Derby HMA Core Strategy

06/10/2015

Reference number 102593

TRANSPORT MODELLING REPORT

SYSTRA

DERBY HMA CORE STRATEGY

TRANSPORT MODELLING REPORT

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1. INTRODUCTION

1.1 Background

1.1.1 SYSTRA Ltd was commissioned by Derby City Council on behalf of the planning and local highways authorities in the Derby Housing Market Area (HMA), to undertake a traffic impact assessment of the proposed developments which form the Derby HMA Core Strategy.

1.1.2 The Derby HMA comprises of the following local authority areas:

- Amber Valley;
- Derby City; and
- South Derbyshire.

1.1.3 The assessment was undertaken using the Greater Derby Transport Model (GDTM) for the 2026 forecast year. The study involved development and analysis of the following future year modelling scenarios:

- 2026 Reference Case – this included all committed land use and infrastructure schemes.
- 2026 With-Development Scenario – this scenario was built on top of the Reference Case by adding the land use allocations for the Core Strategy sites.
- 2026 Non-Highway Mitigation Scenario – this scenario included the public transport mitigation schemes as well as the application of the smarter choices for travel.
- 2026 Full Mitigation Scenario – this scenario included non-highway as well as highway mitigation measures.

1.2 Greater Derby Transport Model (GDTM)

1.2.1 The Greater Derby Transport Model (GDTM) is an expanded version of the Derby Area Transport Model (DATM) that has been created specifically to assess the Core Strategy proposals in the Derby Housing Marketing Area (HMA). It includes the following main characteristics:

- A Land Use model (DELTA), consistent with the Derby City model.
- Traffic Restraint Analysis Model (TRAM) – a Variable Demand model with all the Department for Transport (DfT) demand responses (destination, mode, time of day, and trip frequency choices).
- A SATURN highway model validated to appropriate levels and agreed for assessment of the Core Strategy by Highways England (HE).
- A TRIPS based public transport model.

1.2.2 GDTM has a base year of 2006.

1.3 Structure of the Report

1.3.1 This report details the methodology and modelling results of the Reference Case and 'With Development' modelling scenarios as well as the two mitigation scenarios. This supersedes a previous report relating to an earlier Core Strategy Land Use scenario which was issued in April 2014.

1.3.2 The remainder of this report is structured as follows:

- Chapter 2 – Reference Case;
- Chapter 3 – With Development (No Mitigation);
- Chapter 4 – Modelling Outputs – Reference Case vs With Development Scenario;
- Chapter 5 - Mitigation Scenarios;
- Chapter 6 – Modelling Results – Non-Highway Mitigation;
- Chapter 7 – Modelling Results – Full Mitigation Scenario; and
- Chapter 8 – Conclusions.

2. REFERENCE CASE

2.1 Background

2.1.1 A new 2026 Reference Case was prepared which included existing and committed residential development and infrastructure schemes. It utilised DELTA and was based on the revised latest land use spreadsheets provided by the Derby HMA planning authorities.

2.1.2 The TEMPRO residential growth above the identified committed land use scenario was removed for the appraisals, by removing the non-committed residential schemes from the DELTA models prior to running it through the rest of the model. This ensured that the model represented traffic growth resulting from demographic trends (car ownership, increased travel frequency) and employment growth but not the housing growth associated with the Core Strategy.

2.2 Assumptions

2.2.1 The Reference Case includes all completed and committed development sites, but none of the additional Derby HMA Core Strategy allocations. Full inventories of committed developments that have been included in the Reference Case are included in Appendix A.

2.2.2 Between the 2006 Base and the 2026 Reference Case, there are a number of changes to the highway network which are likely to have a significant impact on traffic patterns across the network. The impact of traffic growth between the 2006 Base and the 2026 Reference Case network has been reported in previous technical note dated 25th April 2014. The key highway infrastructure schemes included in the 2026 Reference Case are:

- Connecting Derby (already implemented);
- A38 grade separation;
- Raynesway grade separation (already implemented);
- London Road Bridge open to all traffic and Litchurch Lane closed;
- Junction improvements at A5111/A514 Mitre Island;
- New layouts for A5111 junctions with Stenson Road and Sinfin Lane;
- M1 widening between junctions 25 and 28 (already implemented);
- T12 Link Road and associated schemes; and,
- A38/A50 Toyota junction revised layout.

2.2.3 This list is not exhaustive, but includes the most significant highway infrastructure schemes. A full list of committed infrastructure included in the Reference Case is included in Appendix B.

3. WITH DEVELOPMENT (NO MITIGATION) SCENARIO

3.1 Introduction

3.1.1 This chapter presents the Core Strategy Land Use assumptions that have been incorporated into the 'With Development (No Mitigation)' scenario.

3.2 Land Use Assumptions

3.2.1 Tables 1- 3 provide details the land use assumptions for the proposed development sites within each of the local authorities that make up the Derby HMA.

