



Issues and Options Assessment

Broomfield, Chignal and Little Waltham Parish Council

January 2016

**Chelmsford City Council Issues and Options Transport Assessment
January 2016**



Quality Assurance

Site name: Issues and Options Assessment

Client name: Broomfield, Chignal and Little Waltham Parish Council's

Type of report: Option Assessment

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Signed

A handwritten signature in black ink, appearing to be "S. Amann", written over a horizontal line.

Date January 2016



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1 INTRODUCTION

Brief

- 1.1 Journey Transport Planning Ltd has been instructed by the Parish Councils of Broomfield, Chignal and Little Waltham, to undertake an assessment of likely traffic impacts that could be associated with the proposed growth scenarios outlined in Chelmsford City Council's Issues and Options Consultation Document, November 2015.

Background

- 1.2 Specifically this report provides a desk-top analysis of the likely traffic impact of a western 'relief road' on the west Chelmsford area, taking account of the level of development suggested in the City Consultation Document and of further development (e.g. in the next planning period) which would be likely to follow.
- 1.3 The study provides an assessment of the impact of the following development scenarios on traffic flows and volumes west of Chelmsford in relation to the following client identified zones:
- Zone A: A12 to A1060 (Highwood and Writtle)
 - Zone B: Western approach to City Centre on A1060
 - Zone C: B1008 Main Road/Broomfield Road from Broomfield Hospital to the City Centre
 - Zone D: A130 Essex Regiment Way from Sheepcotes Roundabout to Nabbotts Farm Roundabout
- 1.4 The zones have been assessed against the following identified development scenarios:
- Scenario 1: Development outlined in Options 1, 2 and 3 of Issues and Options Document in Locations:
 - 2 (west of Chelmsford/north of Writtle);
 - 3 (north and west of Broomfield);
 - 4 (north-east of Chelmsford/east of Little Waltham); and
 - 7 (Great Leighs).
 - Scenario 1A: With a 'Western Relief Road' from A414 to Sheepcotes Roundabout (junction of A130/A131) and North-Eastern Bypass (agreed route)



- Scenario 1B: North-Eastern Bypass but no 'Western Relief Road'
- Scenario 1C: North-Eastern Bypass and 'Western Relief Road' only between A414 and A1060
- Scenario 1D: No North-Eastern Bypass or 'Western Relief Road'

2 Base Traffic Assessment

- 2.1 The availability of suitable traffic data to support and inform the assessment has been investigated alongside discussions with officers at Essex County Council to determine the level of evidence and assessment that has been undertaken to support the proposed development growth scenarios for Chelmsford.
- 2.2 It is understood from discussions with Essex County Council that the proposed development scenarios set out in the Issues and Options consultation document are not supported by any detailed traffic modelling or assessment and that the work and detailed traffic studies to support these options is currently being undertaken and as such is not available for use in this assessment.
- 2.3 In consideration of the above the availability of alternative traffic data has been investigated in order to provide the basis for this assessment.
- 2.4 A number of traffic assessments that have been undertaken in the Chelmsford City Council area have been examined that could provide traffic data to inform this study have been examined including the developments at Broomfield Hospital, Channels and Greater Beaulieu Park.
- 2.5 Whilst the supporting applications and documentation for these developments provide a suitable level of traffic data for their local area impact analysis, the data available is not considered suitable for use in this assessment as it covers incomparable time periods and insufficient data to cover the areas identified for this study.
- 2.6 Given the foregoing alternative data has been examined in the form of data extracted from the Chelmsford SATURN Model (CSM) – Local Model Validation Report 2009.
- 2.7 The CSM was undertaken based on a 2007 PARAMICS model of the Chelmsford area validated with 2007 traffic data and developed to assess the impacts of various proposed junction and highway schemes.
- 2.8 The modelled network included all A and B category routes into the city centre and as such provides a suitable level of information to inform this study.
- 2.9 The time periods in the modelled in the CSM covered the 08:00-09:00 AM and 17:00-18:00 PM weekday peak periods and as such the traffic generation appraisal for the various development scenarios has been undertaken for the same time periods.
- 2.10 In the context of the area being studied and the availability of data, the following links from the model have been identified and utilised in this assessment.
 - B1008 Broomfield Road north of Valley Bridge

- B1008 Broomfield Road south of Valley Bridge
- Essex Regiment Way north of Valley Bridge
- Chelmer Valley Road south of Valley Bridge
- A1060 west of Chignal Road
- A1060 east of Chignal Road

2.11 The traffic surveys utilised in the modelling work were undertaken in 2007 and as such need to be validated in terms of their appropriateness for use in this assessment. In order to assess the suitability of the 2007 surveys, DfT traffic surveys for the A131 and Essex Regiment Way and the A1016 Roxwell Road have been examined. This data includes total Annual Average Daily Flows (AADF) along these links between 2007 and 2014. An examination of this data indicates that there has been little or no daily growth between 2007 and 2014. In consideration of this the 2007 flows are considered to be reasonably representative of the current 2016 base situation and as such are suitable to form the basis for an appropriately robust strategic assessment.

2.12 **Table 2.1** below provides a summary of the base AM and PM peak traffic flows on the strategic links in the network.

Table 2.1 Study Area 2007 Peak Hour Traffic Flow Summary

	AM Peak 08:00-09:00		PM Peak 17:00-18:00	
	Inbound	Outbound	Inbound	Outbound
B1008 Broomfield Road north of Valley Bridge	762	880	748	935
B1008 Broomfield Road south of Valley Bridge	878	655	535	1002
Essex Regiment Way north of White Hart Lane	1669	988	977	1538
Chelmer Valley Road south of Valley Bridge	1682	701	738	1363
A1060 West of Chignal Road	640	1093	989	722
A1060 East of Chignal Road	950	725	718	934

2.13 The data set out in Table 2.1 is illustrated in the base network flow diagrams in **Appendix 2**.



- 2.14 There was limited data available for Lordship Road Writtle and as such the CSM approximate flow range was utilised to represent 2007 flows on this link which gave a range of between 500 and 1000 movements in the peak periods. This range was attributed to the link assuming 500 northbound and 300 southbound in the AM with the reverse in the PM peak.

3 Issues and Options Traffic Generation

- 3.1 In accordance with the accepted methodology for Transport Assessment, the various development options have been considered with respect to the likely level of vehicular trips that could be generated.
- 3.2 In accordance with that methodology the TRICS 7.2.4 trip generation database has been interrogated to provide an estimate of the likely number of vehicular trips that could be generated by each option being considered.
- 3.3 Sites within the database have been interrogated to consider sites that are similar in land use, location and size to the options being considered.
- 3.4 **Table 3.1** summarises the trip generation rates that could be associated with a large residential allocation in the Chelmsford City Council area.

Table 3.1 TRICS Residential Vehicular Trip Rate Summary

	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Arrivals	Departures	Arrivals	Departures
Residential Trip Rate per unit	0.116	0.331	0.247	0.120

- 3.5 In addition to the residential rates, the database has also been interrogated to define the rates associated with the proposed business park options.
- 3.6 **Table 3.2** summarises the trip generation rates that could be associated with business park development in the Chelmsford City Council area.

Table 3.2 TRICS Business Park Vehicular Trip Rate Summary

	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Arrivals	Departures	Arrivals	Departures
Business Park Trip Rate per 100sqm	1.397	0.245	0.172	1.107

- 3.7 The trip generation rates set out above represent unconstrained rates for standalone residential and business park developments and do not take account of potential improvements to public transport, cycling and pedestrian infrastructure.
- 3.8 The rates set out in **Table 3.1 and 3.2** have been applied to the various development options set out in the Chelmsford City Council Issues and Options and summarised in Section 4.

3.9 The TRICS data is held in **Appendix 1**.

Trip Distribution

3.10 The likely distribution of trips associated with the development options has been assessed against the choice, length and availability of routes from the specified development areas in conjunction with information relating to Chelmsford based commuting destinations as set out in Figure 8 of the Chelmsford Local Plan Issues and Options Consultation report.

3.11 The data indicates that 63% of Chelmsford workers work and live in Chelmsford with the remaining 37% out-commuting. The information indicates that commuting flows to the west of Chelmsford are minimal and as such the west has not been highlighted as a commuting direction; as such in order to provide a robust appraisal in this assessment, a nominal 2% of out-commuting development traffic has been distributed to the west.

3.12 In view of the above, generated traffic from the proposed Scenarios has been distributed in the following manner:

- Chelmsford Town Centre 63%
- North (Braintree/Stansted /A120) 5%
- North East (Colchester/Maldon) 5%
- South (London/Brentwood/Basildon) 25%
- West (Harlow) 2%

4 Development Options

Chelmsford Local Plan Development Options

- 4.1 Within each of the Options, only the development proposals likely to have an impact on the identified transport corridors/zones have been assessed.

Option1 Urban Focus

- 4.2 This option considers the following development proposals:

- 3,000 homes west Chelmsford
- 3,000 homes north east Chelmsford + 45,000 sqm B1 + R&D
- 1,500 homes Broomfield
- 2,000 homes Great Leighs

- 4.3 **Table 4.1** summarises the trips generation that could be associated with the development aspirations set out in Option 1.

Table 4.1 Option 1 Vehicular Trip Generation Summary

	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Arrivals	Departures	Arrivals	Departures
Business Park Trips per 100sqm	628	110	77	498
3000 Residential West Chelmsford	348	993	741	360
3000 Residential NE Chelmsford	348	993	741	360
1500 Residential Broomfield	174	496	370	180
2,000 Residential Gt Leighs	232	662	494	240
Total Trips	1730	3254	2423	1638

- 4.4 **Table 4.1** indicates that Option 1 would generate around 5000 additional vehicular trips in the AM peak and 4000 trips in the PM peak on the western and north east corridors.

Option2 Urban Focus and Growth on Strategic Transport Corridor

4.5 This option considers the following development proposals:

- 2,500 homes west Chelmsford
- 2,500 homes north east Chelmsford + 40,000 sqm B1 + R&D
- 1,250 homes Broomfield
- 1,500 homes Great Leighs

4.6 **Table 4.4** summarises the trips generation that could be associated with the development aspirations set out in Option 2.

Table 4.4 Option 2 Vehicular Trip Generation Summary

	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Arrivals	Departures	Arrivals	Departures
Business Park Trips per 40000sqm	559	98	69	443
2500 Residential West Chelmsford	290	828	618	300
2500 Residential NE Chelmsford	290	828	618	300
1250 Residential Broomfield	145	414	309	150
1,500 Residential Gt Leighs	174	497	371	180
Total Trips	1458	2663	1983	1373

4.7 **Table 4.4** indicates that Option 2 would generate around 4120 additional vehicular trips in the AM peak and 3350 trips in the PM peak on the western and north east corridors.

Option 3 Urban Focus and Growth in Key Villages

4.8 This option considers the following development proposals:

- 2,250 homes west Chelmsford

- 2,250 homes north east Chelmsford + 40,000 sqm B1 + R&D
- 750 homes Broomfield
- 1,000 homes Great Leighs

4.9 **Table 4.6** summarises the trips generation that could be associated with the development aspirations set out in Option 3.

Table 4.6 Option 3 Vehicular Trip Generation Summary

	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
	Arrivals	Departures	Arrivals	Departures
Business Park Trips per 40000sqm	559	98	69	443
2250 Residential West Chelmsford	261	745	556	270
2250 Residential NE Chelmsford	261	745	556	270
750 Residential Broomfield	87	248	185	90
1,000 Residential Gt Leighs	116	331	247	120
Total Trips	1284	2167	1613	1193

4.10 **Table 4.6** indicates that Option 3 would generate around 3450 additional vehicular trips in the AM peak and 2800 trips in the PM peak on the western and north east corridors.

5 Scenario Tests

- 5.1 Each of the identified development Options as set out in the Chelmsford Local Plan Issues and Options Consultation Document November 2015, have been assessed in the context of both the existing and potential improvements to the Chelmsford Strategic Road network.
- 5.2 The network assessment diagrams are held in **Appendix 2**. The information in these diagrams provides the basis for the assessment.

Scenario 1A Testing

- 5.3 The various development options have all been tested on an improved highway network assuming a North Eastern Bypass and a Western Relief Road.
- 5.4 The results of the assessment indicate that 25% southbound (out of Chelmsford) traffic both development and existing would be likely to re-assign from Broomfield Road and Essex Regiment Way and follow the North Eastern Bypass to access the A12 or the Western Relief Road to the A414.

Option 1 Results

- 5.5 The modelling indicates that the impact of Option 1 development on the identified zones as follows:

<ul style="list-style-type: none"> • Zone A Lordship Road Writtle 			
		AM Peak	PM Peak
○ Lordship Road northbound	-25%	-25%	
○ Lordship Road southbound	-25%	-25%	
<ul style="list-style-type: none"> • Zone B Western Approach A1060 			
		AM Peak	PM Peak
○ Roxwell Road Eastbound	65%	-3%	
○ Roxwell Road Westbound	-4%	35%	
<ul style="list-style-type: none"> • Zone C Broomfield Road 			
		AM Peak	PM Peak
○ Broomfield Road northbound	-7%	7%	

○ Broomfield Road southbound	28%	-3%
• Zone D Essex Regiment Way		
	AM Peak	PM Peak
○ Essex Regiment Way Southbound	37%	43%
○ Essex Regiment Way Northbound	47%	24%

Option 2 Results

5.6 The modelling indicates that the impact of Option 2 development on the identified zones as follows:

• Zone A Lordship Road Writtle		
	AM Peak	PM Peak
○ Lordship Road northbound	-25%	-25%
○ Lordship Road southbound	-25%	-25%
• Zone B Western Approach A1060		
	AM Peak	PM Peak
○ Roxwell Road Eastbound	49%	-6%
○ Roxwell Road Westbound	-8%	24%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	-9%	2%
○ Broomfield Road southbound	19%	-7%
• Zone D Essex Regiment Way		
	AM Peak	PM Peak
○ Essex Regiment Way Southbound	26%	32%
○ Essex Regiment Way Northbound	38%	14%

Option 3 Results

5.7 The modelling indicates that the impact of Option 3 development on the identified zones as follows:

Zone A Lordship Road Writtle			
		AM Peak	PM Peak
○ Lordship Road northbound		-25%	-25%
○ Lordship Road southbound		-25%	-25%
Zone B Western Approach A1060			
		AM Peak	PM Peak
○ Roxwell Road Eastbound		41%	-8%
○ Roxwell Road Westbound		-10%	19%
Zone C Broomfield Road			
		AM Peak	PM Peak
○ Broomfield Road northbound		-14%	-8%
○ Broomfield Road southbound		3%	-13%
Zone D Essex Regiment Way			
		AM Peak	PM Peak
○ Essex Regiment Way Southbound		15%	26%
○ Essex Regiment Way Northbound		32%	6%

Scenario 1B Testing

5.8 The various development options have all been tested on an improved highway network assuming a North Eastern Bypass only.

