy no mitigation scenario – PM Peak**

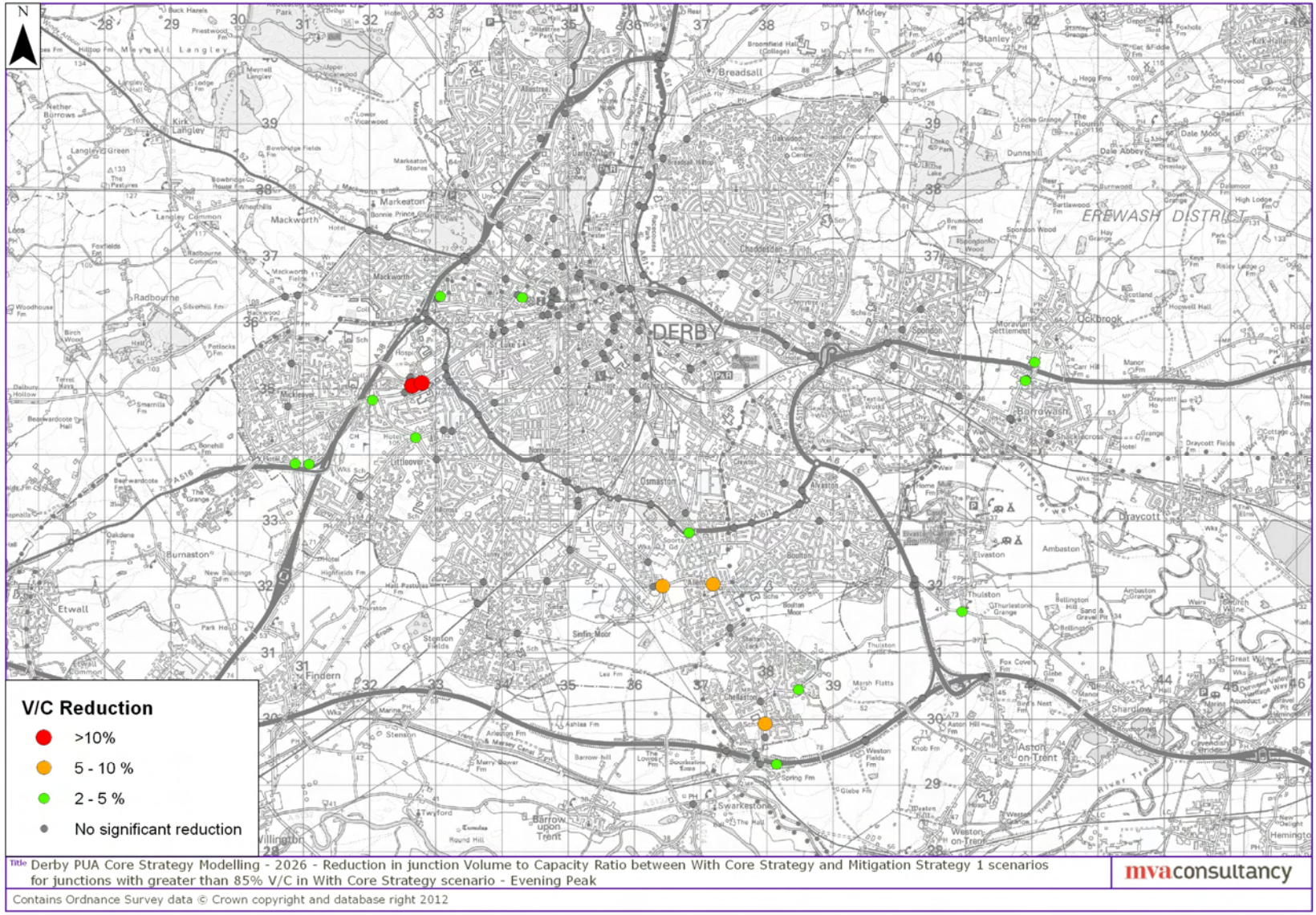


**Figure 5.5 Residual Congestion