Table 1. Residential and Employment Allocations – Amber Valley

SITE	RESIDENTIAL UNITS	EMPLOYMENT SITE AREA
Outseats Farm	500	
Land at Alfreton Road, Codnor	600	
Land North of Denby	1,800	6Ha
Land at Nottingham Road, Ripley	560	7Ha
Taylor Lane Loscoe/Heanor	250	
Newlands, Heanor	250	
Radborne Lane	70	
Kedleston Road	400	
Lily Street Farm, Alfreton	526	
Chesterfield Road, Alfreton	250	
Somercotes Hill, Somercotes	200	
Amber Valley Rigby Club, Lower Somercotes	200	
Bradshaw Avenue Ridings	90	
Derwent Street, Belper	120	
Bullsmoor/Cherry House Farm, Belper	250	
Pottery Farm, Belper	200	
Hall Road Lagley Mill	80	
Amber Heights, Ripley	60	
Asher Lane Business Park, Ripley	170	
Butterley Hall, Ripley	120	

Total	**6696**	**13Ha**

Table 2. Residential and Employment Allocations – Derby City

SITE	RESIDENTIAL UNITS	EMPLOYMENT SITE AREA
Snelsmoor Grange	800	1000 sqm
Hackwood Farm	400	1000 sqm
Nightingale Works	400	-100,000 sqm
Elton Road	100	
Wragley Way	180	
Brook Farm, Chaddeston	275	
South of Mansfield Road, Hilltop	200	
Holmleigh Way. Derby	49	
Onslow Road	200	
Infinity Park		50,000 sqm
Totals	**2604**	**50,000 sqm**

Table 3. Residential and Employment Allocations – South Derbyshire

SITE	RESIDENTIAL UNITS	EMPLOYMENT SITE AREA
Primula Way	366	
Wragley Way	1,950	
Chellaston Fields	500	
Boulton Moor Phase 2	700	
Boulton Moor Phase 3	190	
Land off Holmleigh Way	157	
Land at Hackwood Farm	290	
Broomy Farm	400	
Land NE of Hatton	400	
North of William Nadin Way	600	
Church Street, Church Gresley	400	
Land off The Mease, Hilton	375	35,000 sqm
Longlands, Repton	100	
Willington Road, Etwall	100	
Aston-on-Trent	100	
Woodville Regeneration Area	150	60,000 sqm
Land South of Cadley Hill		25,000 sqm
Land North of Dove Valley Business Park		141,150 sqm
Land at Swadlincote Lane, Church Gresley		15,000 sqm
Total	**6,008**	**276,150 sqm**

3.3 Trip Generations

3.3.1 The trip rates for the proposed developments have been derived from the TRICS database. Table 4 details the trip rates for the proposed developments.

3.3.2 Trip generations have been produced for residential and employment land uses only. Whilst some sites are proposed to have small scale retail, or educational facilities (e.g. primary schools), the majority of the trip generation associated with these local facilities are internal to the site and therefore will not have a significant affect the external highway network.

Table 4. Trip rates for the proposed developments

LAND USE	TRIP RATES			
	AM PEAK		PM PEAK	
	Arrivals	Departures	Arrivals	Departures
Residential	0.177	0.523	0.463	0.296
Employment B1	1.480	0.239	0.193	1.269
Employment B2	0.318	0.071	0.034	0.267
Employment B8	0.149	0.063	0.055	0.145

3.3.3 Table 5 shows the forecast vehicle generations in the morning and evening peak hours for the Amber Valley development sites. The Core Strategy sites in Amber Valley are forecast to generate between 5,250 and 5,600 two-way trips during the peak hours.

Table 5. Trip Generations for the proposed developments – Amber Valley

LAND USE	TRIP GENERATIONS			
	AM PEAK		PM PEAK	
	Arrivals	Departures	Arrivals	Departures
Outseats Farm	89	262	232	148
Land at Alfreton Road, Codnor	106	314	278	178
Land North of Derby	674	999	880	837
Land at Nottingham Road	234	321	280	283
Taylor Lane Loscoe/Heanor	44	131	116	74
Newlands, Heanor	44	131	116	74
Radborne Lane	12	37	32	21
Kedleston Road	71	209	185	118
Lily Street Farm, Alfreton	93	275	244	156
Chesterfield Road, Alfreton	44	131	116	74
Somercotes Hill, Somercotes	35	105	93	59
Amber Valley Rugby Club	35	105	93	59
Bradshaw Avenue Ridings	16	47	42	27
Derwent Street, Belper	21	63	56	36
Bullsmoor/Cherry House Farm	44	131	116	74

Pottery Farm, Belper	35	105	93	59
Hall Road Lagley Mill	14	42	37	24
Amber Heights, Ripley	11	31	28	18
Asher Lane Business Park	30	89	79	50
Butterley Hall, Ripley	21	63	56	36
Total	**1676**	**3588**	**3167**	**2404**

Derby City Trip Generations

3.3.4 Table 6 shows the resultant vehicle generations in the morning and evening peak hours for the Derby City development sites. The core strategy sites in Derby City are forecast to generate between 1,650 and 1,800 two-way trips in the peak hours.

Table 6. Trip generations for the proposed developments – Derby City

LAND USE	TRIP GENERATIONS			
	AM PEAK		PM PEAK	
	Arrivals	Departures	Arrivals	Departures
Boulton Moor	142	418	370	237
Hackwood Farm	71	209	185	118
Nightingale Works	-247	138	151	-149
Elton Road	18	52	46	30
Wragley Way	32	94	83	53
Brook Farm, Chaddeston	49	144	127	81
South of Mansfield Road, Hilltop	35	105	93	59
Holmleigh Way. Derby	9	26	23	15
Onslow Road	35	105	93	59
Infinity Park	179	42	30	112

Total	**322**	**1333**	**1201**	**616**

South Derbyshire Trip Generations

3.3.5 Table 7 shows the resultant vehicle generations in the morning and evening peak hours for the South Derbyshire development sites.