5.9 The results of the assessment indicate that 25% southbound (out of Chelmsford) traffic both development and existing would be likely to re-assign from Broomfield Road and Essex Regiment Way and follow the North Eastern Bypass to access the A12.

Option 1

5.10 The modelling indicates that the impact of Option 1 development on the identified zones as follows:

• Zone A Lordship Road Writtle		
	AM Peak	PM Peak
○ Lordship Road northbound	17%	62%
○ Lordship Road southbound	83%	18%
• Zone B Western Approach A1060		
	AM Peak	PM Peak
○ Roxwell Road Eastbound	120%	29%
○ Roxwell Road Westbound	26%	80%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	-7%	7%
○ Broomfield Road southbound	28%	-3%
• Zone D Essex Regiment Way		
	AM Peak	PM Peak
○ Essex Regiment Way Southbound	37%	43%
○ Essex Regiment Way Northbound	47%	24%

Option 2

5.11 The modelling indicates that the impact of Option 2 development on the identified zones as follows:

• Zone A Lordship Road Writtle		
	AM Peak	PM Peak
○ Lordship Road northbound	15%	52%
○ Lordship Road southbound	69%	15%
• Zone B Western Approach A1060		
	AM Peak	PM Peak

○ Roxwell Road Eastbound	98%	25%
○ Roxwell Road Westbound	23%	66%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	-9%	2%
○ Broomfield Road southbound	19%	-7%
• Zone D Essex Regiment Way		
	AM Peak	PM Peak
○ Essex Regiment Way Southbound	26%	32%
○ Essex Regiment Way Northbound	38%	14%

Option 3

5.12 The modelling indicates the impact of Option 3 development on the identified zones as follows:

• Zone A Lordship Road Writtle		
	AM Peak	PM Peak
○ Lordship Road northbound	13%	46%
○ Lordship Road southbound	62%	14%
• Zone B Western Approach A1060		
	AM Peak	PM Peak
○ Roxwell Road Eastbound	88%	22%
○ Roxwell Road Westbound	20%	59%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	-14%	-8%
○ Broomfield Road southbound	3%	-13%
• Zone D Essex Regiment Way		

	AM Peak	PM Peak
○ Essex Regiment Way Southbound	15%	26%
○ Essex Regiment Way Northbound	32%	6%

Scenario 1C Testing

- 5.13 The various development options have all been tested on an improved highway network assuming a North Eastern Bypass and partial Western Bypass between A1060 and A1414.
- 5.14 The results of the assessment indicate that 25% southbound (out of Chelmsford) traffic both development and existing would be likely to re-assign from Broomfield Road and Essex Regiment Way and follow the North Eastern Bypass to access the A12 and 25% of existing and development traffic would re-assign via the new partial Western Bypass.

Option 1

- 5.15 The modelling indicates that the impact of Option 1 development on the identified zones as follows:

- **Zone A Lordship Road Writtle**

	AM Peak	PM Peak
○ Lordship Road northbound	-25%	-25%
○ Lordship Road southbound	-25%	-25%

- **Zone B Western Approach A1060**

	AM Peak	PM Peak
○ Roxwell Road Eastbound	65%	-3%
○ Roxwell Road Westbound	-6%	35%

- **Zone C Broomfield Road**

	AM Peak	PM Peak
○ Broomfield Road northbound	25%	7%
○ Broomfield Road southbound	28%	-3%

- **Zone D Essex Regiment Way**

	AM Peak	PM Peak
○ Essex Regiment Way Southbound	37%	43%
○ Essex Regiment Way Northbound	47%	24%

Option 2

5.16 The modelling indicates the impact of Option 2 development on the identified zones as follows:

- **Zone A Lordship Road Writtle**

	AM Peak	PM Peak
○ Lordship Road northbound	-25%	-25%
○ Lordship Road southbound	-25%	-25%

- **Zone B Western Approach A1060**

	AM Peak	PM Peak
○ Roxwell Road Eastbound	49%	-6%
○ Roxwell Road Westbound	-8%	24%

- **Zone C Broomfield Road**

	AM Peak	PM Peak
○ Broomfield Road northbound	-9%	2%
○ Broomfield Road southbound	19%	-7%

- **Zone D Essex Regiment Way**

	AM Peak	PM Peak
○ Essex Regiment Way Southbound	26%	32%
○ Essex Regiment Way Northbound	38%	14%

Option 3

5.17 The modelling indicates the impact of Option 3 development on the identified zones as follows:

- **Zone A Lordship Road Writtle**

AM Peak	PM Peak
---------	---------

○ Lordship Road northbound	-25%	-25%
○ Lordship Road southbound	-25%	-25%
• Zone B Western Approach A1060		
	AM Peak	PM Peak
○ Roxwell Road Eastbound	41%	-8%
○ Roxwell Road Westbound	-10%	19%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	-14%	-8%
○ Broomfield Road southbound	3%	-13%
• Zone D Essex Regiment Way		
	AM Peak	PM Peak
○ Essex Regiment Way Southbound	15%	26%
○ Essex Regiment Way Northbound	32%	6%

Scenario 1D

- 5.18 The various development options have all been tested on the base situation without any highway infrastructure improvements.

Option 1

- 5.19 The modelling indicates that the impact of Option 1 development on the identified zones as follows:

• Zone A Lordship Road Writtle		
	AM Peak	PM Peak
○ Lordship Road northbound	17%	62%
○ Lordship Road southbound	83%	18%
• Zone B Western Approach A1060		
	AM Peak	PM Peak

○ Roxwell Road Eastbound	120%	29%
○ Roxwell Road Westbound	26%	80%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	25%	43%
○ Broomfield Road southbound	70%	29%
• Zone D Essex Regiment Way		
	AM Peak	PM Peak
○ Essex Regiment Way Southbound	95%	105%
○ Essex Regiment Way Northbound	110%	77%

Option 2

5.20 The modelling indicates the impact of Option 2 development on the identified zones as follows:

• Zone A Lordship Road Writtle		
	AM Peak	PM Peak
○ Lordship Road northbound	15%	52%
○ Lordship Road southbound	69%	15%
• Zone B Western Approach A1060		
	AM Peak	PM Peak
○ Roxwell Road Eastbound	98%	25%
○ Roxwell Road Westbound	23%	66%
• Zone C Broomfield Road		
	AM Peak	PM Peak
○ Broomfield Road northbound	21%	35%
○ Broomfield Road southbound	59%	24%
• Zone D Essex Regiment Way		

	AM Peak	PM Peak
○ Essex Regiment Way Southbound	79%	88%
○ Essex Regiment Way Northbound	97%	63%

Option 3

5.21 The modelling indicates the impact of Option 3 development on the identified zones as follows:

- **Zone A Lordship Road Writtle**

	AM Peak	PM Peak
○ Lordship Road northbound	13%	46%
○ Lordship Road southbound	62%	14%

- **Zone B Western Approach A1060**

	AM Peak	PM Peak
○ Roxwell Road Eastbound	88%	22%
○ Roxwell Road Westbound	20%	59%

- **Zone C Broomfield Road**

	AM Peak	PM Peak
○ Broomfield Road northbound	14%	22%
○ Broomfield Road southbound	37%	16%

- **Zone D Essex Regiment Way**

	AM Peak	PM Peak
○ Essex Regiment Way Southbound	64%	80%
○ Essex Regiment Way Northbound	89%	52%

Scenario 2

5.22 This Scenario tests the development option outlined in option 1 with the addition of 7200 houses in the western zone with the western and north eastern bypass.

Option 1 plus Infill

5.23 The modelling indicates that the impact of Option 1 plus infill development on the identified zones as follows:

• Zone A Lordship Road Writtle			
		AM Peak	PM Peak
○ Lordship Road northbound	-25%	-25%	
○ Lordship Road southbound	-25%	-25%	
• Zone B Western Approach A1060			
		AM Peak	PM Peak
○ Roxwell Road Eastbound	240%	38%	
○ Roxwell Road Westbound	20%	150%	
• Zone C Broomfield Road			
		AM Peak	PM Peak
○ Broomfield Road northbound	0%	-3%	
○ Broomfield Road southbound	-7%	7%	
• Zone D Essex Regiment Way			
		AM Peak	PM Peak
○ Essex Regiment Way Southbound	37%	43%	
○ Essex Regiment Way Northbound	47%	24%	

Scenario 3

5.24 Assuming no significant development in any of the identified locations, based on the trip distribution assumptions set out in 4.7 and various modelling test results, the implementation of a North East Bypass would be likely to reduce peak hour flows on the Broomfield and Essex Regiment Way corridors by around 25% on current levels.

6 Summary and Conclusions

Summary

- 6.1 A range of high level strategic tests have been undertaken on the strategic Chelmsford highway network for the northern and western approaches using broad evidence based assumptions utilising surveyed data from the Chelmsford Saturn Model and trip distribution data based on Official National Statistics census data.
- 6.2 The testing was based on the development scenarios outlined in options 1, 2 and 3 of the Chelmsford Local Plan, Issue and Options Consultation, Nov 2015.
- 6.3 All trip generation data for the various development options was based on the application of TRICS trip generation rates on the various scenarios in accordance with industry standard practice.
- 6.4 The impact of the development options was assessed on four separate travel zones/corridors:
- Zone A: A12 to A1060 (Highwood and Writtle)
 - Zone B: Western approach to City Centre on A1060
 - Zone C: B1008 Main Road/Broomfield Road from Broomfield Hospital to the City Centre
 - Zone D: A130 Essex Regiment Way from Sheepcotes Roundabout to Nabbotts Farm Roundabout
- 6.5 Table 6.1 provides a summary of the impacts of Option 1 development on the identified Zones assuming the alternative highway infrastructure strategies.

Table 6.1 Option 1 Impact Summary

ZONE	Scenario 1A		Scenario 1B		Scenario 1C		Scenario 1D	
	AM	PM	AM	PM	AM	PM	AM	PM
A Lordship Rd Northbound	-25%	-25%	17%	62%	-25%	-25%	17%	62%
A Lordship Rd Southbound	-25%	-25%	83%	18%	-25%	-25%	83%	18%
B Roxwell Road Eastbound	65%	-3%	120%	29%	65%	-3%	120%	29%
B Roxwell Road Westbound	-4%	35%	26%	80%	-6%	35%	26%	80%
C Broomfield Rd Northbound	-7%	7%	-7%	7%	25%	7%	25%	43%
C Broomfield Rd Southbound	28%	-3%	28%	-3%	28%	-3%	70%	29%
D Essex R Way Southbound	37%	43%	37%	43%	37%	43%	95%	105%
D Essex R Way Northbound	47%	24%	47%	24%	47%	24%	110%	63%

6.6 Table 6.2 provides a summary of the impacts of Option 2 development on the identified Zones assuming the alternative highway infrastructure strategies.

Table 6.2 Option 2 Impact Summary

ZONE	Scenario 1A		Scenario 1B		Scenario 1C		Scenario 1D	
	AM	PM	AM	PM	AM	PM	AM	PM
A Lordship Rd Northbound	-25%	-25%	15%	52%	-25%	-25%	15%	52%
A Lordship Rd Southbound	-25%	-25%	69%	15%	-25%	-25%	69%	15%
B Roxwell Road Eastbound	49%	-6%	98%	25%	49%	-6%	98%	25%
B Roxwell Road Westbound	-8%	24%	23%	66%	-8%	24%	23%	66%
C Broomfield Rd Northbound	-9%	2%	-9%	2%	-9%	2%	21%	35%
C Broomfield Rd Southbound	19%	-7%	19%	-7%	19%	-7%	59%	24%
D Essex R Way Southbound	26%	32%	26%	32%	26%	32%	79%	99%
D Essex R Way Northbound	38%	14%	38%	14%	38%	14%	97%	63%

6.7 Table 6.3 provides a summary of the impacts of Option 3 development on the identified Zones assuming the alternative highway infrastructure strategies.

Table 6.3 Option 3 Impact Summary

ZONE	Scenario 1A		Scenario 1B		Scenario 1C		Scenario 1D	
	AM	PM	AM	PM	AM	PM	AM	PM
A Lordship Rd Northbound	-25%	-25%	13%	46%	-25%	-25%	13%	46%
A Lordship Rd Southbound	-25%	-25%	62%	14%	-25%	-25%	62%	14%
B Roxwell Road Eastbound	41%	-8%	88%	22%	41%	-8%	88%	22%
B Roxwell Road Westbound	-10%	19%	20%	59%	-10%	19%	20%	59%
C Broomfield Rd Northbound	-14%	-8%	-14%	-8%	-14%	-8%	14%	22%
C Broomfield Rd Southbound	3%	-13%	3%	-13%	3%	-13%	37%	16%
D Essex R Way Southbound	15%	26%	15%	26%	15%	26%	64%	80%
D Essex R Way Northbound	32%	6%	32%	6%	32%	6%	89%	52%

6.8 In terms of overall impact the summary indicates that Option 1 development as outlined in the Issues and Options report will have the greatest adverse impact on the Zones being considered, followed by Option 2 and then Option 3.

6.9 The impact summary tables indicate that the provision of a western relief road would offer substantial benefits for Zone A (Writtle/Highwood) as it would remove a significant proportion of both existing and development traffic from the Writtle through routes.

6.10 A western relief road would also reduce the impact of existing and through traffic on the Zone B the A1060 approach to Chelmsford.

6.11 Notwithstanding the above it makes no difference to Zone A or B whether the relief road is the full version as in Scenario 1A or partial as in Scenario 1C as the benefits are likely to be the same.