Plot – AM Peak**

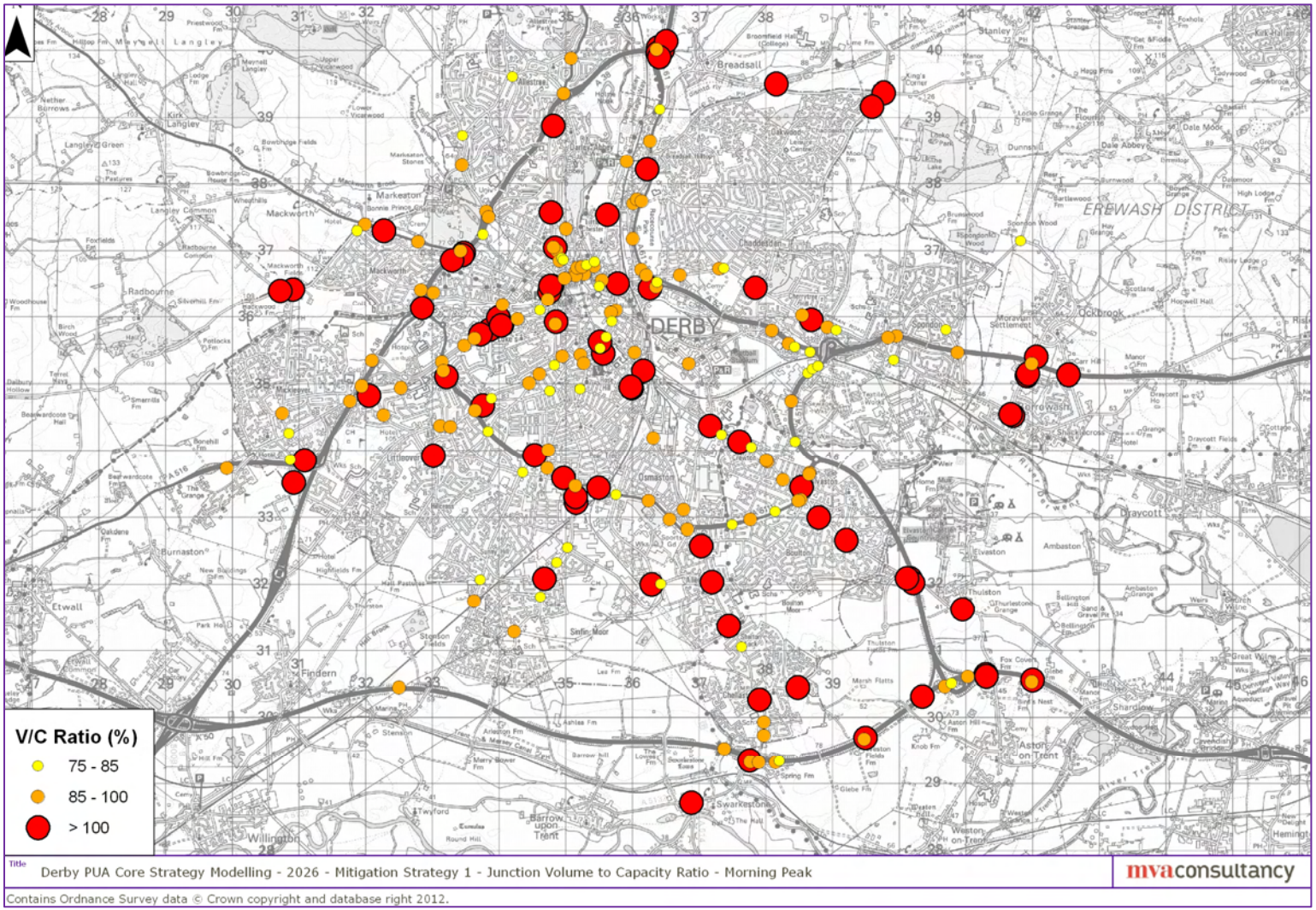


**Figure 5.6 Residual Congestion Plot – PM Peak**