3.3.6 The core strategy sites in South Derbyshire are forecast to generate approximately 6,350 two-way trips during the morning peak and around 6,500 two-way trips in the evening peak.

Table 7. Trip generations for the proposed developments – South Derbyshire

LAND USE	TRIP GENERATIONS			
	AM PEAK		PM PEAK	
	Arrivals	Departures	Arrivals	Departures
Primula Way	65	191	169	108
Wragley Way	345	1020	903	577
Chellaston Fields	89	262	232	148
Boulton Moor Phase 2	124	366	324	207
Boulton Moor Phase 3	34	99	88	56
Land off Holmleigh Way	28	82	73	46
Land at Hackwood Farm	51	152	134	86
Broomy Farm	71	209	185	118
Land NE of Hatton	71	209	185	118
North of William Nadin Way	106	314	278	178
Church Street, Church Gresley	71	209	185	118
Land off The Mease, Hilton	235	232	200	258
Longlands, Repton	18	52	46	30

Willington Road, Etwall	18	52	46	30
Aston-on-Trent	18	52	46	30
Woodville Regeneration Area	316	139	114	296
Land South of Cadley Hill	121	25	19	105
Land North of Dove Valley Business Park	681	143	105	591
Land at Swadlincote Lane, Church Gresley	72	15	11	63
Total	**2533**	**3825**	**3343**	**3162**

3.3.7 The proposed Derby HMA Core Strategy development sites are forecast to generate approximately 13,650 vehicle trips during morning peak hour and 12,650 vehicle trips during evening peak hour. Approximately half of the forecast additional trips are from development sites located in South Derbyshire, where the majority of the sites are located adjacent to the Derby Urban Area.

4. COMPARISON OF REFERENCE CASE AND WITH DEVELOPMENT SCENARIOS

4.1 Introduction

4.1.1 This chapter presents the outputs from the Reference Case compared with the Development Scenario. The Chapter is split into the modelling results for the Full Derby HMA Area, Amber Valley, Derby City and South Derbyshire.

4.1.2 The forecast impacts of the With Development (No Mitigation) scenario are reported using the following key performance indicators:

- **Flow Difference** – identifying the combined effect of the development and reassignment traffic on the local networks;
- **Junction Congestion** – identifying junctions forecast to become congested with the development in place; and,
- **Network Indicators** – identifies changes in key network indicators.

4.2 Network Indicators

4.2.1 Network Indicators provide a way of gauging the overall impact of the predicted increase in trips associated with the development sites across the whole of the modelled simulation area. A brief explanation of key indicators is provided below:

- **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** – Total travel time across the highway network simulation area expressed in pcu hours.
- **Total Travel Distance** – Total distance travelled across the highway network simulation area expressed in pcu kilometres.
- **Average speed** - Expressed as kilometres per hour for all traffic within the highway model simulation area for each peak period. Increased traffic levels lead to more delays resulting in lower average speeds.

4.3 Full Derby HMA Area - Flow Difference

4.3.1 Figures 1 and 2 show the flow difference between the Reference Case and the 'With Development' (No Mitigation) scenarios for the morning and evening peak hours respectively. Blue lines indicate roads which are forecast to experience an increase in traffic between the Reference Case and the With Development Scenario , whilst green lines indicate roads which are forecast to experience a decrease in traffic.

4.3.2 Increases are forecast along the SRN across the study area, particularly:

- the A50;
- the A38;
- the A6;
- the A516; and,
- the A52.

4.3.3 Within Derby there are significant flow increases to the south, the north and east of the city especially along the A38, the A50, the A52 and also along the Ring Road reflecting the concentration of development to the south of the city.

4.3.4 To the south of the area the major flow impacts are within Swadlincote and also in Burton on Trent.

4.3.5 To the north of the area the flows on the B6179 into Ripley increase significantly as do the flows on routes through Kilburn along the A609 and Heanor along the A610.

4.4 Full Derby HMA Area - Junction Congestion

4.4.1 A junction is considered to become congested when the Reference Case V/C ratio is less than 85% and due to the impact of development it increases to over 85% in the With Development scenario. The increase in V/C ratio is presented for such junctions and are colour coded amber, red and dark red. The red and dark red represent the junctions with higher increases in congestion due to development.

4.4.2 Figures 3 and 4 show the forecast increase in junction congestion between the Reference Case and the No Mitigation scenarios for the morning and evening peak hours respectively.

4.4.3 The majority of the congestion impacts are within Derby City, primarily in the northern and southern part of the city where a significant proportion of the residential developments reside. This reflects the levels of congestion that are present in the Reference Case within the city.

4.4.4 There are only a few small increases in congestion identified in the southern part of the HMA, primarily within Swadlincote.

4.4.5 In the north of the area there are predicted to be some significant impacts in Ripley, Heanor, Belper and the villages along the A6.

4.4.6 The Network Indicators for the With Development and Reference Case are provided in Table 8.

Table 8. Network Indicators – Full HMA Area

INDICATOR	MORNING PEAK			EVENING PEAK		
	REFERENCE CASE	WITH DEV.	% CHANGE	REFERENCE CASE	WITH DEV.	% CHANGE
Over Capacity Queues (PCU hrs)	1,110	2,111	90%	1,137	2,008	76%
Total Travel Time (PCU Hrs)	25,572	29,313	14%	25,546	29,280	14%
Total Travel Distance (PCU kms)	1,131,643	1,228,587	8%	1,130,334	1,232,880	9%
Average Speed (km/hr)	44.25	41.91	-5%	44.25	42.11	-4%

4.4.7 These network indicators show a significant increase in congestion on the highway network as represented by the over-capacity queues indicator which increases by 90% in the AM peak and 76% in the PM peak. This results in a reduction of average speed of around 4% as a result of the HMA Core Strategy proposals.