- 6.12 With respect to Zone C (Broomfield) the provision of a Western Relief Road is likely to make no difference to the impact on this corridor as potentially divertible development and existing traffic can utilise the North Eastern Bypass, so whilst some of this traffic may use the Western Relief Road if it were to be provided, in its absence that traffic would utilise the North Eastern Bypass as it fulfils the same purpose and as such there is limited value in providing a complete Western Relief Road.
- 6.13 Similarly, with regard to Zone D (Essex Regiment Way) as evidenced by the modelling results, the provision of a Western Relief Road will make little or no difference to the impact along this corridor as the provision of a North Eastern Bypass fulfil the same function over a shorter and more direct route to the A12 and the south.
- 6.14 The traffic modelling also indicates clearly that in the absence of either a North East Bypass or Western Relief Road, the traffic impacts on all the identified zones will be significant and substantial.
- 6.15 With respect to Scenario 2, infill development between Broomfield and Newland Spring, such an option is likely to have a very significant impact on Zone B the Chelmsford western approach A1060 as traffic heading into the City from such a development would be unlikely to utilise the Western Bypass to access the Broomfield access corridor as it would be longer and less direct. In view of this, the value of a full Western Relief Road to north of Broomfield would be limited.
- 6.16 In the context of Scenario 3, assuming no significant development in any of the identified locations, the implementation of a North East Bypass would be likely to reduce peak hour flows on the Broomfield and Essex Regiment Way corridors by around 25% on current levels.

Conclusions

- 6.17 Based on the foregoing assessment, the following conclusions can be drawn:
- All of the tested options for development as set out in the Issues and Options consultation will have a significantly adverse and potentially unacceptable impact on all the identified Zones in the absence of a North East Bypass
 - Growth options 1 2 and 3 without at least a partial Western Relief Road between the A1060 and the A1414 are likely to lead to an unacceptable increase in traffic volumes on both the western approaches A1060 and the routes through Writtle to the A12.
 - A partial Western Relief Road will provide significant benefits for both the Zone A (Writtle Corridor) and Zone B (Western approaches A1060).



- The provision of a full Western Relief Road, alongside a North East Bypass will not provide any significant benefit in the context of either existing traffic patterns or the growth options being considered in the Issues and Options consultation report.
- A significant Infill development with a full Western Relief Road and the development identified in Option 1 of the Issues and Options Consultation would be likely to result in an unacceptable increase in traffic flow on the Zone B A1060 Chelmsford west approach in the absence of alternative connections to the City Centre.

6.18 In consideration of the foregoing assessment, there is no evidence to support the provision of a Chelmsford Western Relief Road as outlined in the Chelmsford Local Plan Issues and Options Consultation report November 2014 and moreover the provision of such infrastructure would not provide sufficient benefit in terms of alleviating Chelmsford's existing or projected traffic congestion on strategic routes into the City Centre.



Appendix 1
TRICS Data

Calculation Reference: AUDIT-757101-160105-0156

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : B - BUSINESS PARK
VEHICLES

Selected regions and areas:

02	SOUTH EAST	
	HC HAMPSHIRE	2 days
	HF HERTFORDSHIRE	1 days
04	EAST ANGLIA	
	NF NORFOLK	1 days
06	WEST MIDLANDS	
	HE HEREFORDSHIRE	1 days
07	YORKSHIRE & NORTH LINCOLNSHIRE	
	WY WEST YORKSHIRE	1 days
09	NORTH	
	TW TYNE & WEAR	3 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Filtering Stage 2 selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Gross floor area
Actual Range: 7400 to 121275 (units: sqm)
Range Selected by User: 5000 to 121275 (units: sqm)

Public Transport Provision:

Selection by: Include all surveys

Date Range: 01/01/07 to 23/04/14

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	1 days
Tuesday	1 days
Wednesday	1 days
Thursday	4 days
Friday	2 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	9 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaken using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	2
Edge of Town	6
Neighbourhood Centre (PPS6 Local Centre)	1

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	2
Commercial Zone	2
Retail Zone	1
Village	1
No Sub Category	3

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Filtering Stage 3 selection:

Use Class:

B1

7 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 1 mile:

1,001 to 5,000	2 days
5,001 to 10,000	1 days
10,001 to 15,000	3 days
15,001 to 20,000	1 days
20,001 to 25,000	1 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
25,001 to 50,000	1 days
50,001 to 75,000	1 days
125,001 to 250,000	2 days
250,001 to 500,000	4 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.5 or Less	1 days
0.6 to 1.0	5 days
1.1 to 1.5	2 days
1.6 to 2.0	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

Yes	2 days
No	7 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

TRIP RATE for Land Use 02 - EMPLOYMENT/B - BUSINESS PARK
VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	9	42355	0.549	9	42355	0.122	9	42355	0.671
08:00 - 09:00	9	42355	1.397	9	42355	0.245	9	42355	1.642
09:00 - 10:00	9	42355	0.649	9	42355	0.187	9	42355	0.836
10:00 - 11:00	9	42355	0.217	9	42355	0.169	9	42355	0.386
11:00 - 12:00	9	42355	0.234	9	42355	0.208	9	42355	0.442
12:00 - 13:00	9	42355	0.299	9	42355	0.409	9	42355	0.708
13:00 - 14:00	9	42355	0.391	9	42355	0.359	9	42355	0.750
14:00 - 15:00	9	42355	0.218	9	42355	0.270	9	42355	0.488
15:00 - 16:00	9	42355	0.203	9	42355	0.357	9	42355	0.560
16:00 - 17:00	9	42355	0.227	9	42355	0.734	9	42355	0.961
17:00 - 18:00	9	42355	0.172	9	42355	1.107	9	42355	1.279
18:00 - 19:00	8	46499	0.109	8	46499	0.433	8	46499	0.542
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:		4.665			4.600			9.265	

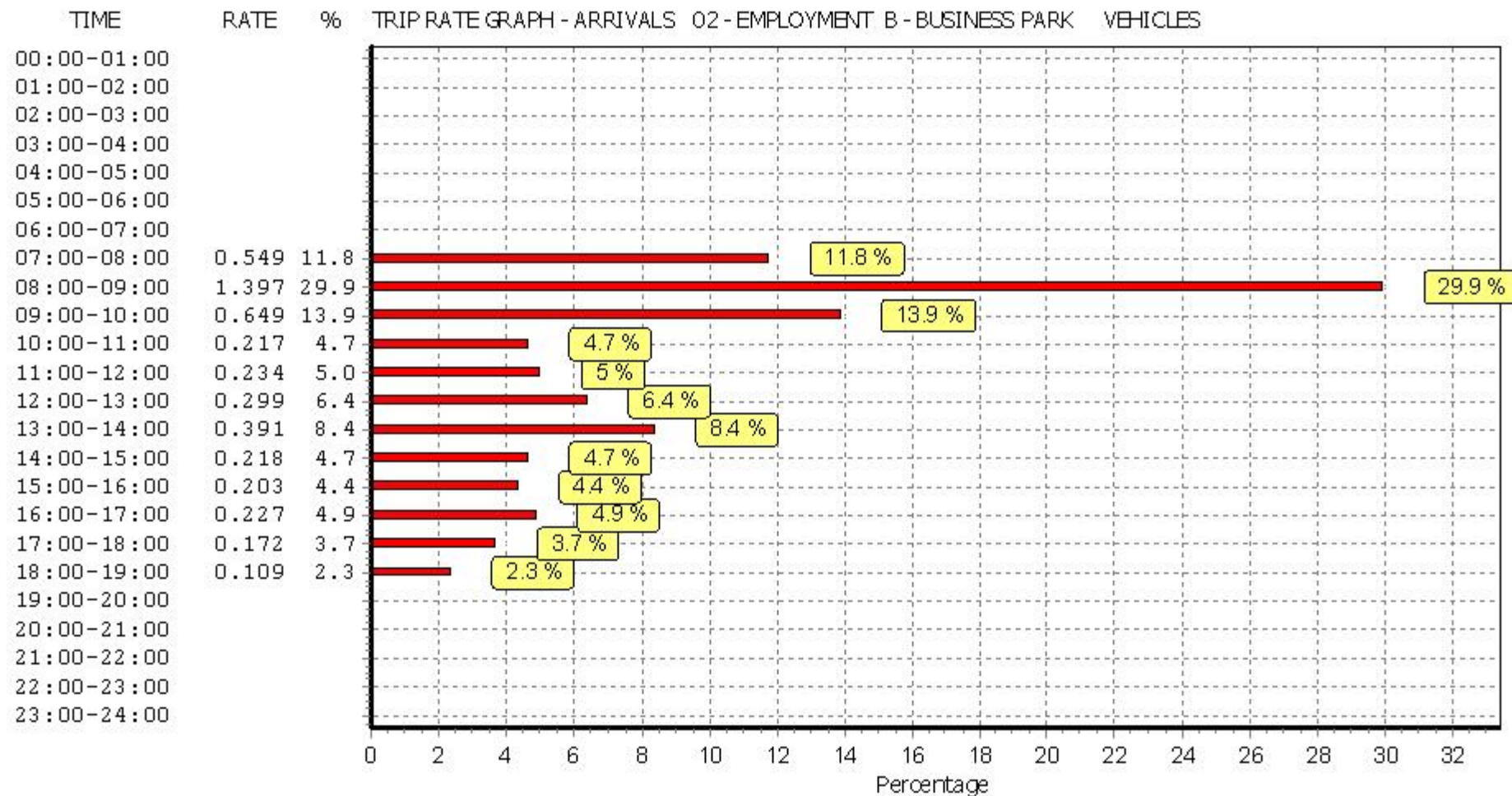
This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

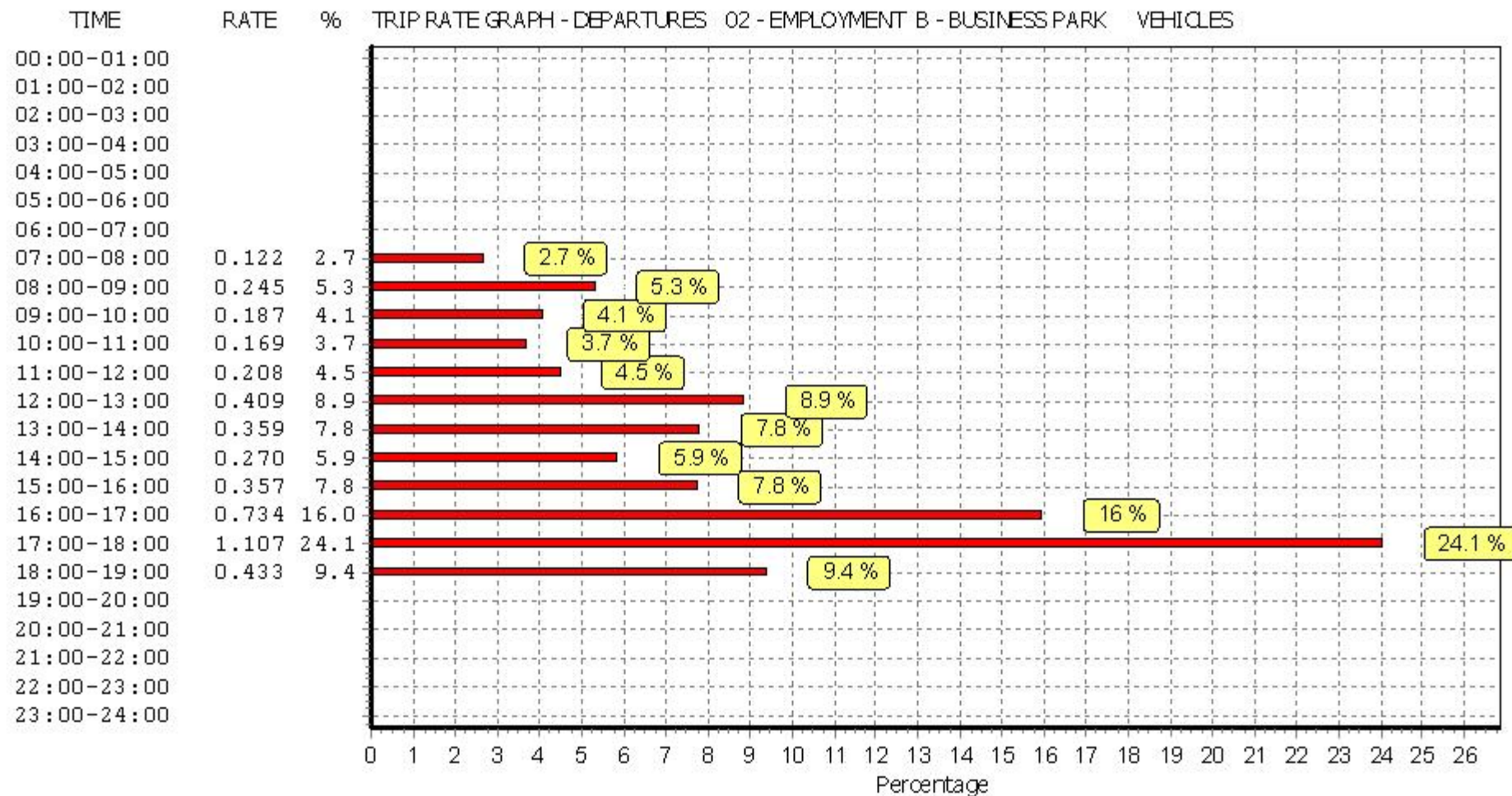
Parameter summary

Trip rate parameter range selected:	7400 - 121275 (units: sqm)
Survey date date range:	01/01/07 - 23/04/14
Number of weekdays (Monday-Friday):	9
Number of Saturdays:	0
Number of Sundays:	0
Surveys manually removed from selection:	0