Figure 1. Flow Difference – Reference Case vs With Development Scenario – Morning Peak

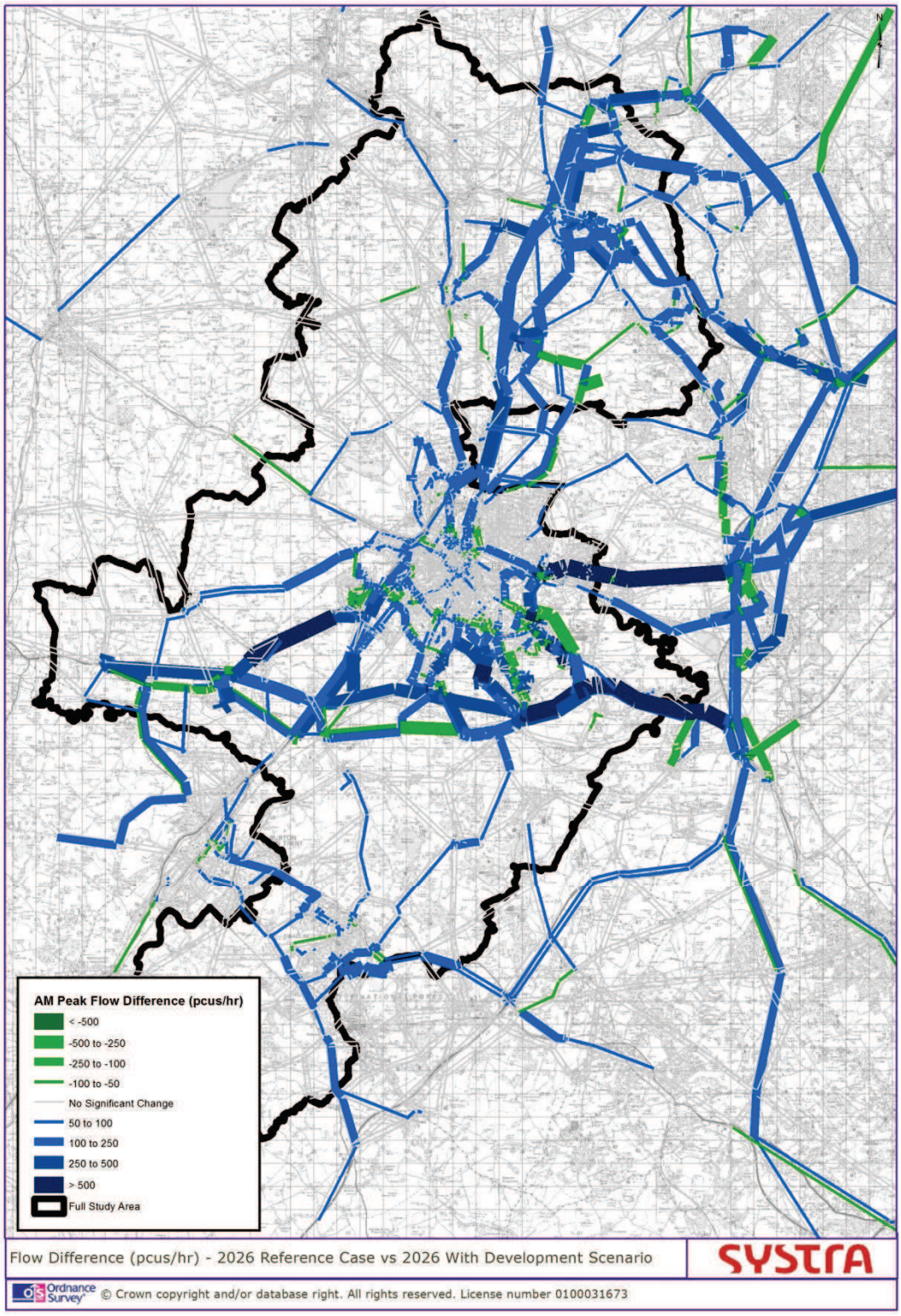


Figure 2. Flow Difference – Reference Case vs With Development Scenario – Evening Peak

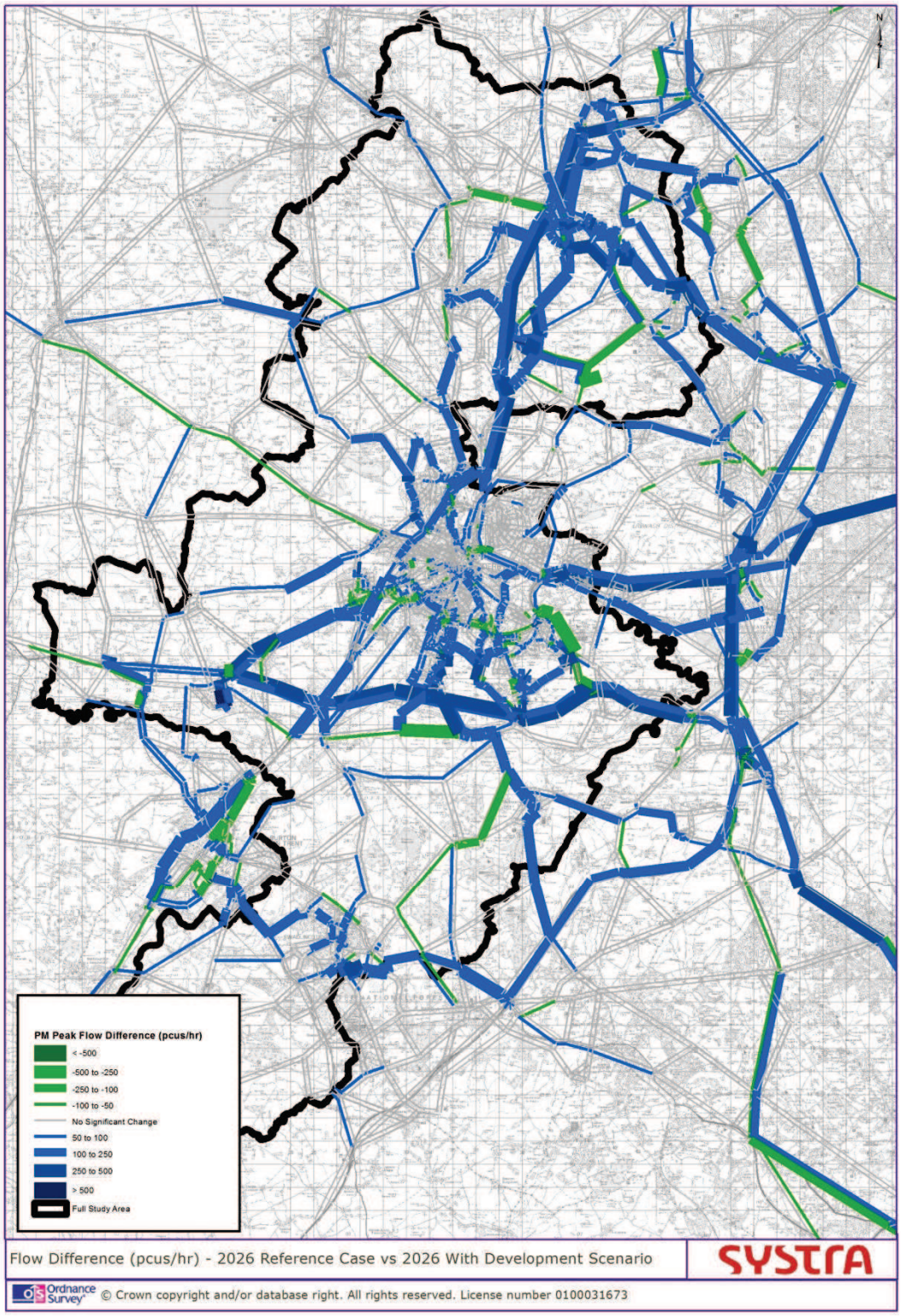


Figure 3. Increase in Junction Congestion – Reference Case vs With Development Scenario – Morning Peak