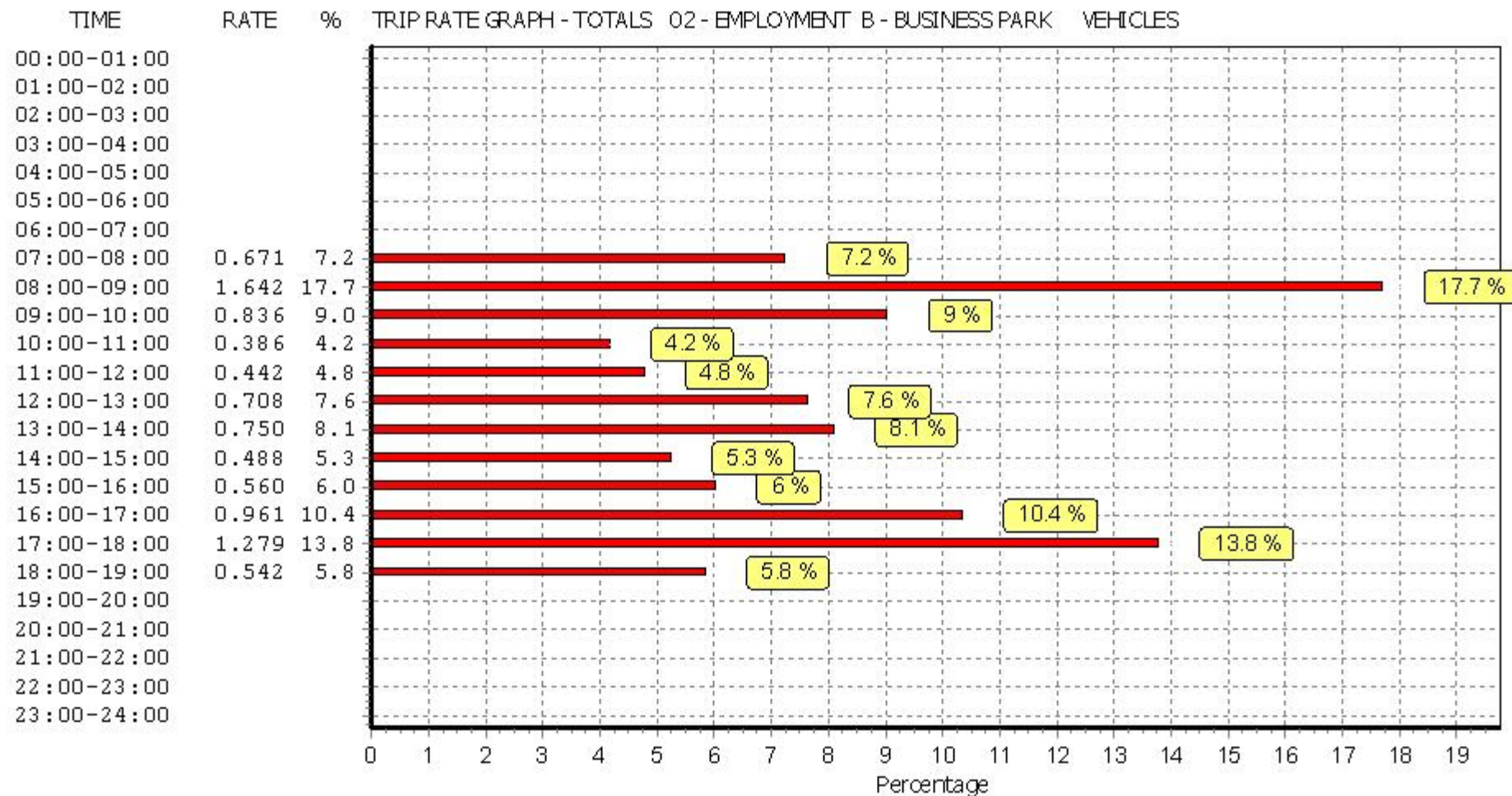
This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

Calculation Reference: AUDIT-757101-160105-0141

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 03 - RESIDENTIAL
Category : M - MIXED PRIVATE/AFFORDABLE HOUSING
VEHICLES

Selected regions and areas:

02	SOUTH EAST	
ES	EAST SUSSEX	2 days
HC	HAMPSHIRE	1 days
KC	KENT	1 days
SC	SURREY	3 days
WS	WEST SUSSEX	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Filtering Stage 2 selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter:	Number of dwellings
Actual Range:	103 to 500 (units:)
Range Selected by User:	100 to 1874 (units:)

Public Transport Provision:

Selection by:	Include all surveys
---------------	---------------------

Date Range: 01/01/07 to 04/11/15

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	1 days
Tuesday	1 days
Wednesday	3 days
Thursday	2 days
Friday	1 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	8 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaken using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	3
Edge of Town	3
Neighbourhood Centre (PPS6 Local Centre)	2

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Residential Zone	6
Village	2

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Filtering Stage 3 selection:

Use Class:

C3

8 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 1 mile:

1,000 or Less	1 days
1,001 to 5,000	1 days
5,001 to 10,000	3 days
15,001 to 20,000	1 days
20,001 to 25,000	1 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

25,001 to 50,000	1 days
50,001 to 75,000	1 days
75,001 to 100,000	1 days
100,001 to 125,000	1 days
125,001 to 250,000	4 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	1 days
1.1 to 1.5	4 days
1.6 to 2.0	3 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

Yes	6 days
No	2 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

LIST OF SITES relevant to selection parameters

1	ES-03-M-04	MIXED HOUSING		EAST SUSSEX
	SOUTH COAST ROAD			
	PEACEHAVEN			
	Edge of Town			
	Residential Zone			
	Total Number of dwellings:		188	
2	ES-03-M-05	HOUSES & FLATS		EAST SUSSEX
	A26 CROWBOROUGH RD			
	FIVE ASH DOWN VILLAGE			
	NEAR UCKFIELD			
	Neighbourhood Centre (PPS6 Local Centre)			
	Village			
	Total Number of dwellings:		138	
3	HC-03-M-06	HOUSES & FLATS		HAMPSHIRE
	HUNTS POND ROAD			
	TITCHFIELD			
	NEAR FAREHAM			
	Edge of Town			
	Residential Zone			
	Total Number of dwellings:		328	
4	KC-03-M-01	BLOCKS OF FLATS		KENT
	HIGH STREET			
	RAMSGATE			
	Suburban Area (PPS6 Out of Centre)			
	Residential Zone			
	Total Number of dwellings:		103	
5	SC-03-M-02	HOUSES & FLATS		SURREY
	DEEPCUT BRIDGE ROAD			
	DEEPCUT			
	NEAR FRIMLEY			
	Neighbourhood Centre (PPS6 Local Centre)			
	Village			
	Total Number of dwellings:		342	
6	SC-03-M-06	HOUSES & FLATS		SURREY
	ST ANNE'S DRIVE			
	REDHILL			
	Edge of Town			
	Residential Zone			
	Total Number of dwellings:		500	
7	SC-03-M-07	HOUSES/FLATS		SURREY
	EPSOM ROAD			
	GUILDFORD			
	Suburban Area (PPS6 Out of Centre)			
	Residential Zone			
	Total Number of dwellings:		199	
8	WS-03-M-04	HOUSES & FLATS		WEST SUSSEX
	SUMMERSDALE ROAD			
	CHICHESTER			
	Suburban Area (PPS6 Out of Centre)			
	Residential Zone			
	Total Number of dwellings:		214	

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 03 - RESIDENTIAL/M - MIXED PRIVATE/AFFORDABLE HOUSING
VEHICLES
Calculation factor: 1 DWELLS
BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate	No. Days	Ave. DWELLS	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	8	252	0.059	8	252	0.207	8	252	0.266
08:00 - 09:00	8	252	0.116	8	252	0.331	8	252	0.447
09:00 - 10:00	8	252	0.116	8	252	0.159	8	252	0.275
10:00 - 11:00	8	252	0.101	8	252	0.125	8	252	0.226
11:00 - 12:00	8	252	0.098	8	252	0.119	8	252	0.217
12:00 - 13:00	8	252	0.102	8	252	0.120	8	252	0.222
13:00 - 14:00	8	252	0.107	8	252	0.109	8	252	0.216
14:00 - 15:00	8	252	0.109	8	252	0.139	8	252	0.248
15:00 - 16:00	8	252	0.212	8	252	0.144	8	252	0.356
16:00 - 17:00	8	252	0.213	8	252	0.131	8	252	0.344
17:00 - 18:00	8	252	0.247	8	252	0.120	8	252	0.367
18:00 - 19:00	8	252	0.246	8	252	0.111	8	252	0.357
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			1.726			1.815			3.541

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

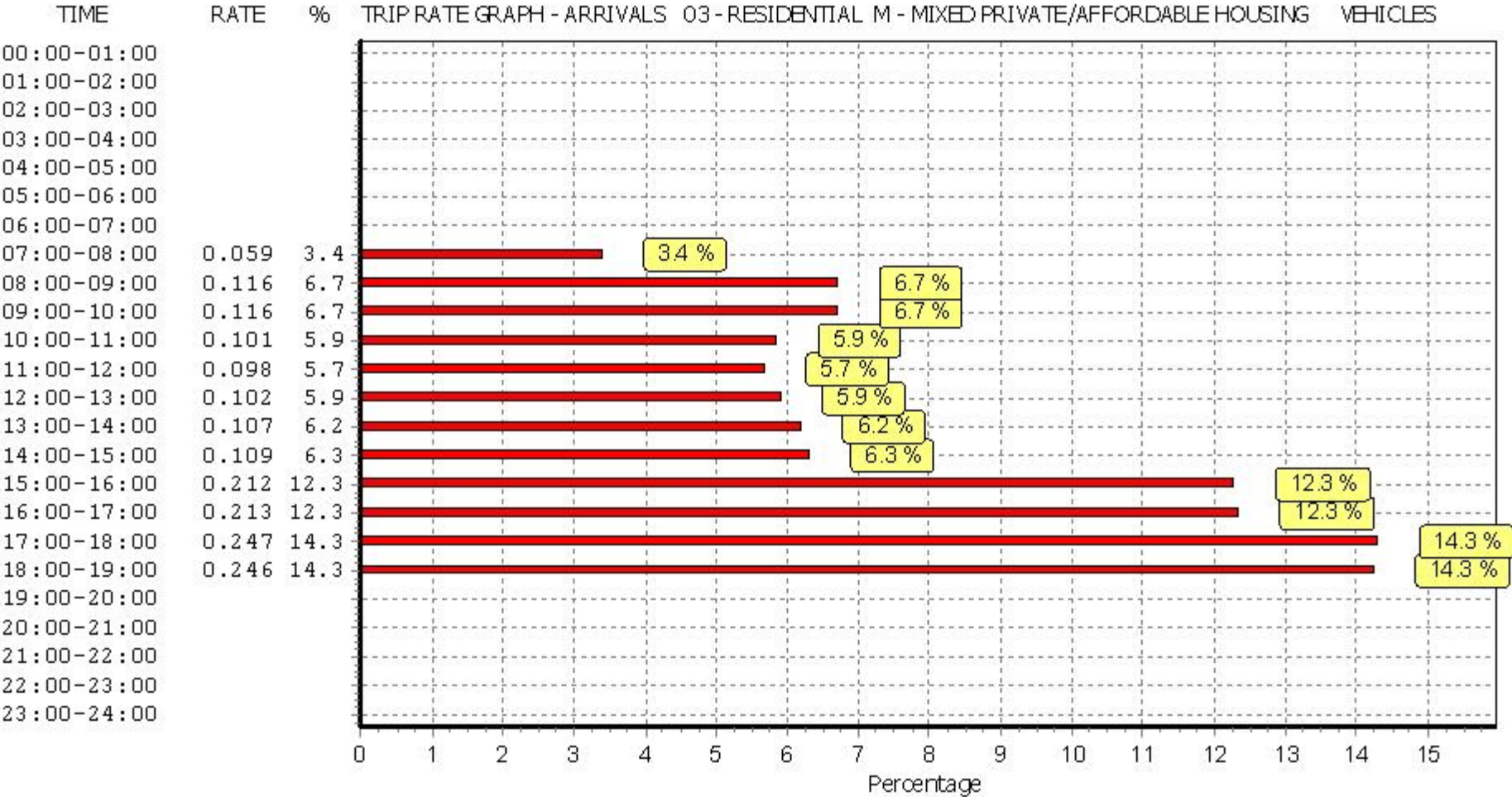
To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

Parameter summary

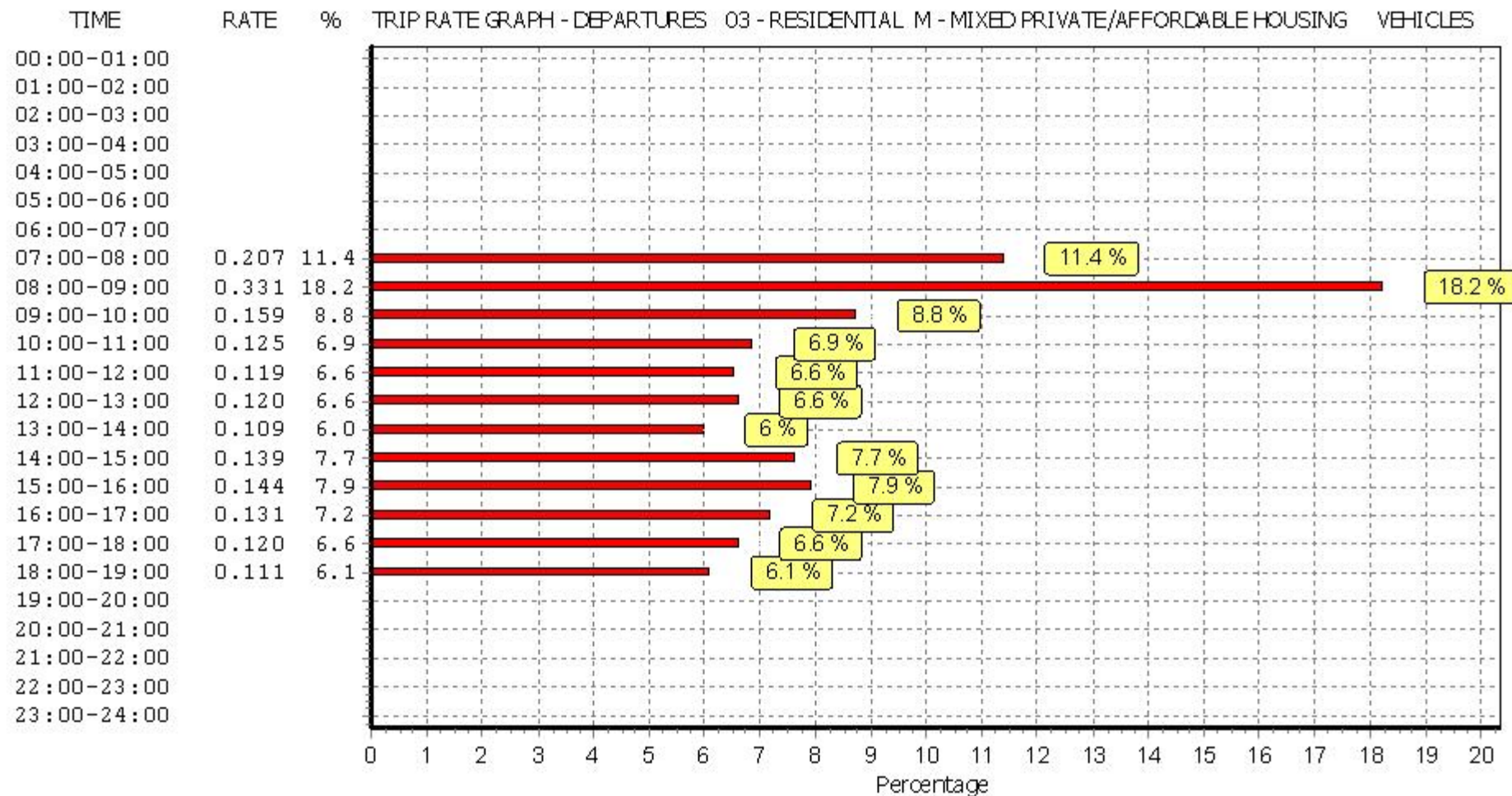
Trip rate parameter range selected:
Survey date date range:
Number of weekdays (Monday-Friday):
Number of Saturdays:
Number of Sundays:
Surveys manually removed from selection:

103 - 500 (units:)
01/01/07 - 04/11/15
8
0
0
4

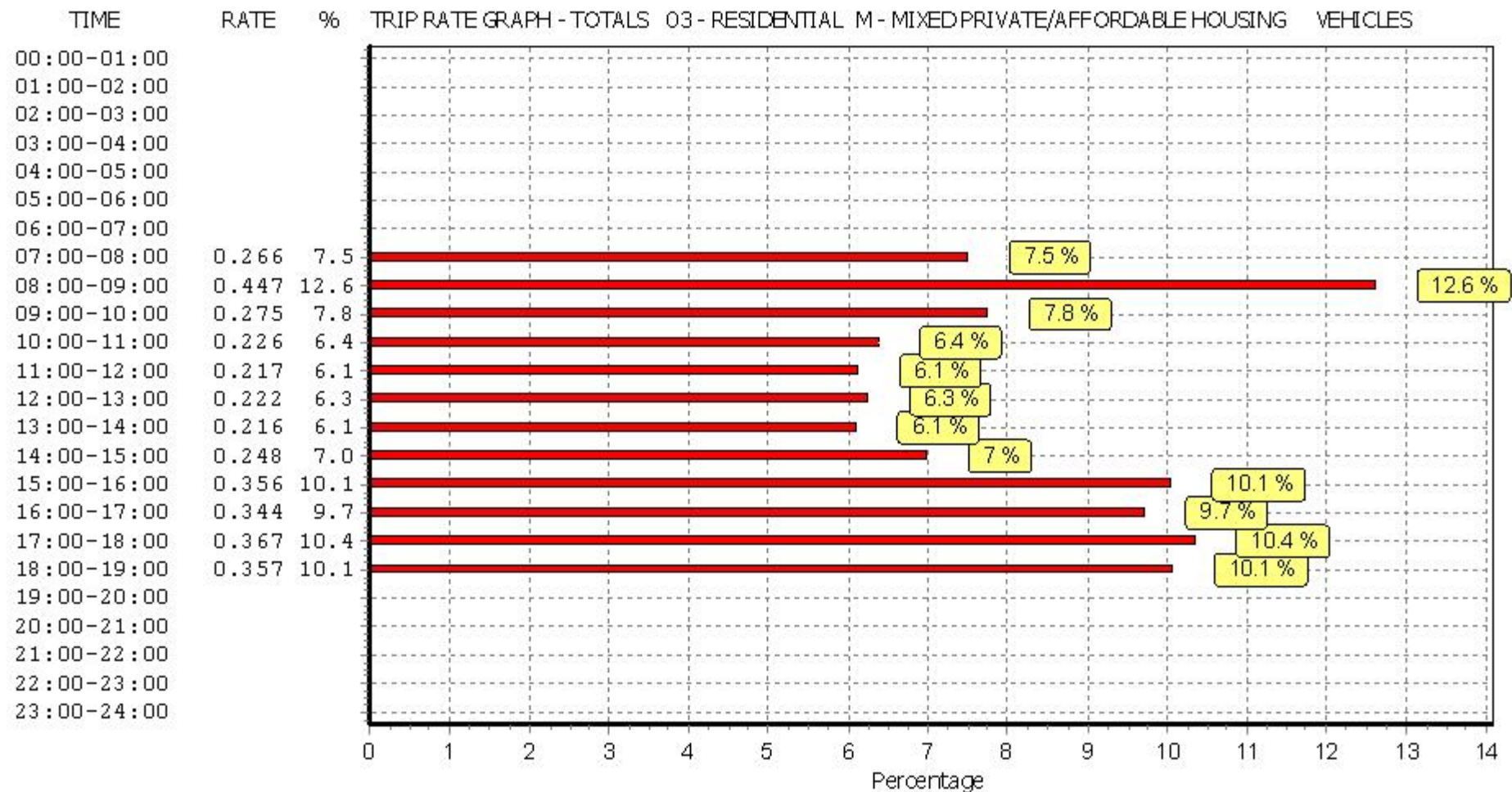
This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

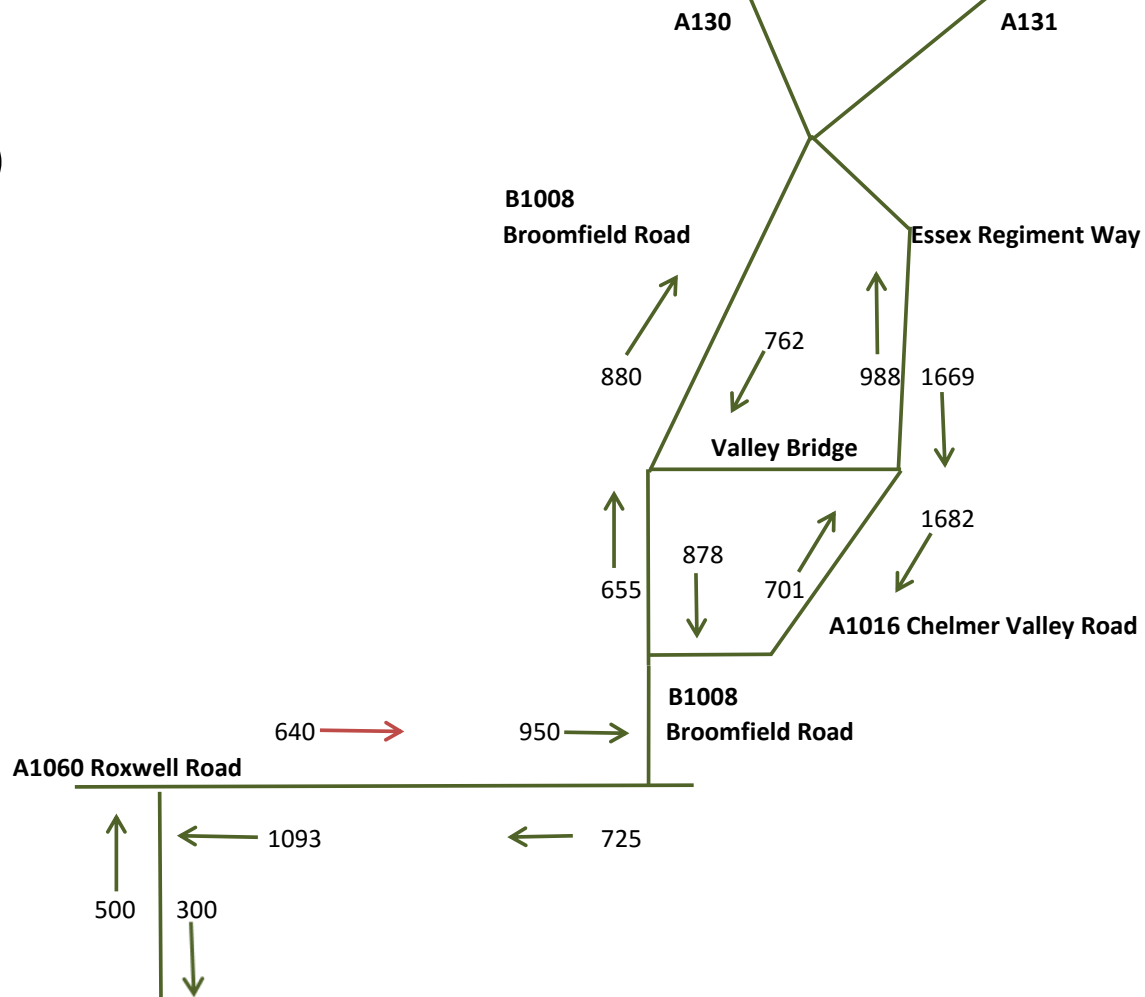
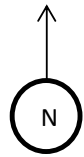



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

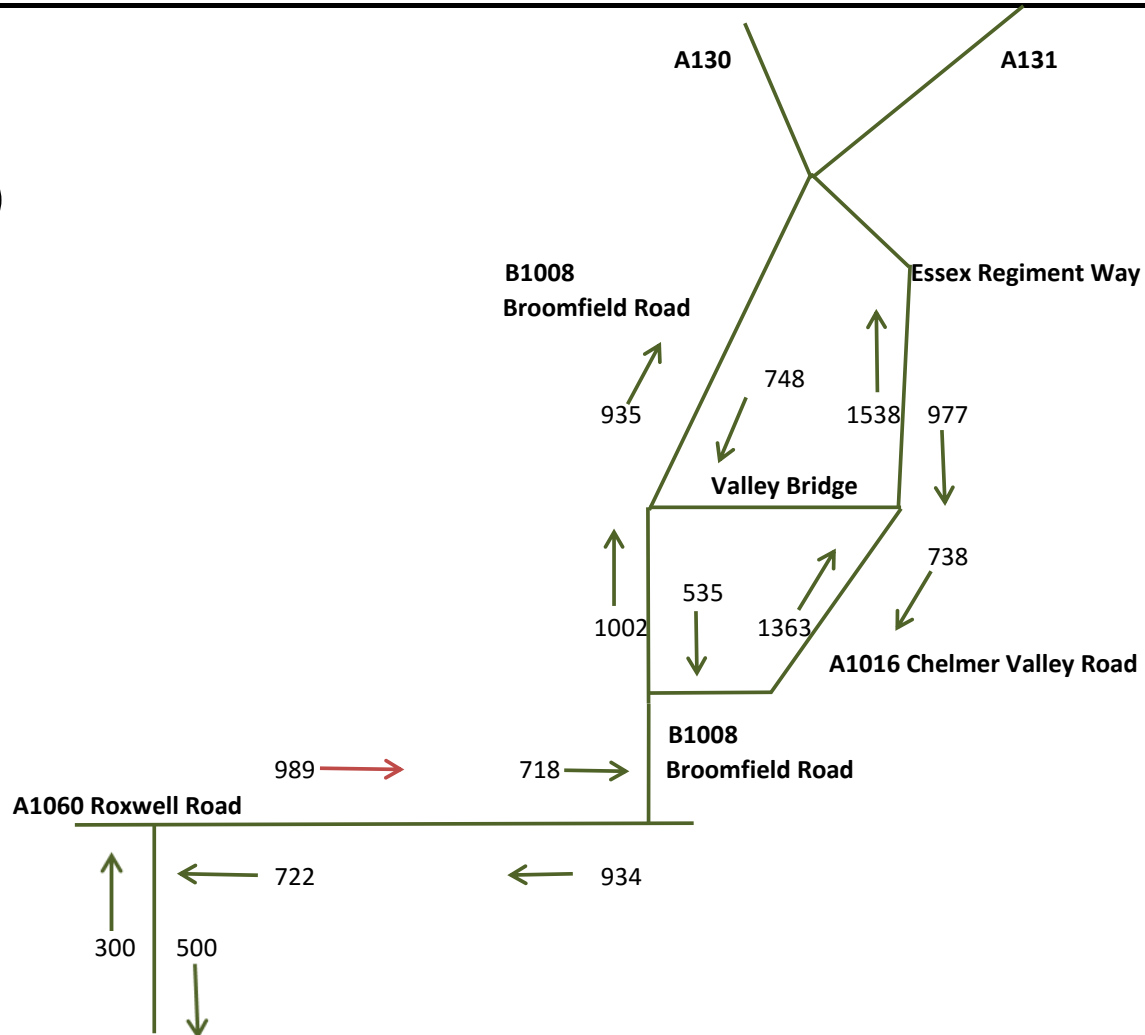
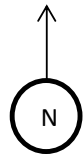