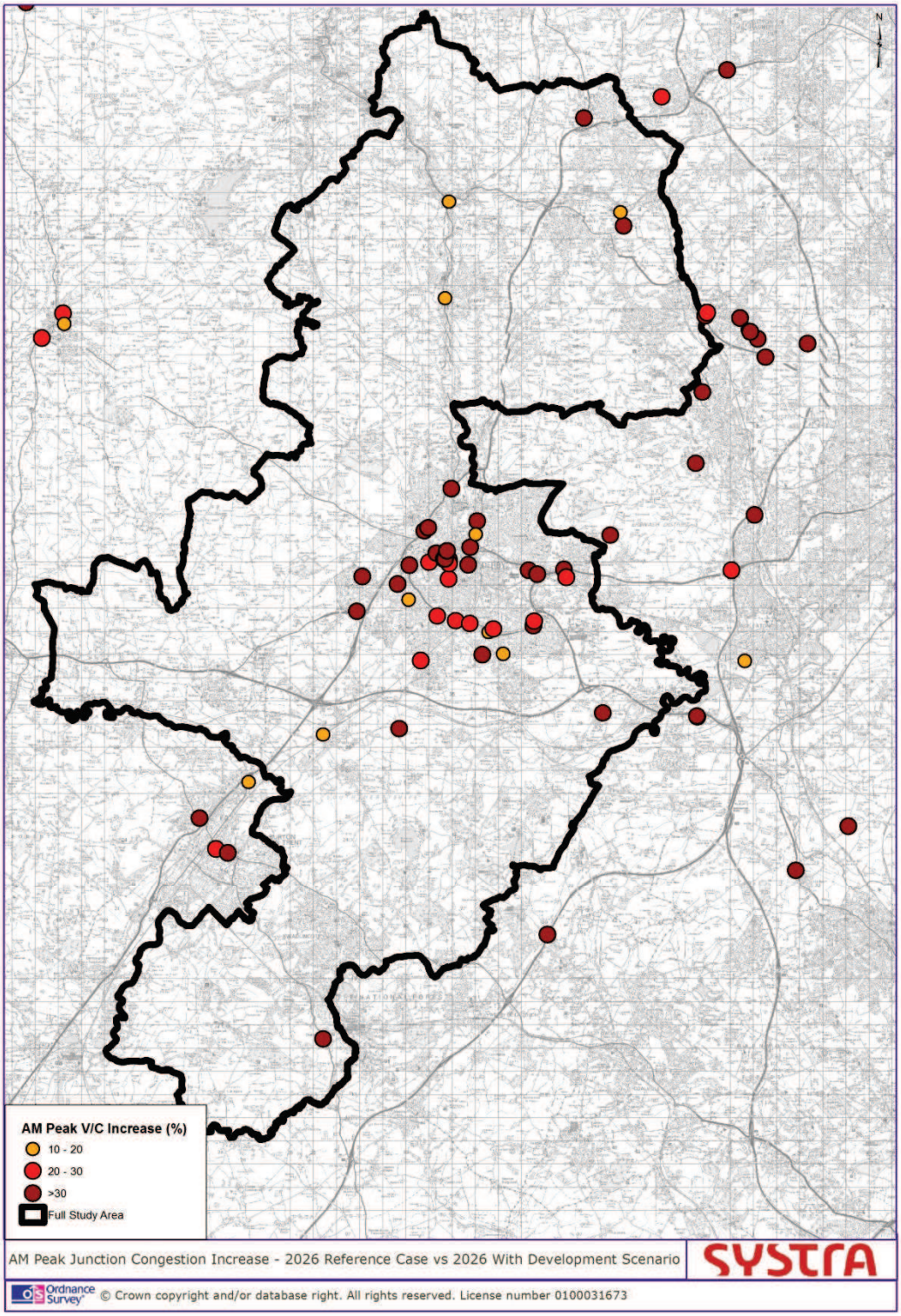
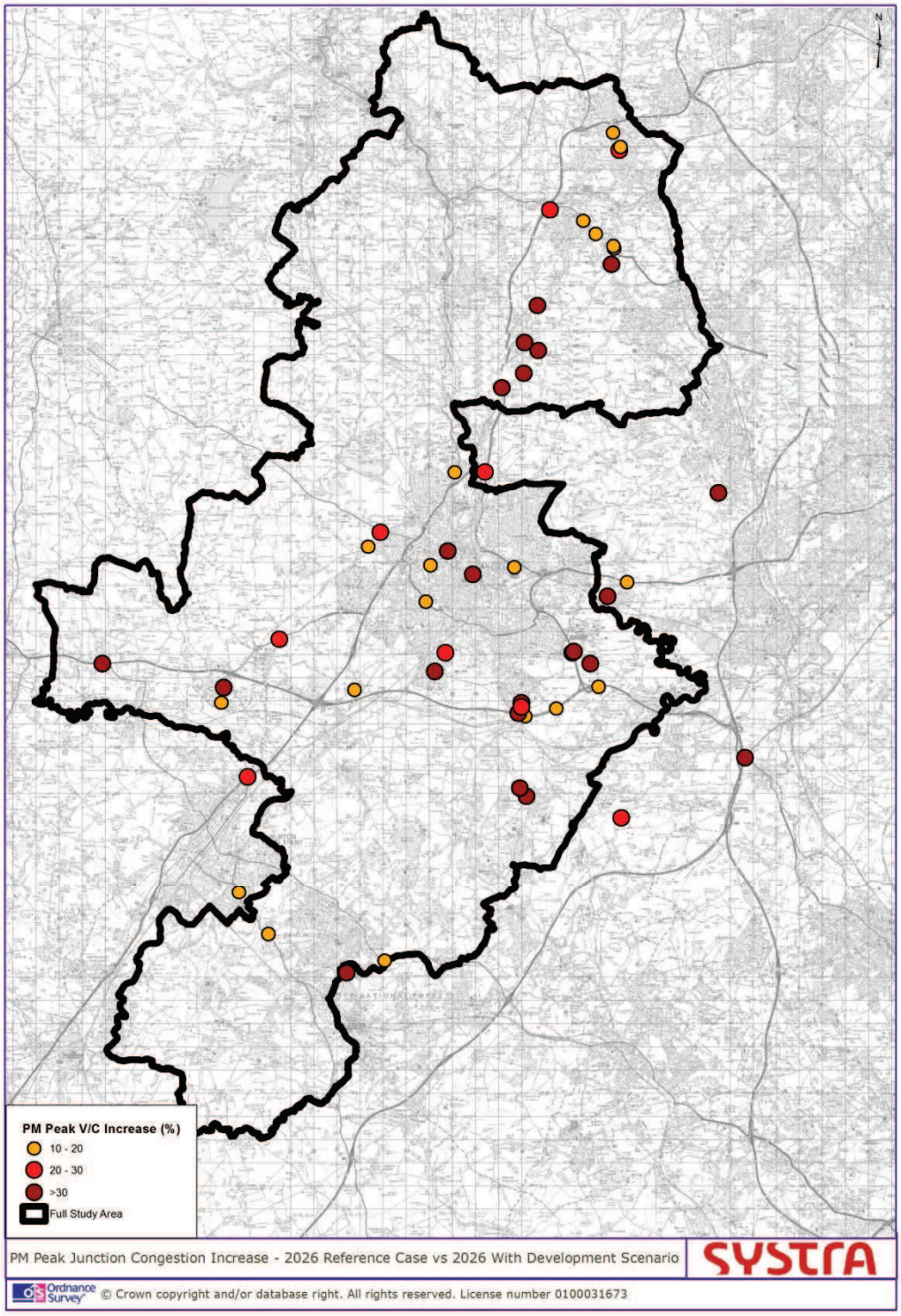


Figure 4. Increase in Junction Congestion – Reference Case vs With Development Scenario – Evening Peak



4.5 Introduction

4.5.1 This section presents the outputs from the modelling for the Amber Valley area.

4.5.2 The Ripley Link Road is not included in the 'With Development' scenario as it is assumed to be a mitigation scheme. Access for the proposed developments adjacent to the Link Road are provided with direct connection to Nottingham Road to avoid redistribution effects associated with the Link Road.

4.6 Amber Valley - Flow Difference

4.6.1 Figures 5 and 6 show the flow difference between the Reference Case and 'With Development' (No Mitigation) scenarios for the morning and evening peak hours. Blue lines indicate roads which are forecast to experience an increase in traffic between the Base and Reference Case , whilst green lines indicate roads which are forecast to experience a decrease in traffic.

4.6.2 The following roads are forecast to experience significant increases in traffic:

- A38;
- B6179;
- A608
- A610; and,
- A609.

4.6.3 There is a significant increase in traffic volumes on the B6179 as a result of the developments on the edge of Derby within Amber Valley. This is because the B6179 provides an access route between Ripley and Derby City via the A38. Similar increases in traffic volume ranging between 100 pcus and 300 pcus are observed along the A38 and the A608 in peak hours.

4.6.4 The residential developments in Amber Valley also cause significant increases in traffic volumes on the A610 to the East of Ripley. This is because the A610 provides an alternative route to the M1 as well as access to the Nottingham area.

4.7 Amber Valley - Junction Congestion

4.7.1 A junction is considered to become congested when the Reference Case V/C ratio is less than 85% and due to the impact of development it increases to over 85% in the With Development scenario. The increase in V/C ratio is presented for such junctions and are colour coded amber, red and dark red. The red and dark red represent the junctions with higher increases in congestion due to development.

4.7.2 Figures 7 and 8 show the forecast increase in junction congestion between the Reference Case and the 'With Development' (No Mitigation) scenarios for the morning and evening peak hours respectively.

4.7.3 There are a limited number of junctions that are taken over capacity in Amber Valley in the morning peak, with a larger impact in the evening peak hour. Significant increases in junction congestion are forecast at junctions in the vicinity of Kilburn, Lower Kilburn and Horsley due to the increased demand along the A38, A610 and B6179.

4.7.4 During the morning peak, areas forecast to be affected by increased congestion include Alfreton and some villages east of Ripley.

4.7.5 During the evening peak, areas forecast to be affected by increased levels of congestion include Somercotes, Codnor, Kilburn and Smalley.

4.7.6 There are a number of junctions within Ripley and Codnor, where development traffic is forecast to increase traffic flows resulting in increased congestion. The main junctions include;

- The A610 junction with A38 which is also affected by the increase in traffic flows;
- The A610 junction with Coach Road and Alfreton Road in Condor; and
- The B600 junctions with Cotes Park lane Swanwick Road and Swanwick Road junction with Green Hill Lane in Somercotes.

Figure 5. Flow Difference – Reference Case vs With Development Scenario – Amber Valley – Morning Peak