Appendix 2

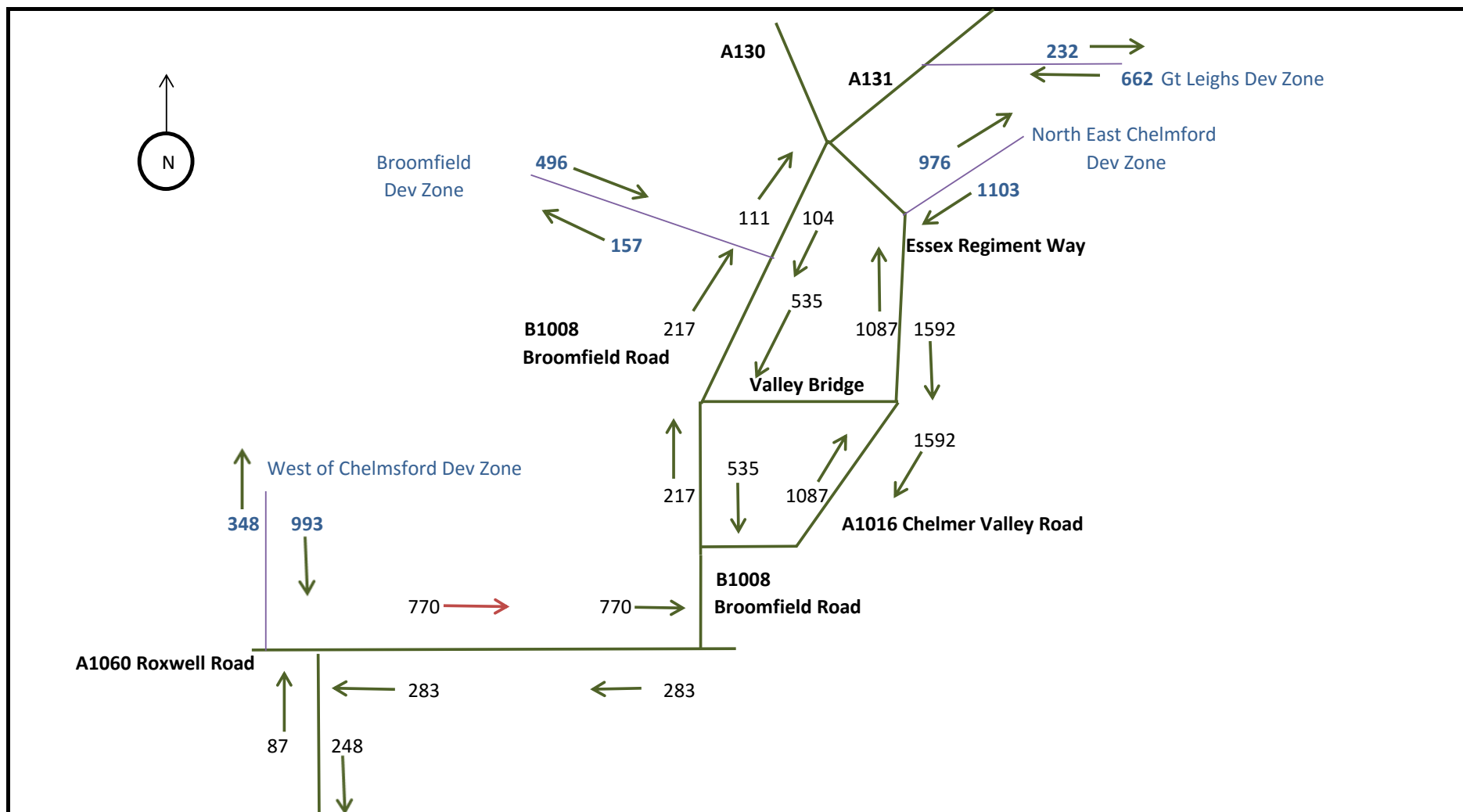
Network Flows




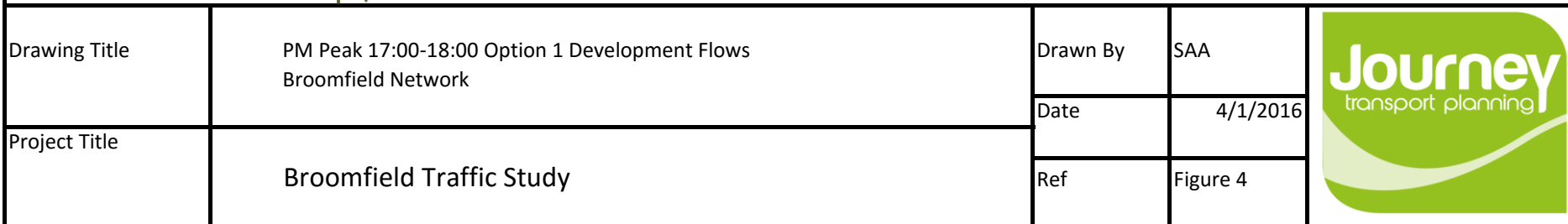
Drawing Title	AM Peak 08:00-09:00 2007 Observed Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 1	




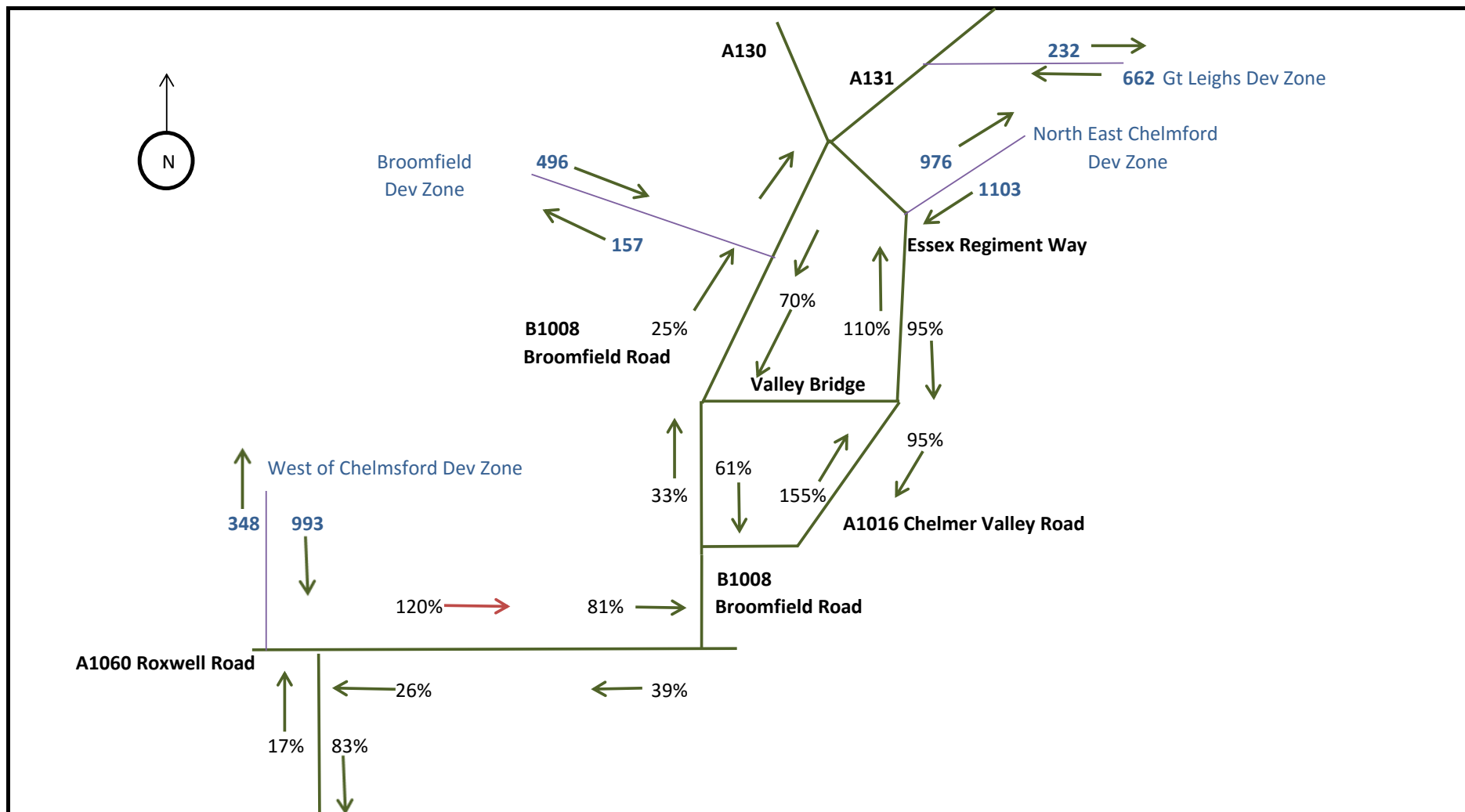
Drawing Title	PM Peak 17:00-18:00 2007 Observed Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 2	




Drawing Title	AM Peak 08:00-09:00 Option 1 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 3	




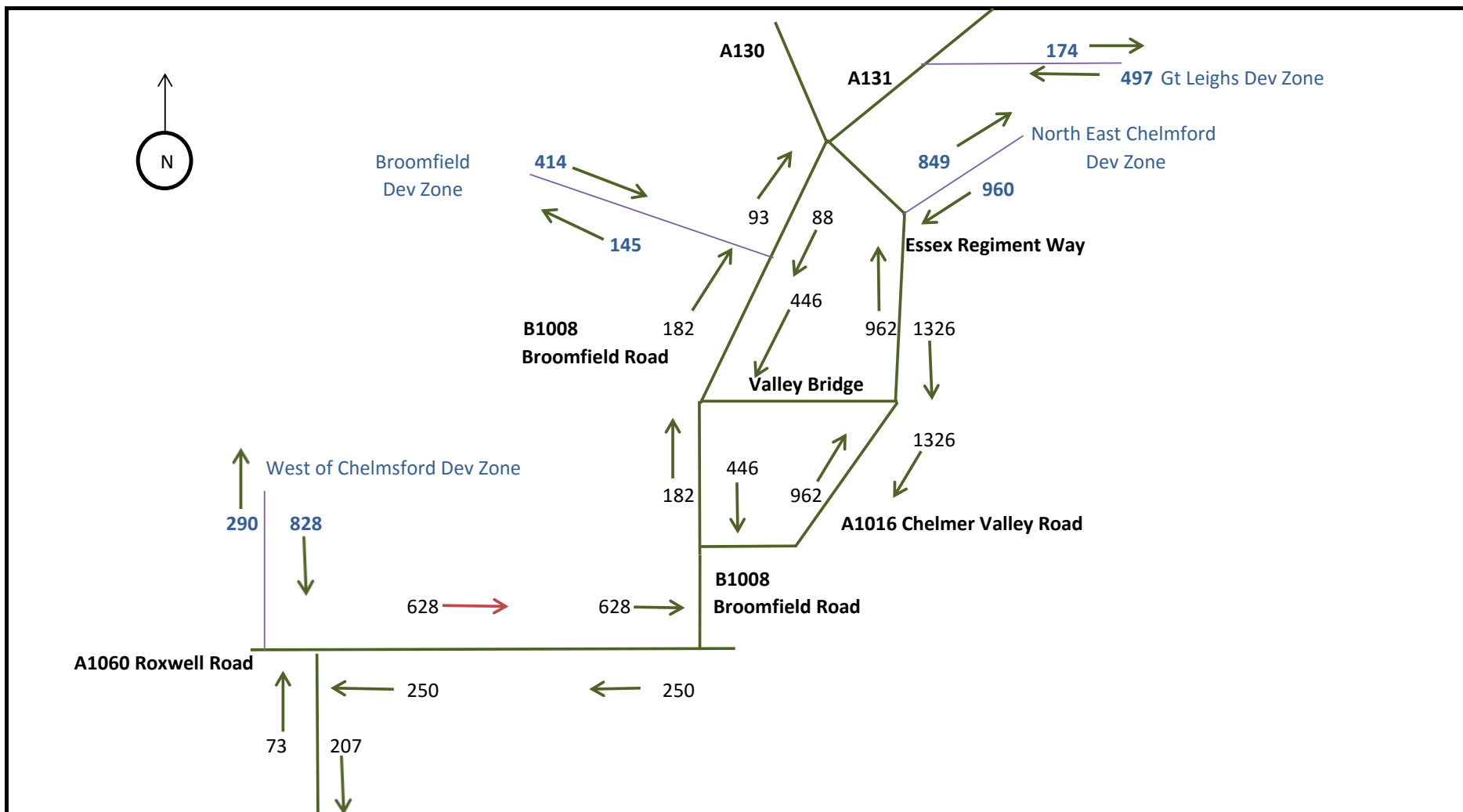
Drawing Title	PM Peak 17:00-18:00 Option 1 Development Flows Broomfield Network	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 4	




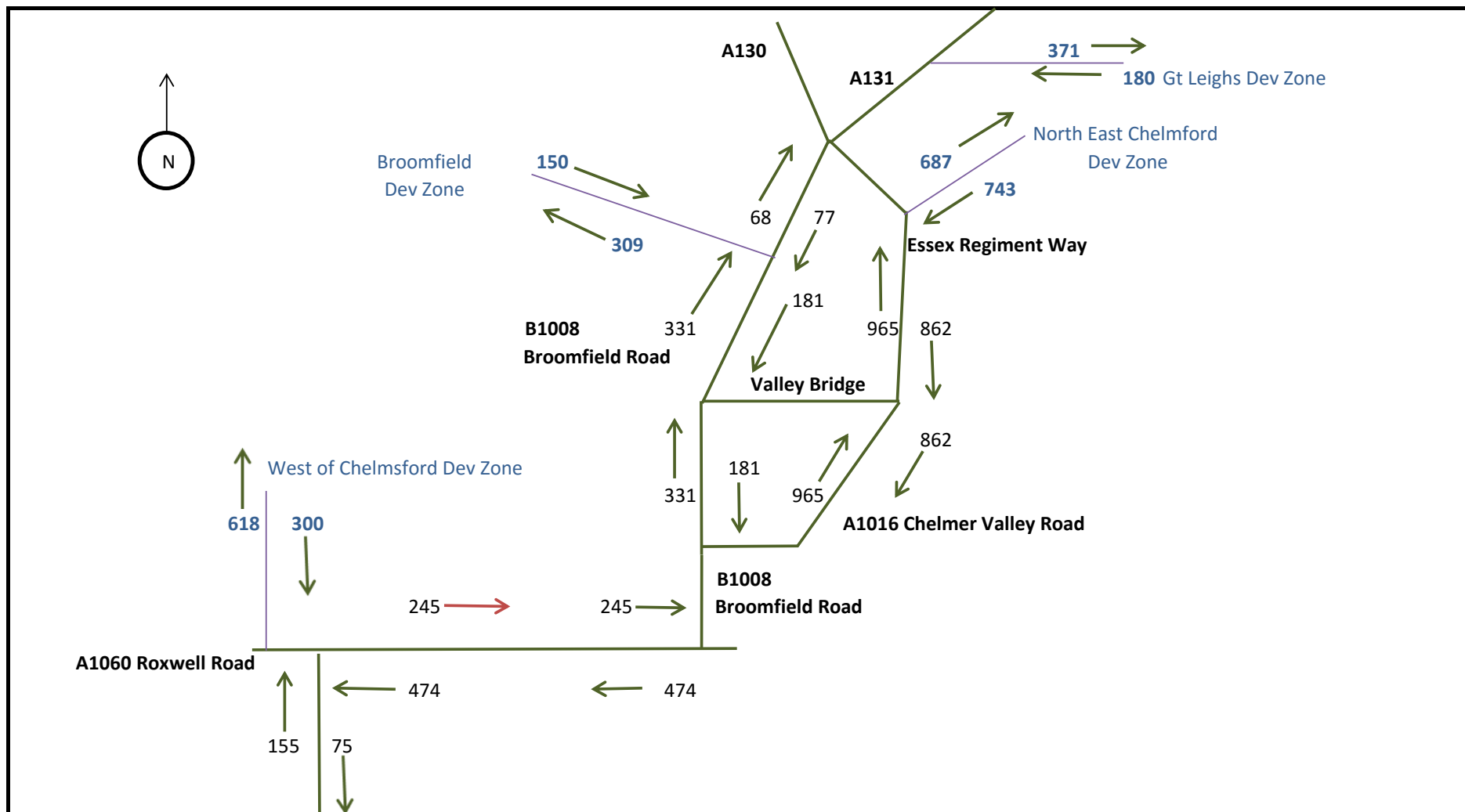
Drawing Title	AM Peak 08:00-09:00 Option 1 Development Flows Percentage increase on Base Flows	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 5	