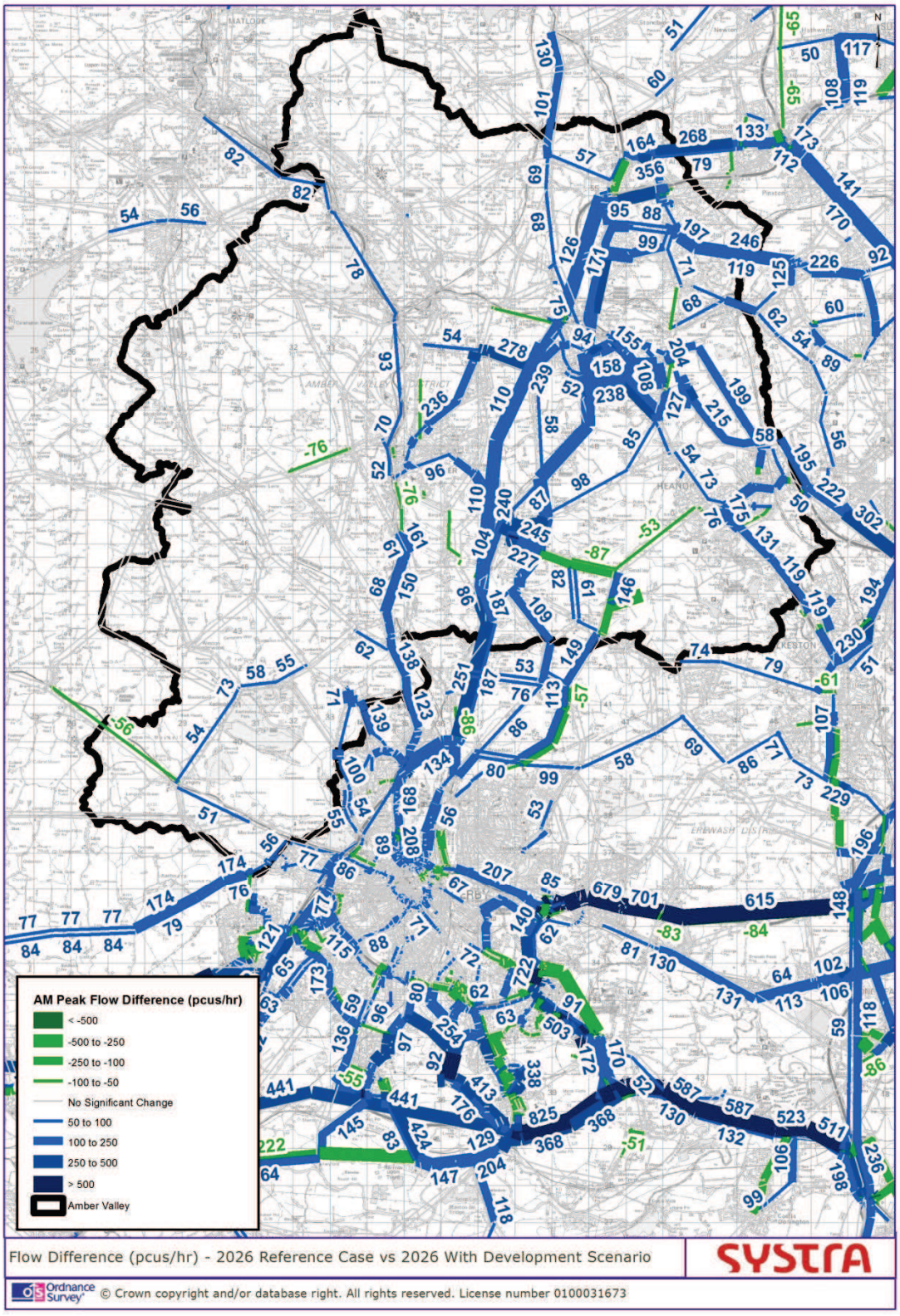
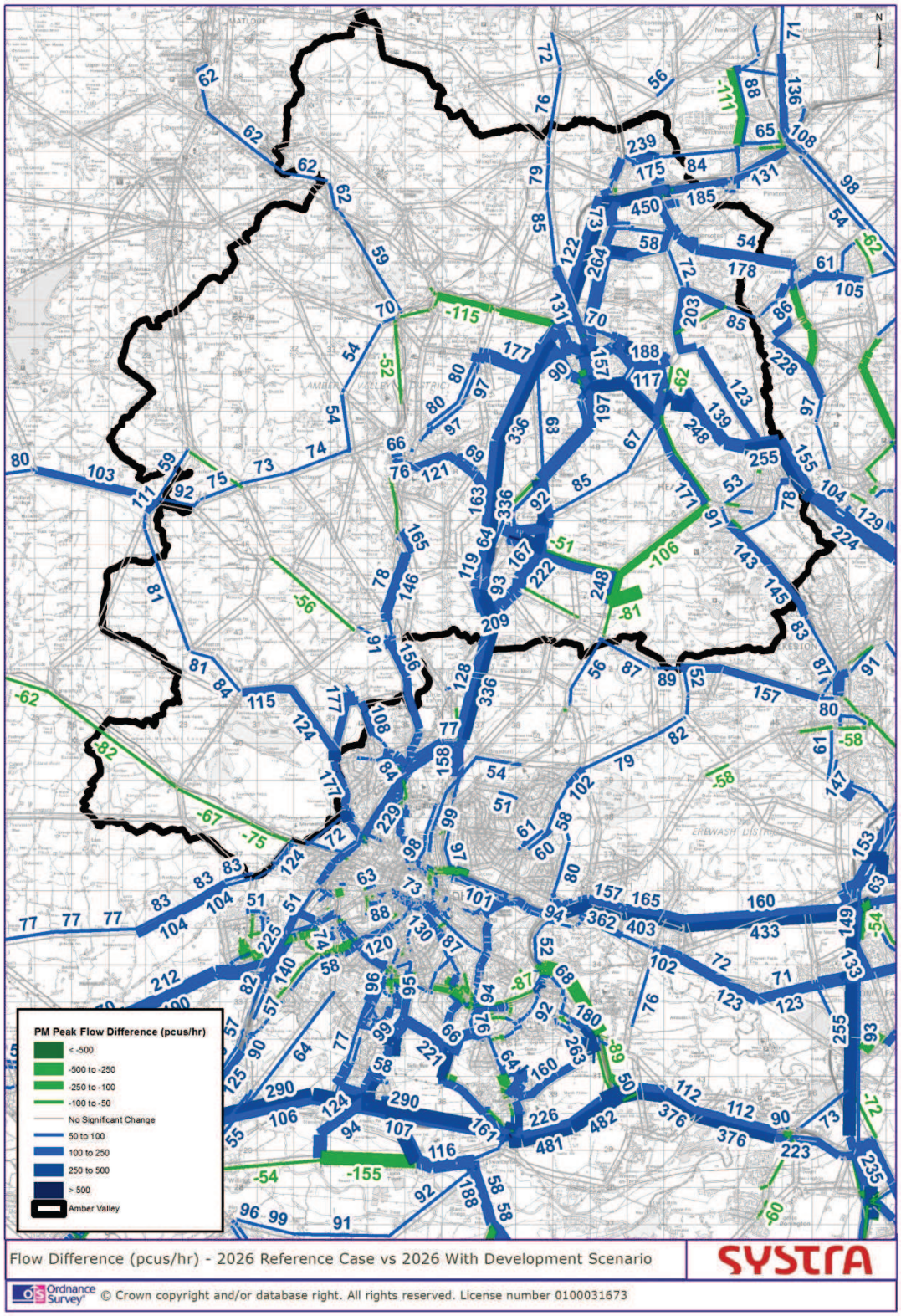



Figure 6. Flow Difference – Reference Case vs With Development Scenario – Amber Valley – Evening Peak