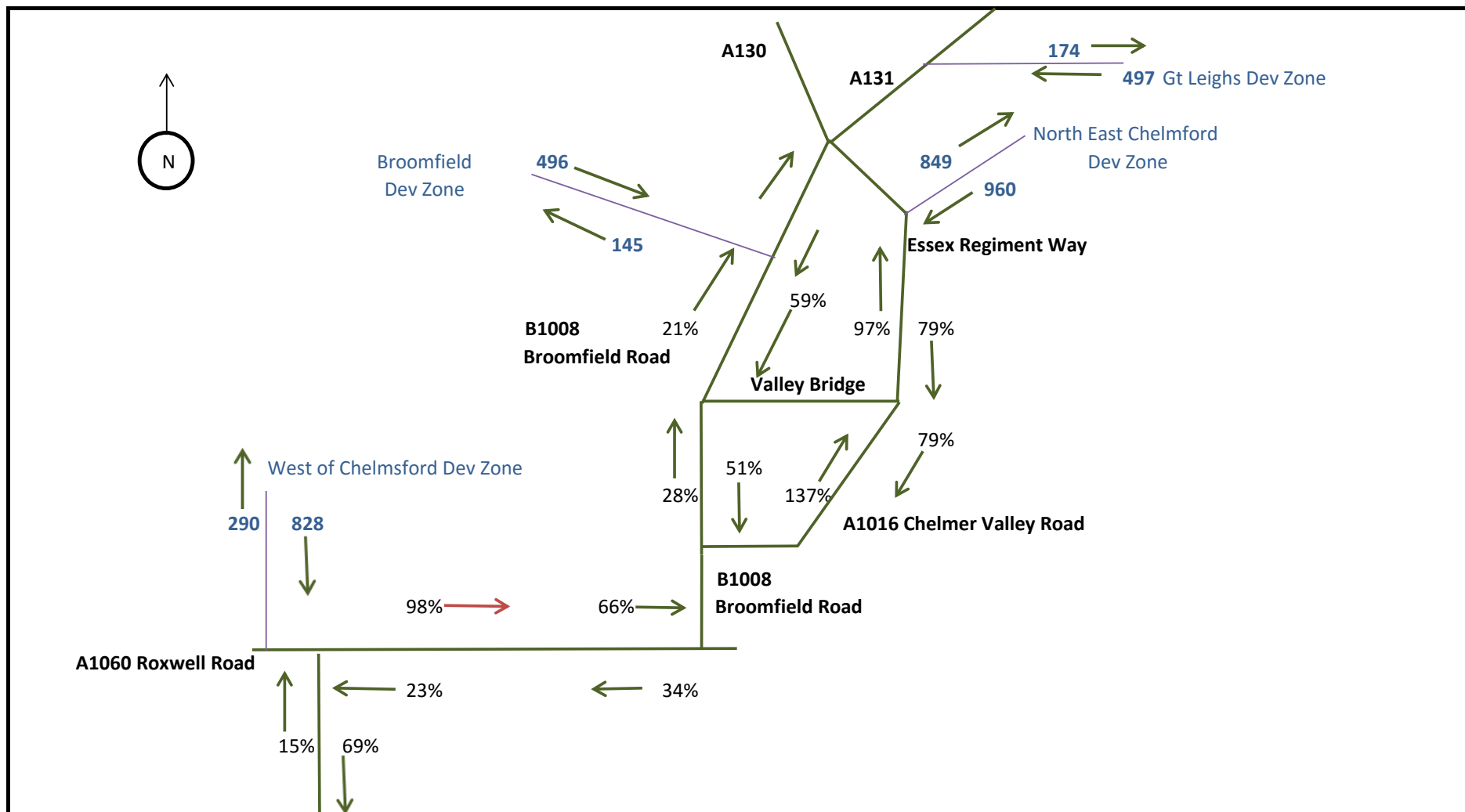
Drawing Title	PM Peak 17:00-18:00 Option 1 Development Flows Percentage Increase on Base Flows	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 6	




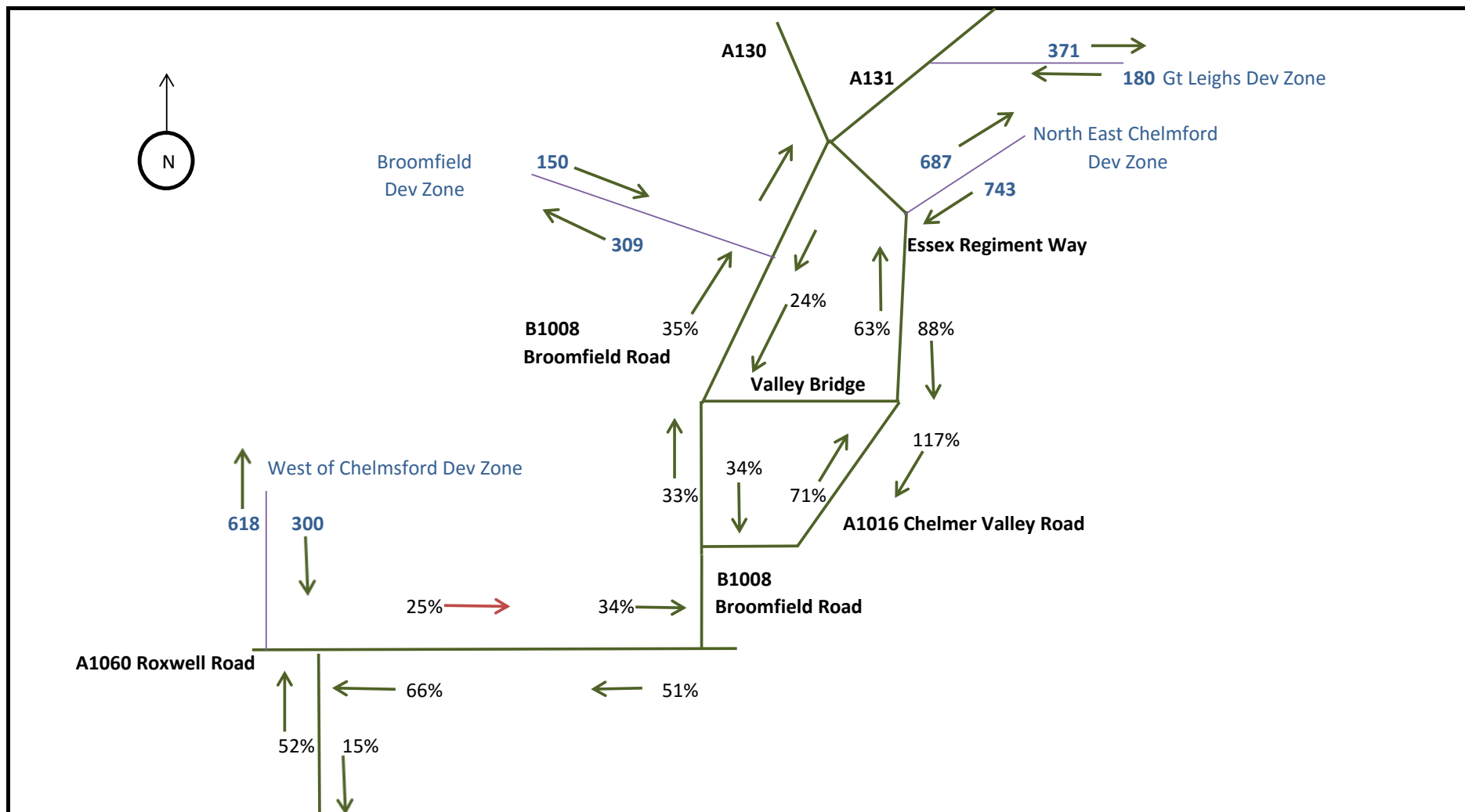
Drawing Title	AM Peak 08:00-09:00 Option 2 Development Flows Broomfield Network	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 7	




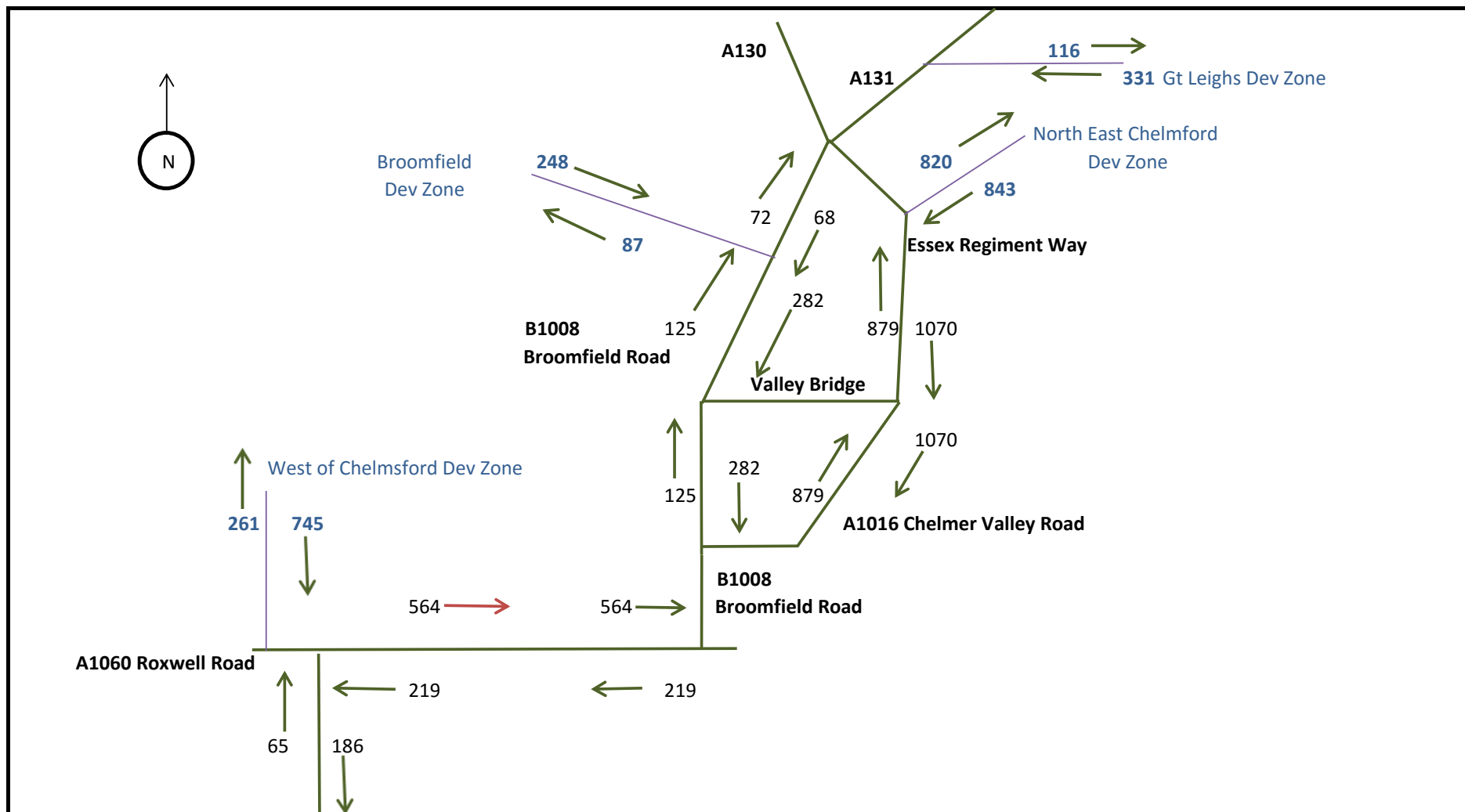
Drawing Title	PM Peak 17:00-18:00 Option 2 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 8	




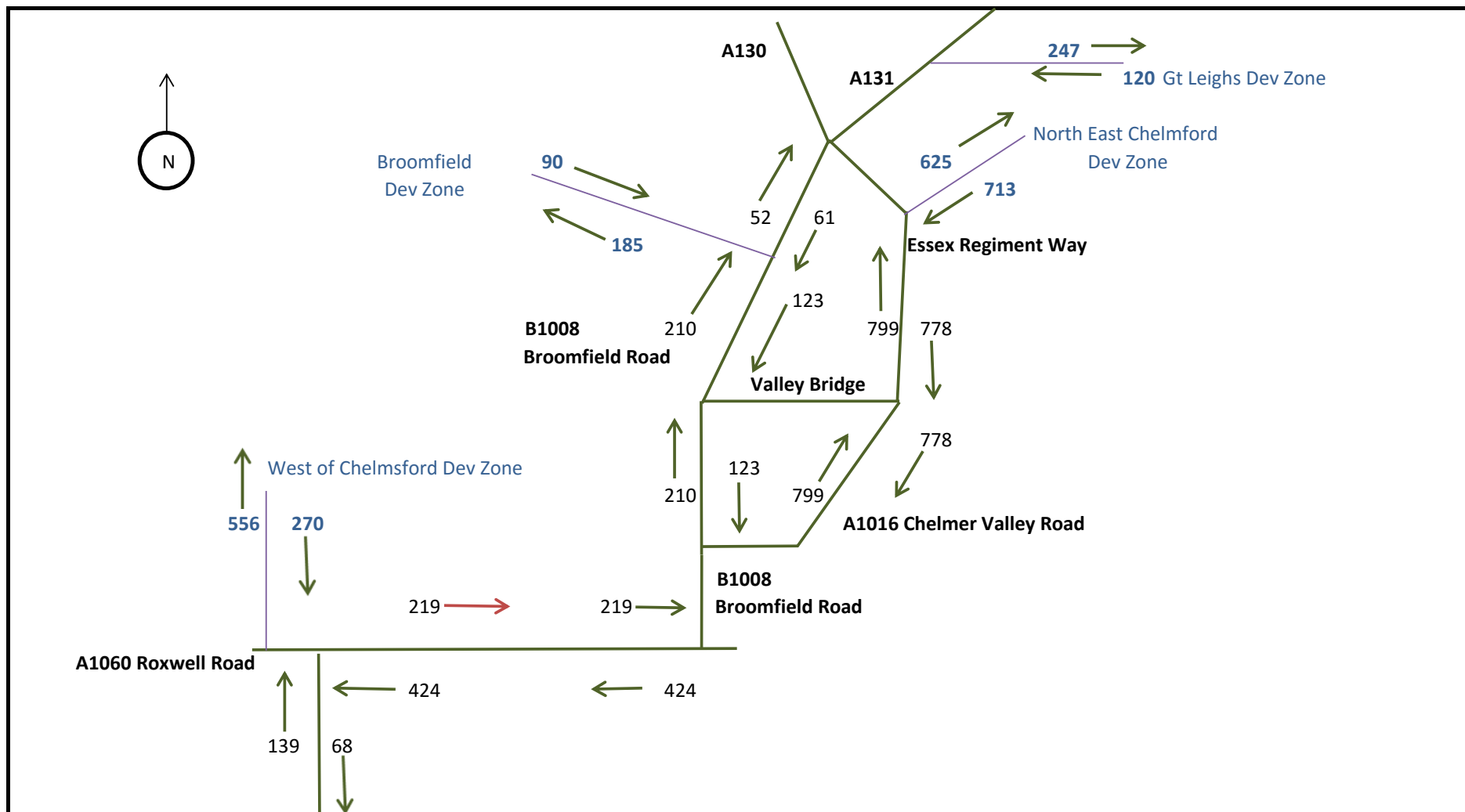
Drawing Title	AM Peak 08:00-09:00 Option 2 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 9	




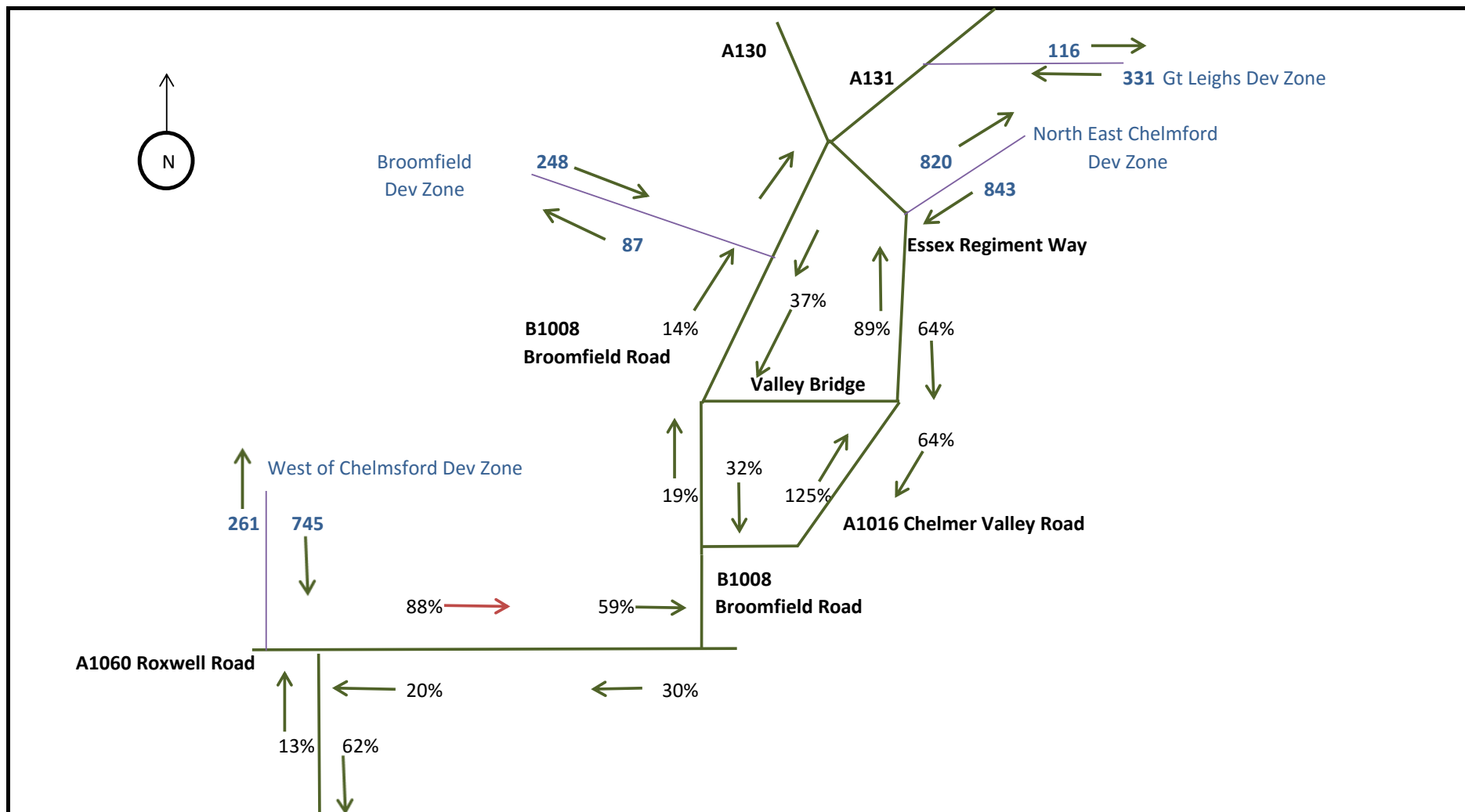
Drawing Title	PM Peak 17:00-18:00 Option 2 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 10	




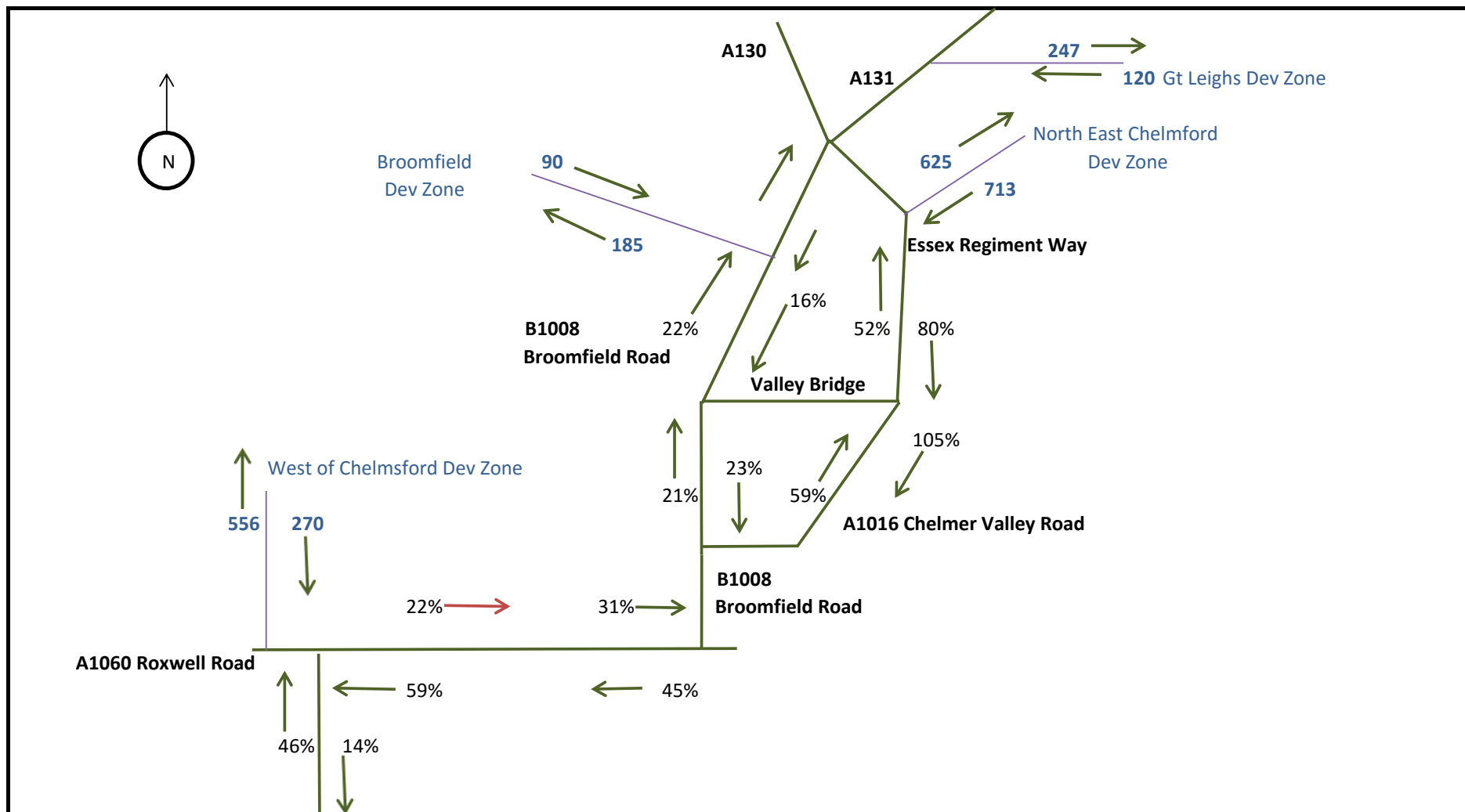
Drawing Title	AM Peak 08:00-09:00 Option 3 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 11	




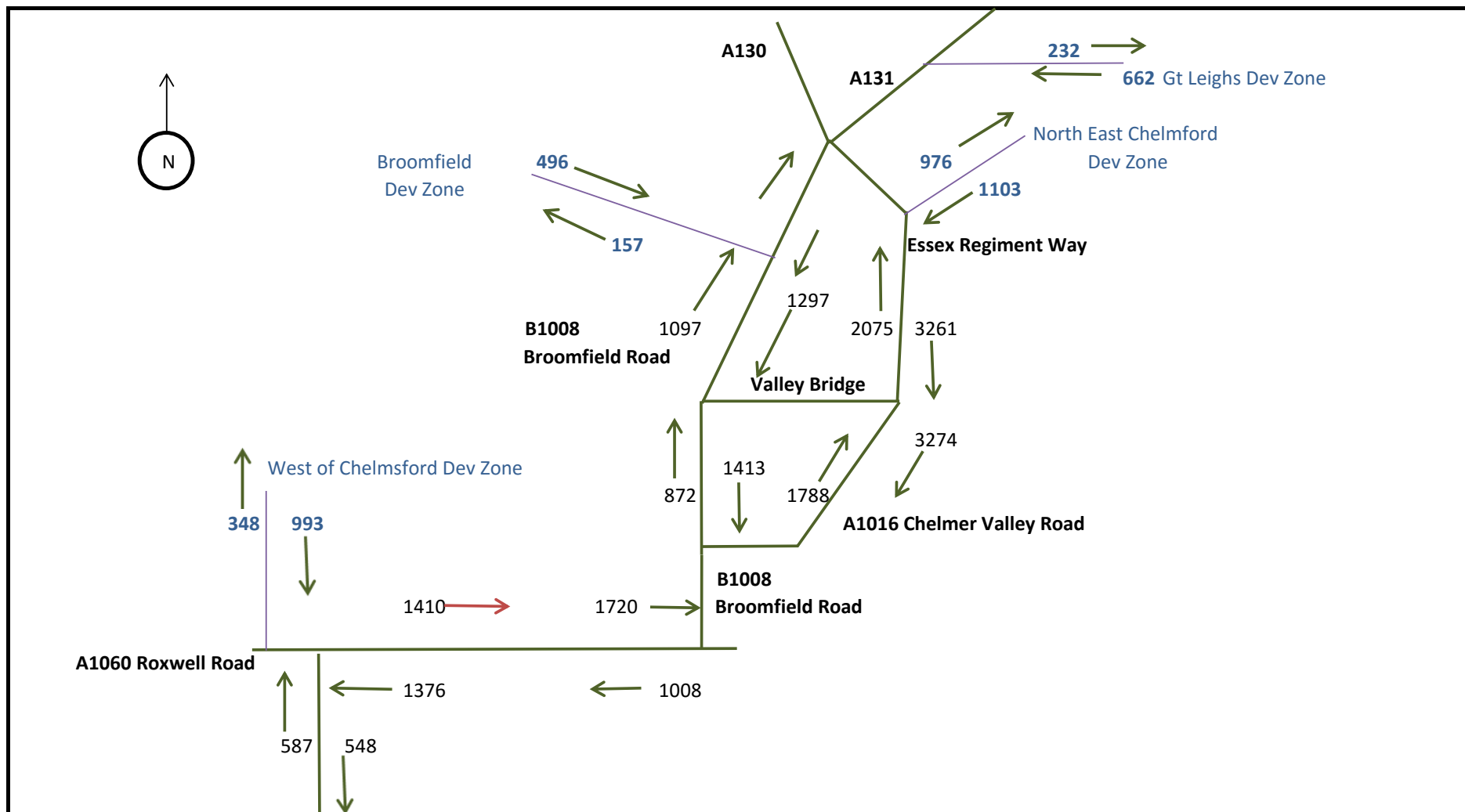
Drawing Title	PM Peak 17:00-18:00 Option 3 Development Flows Broomfield Network	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 12	




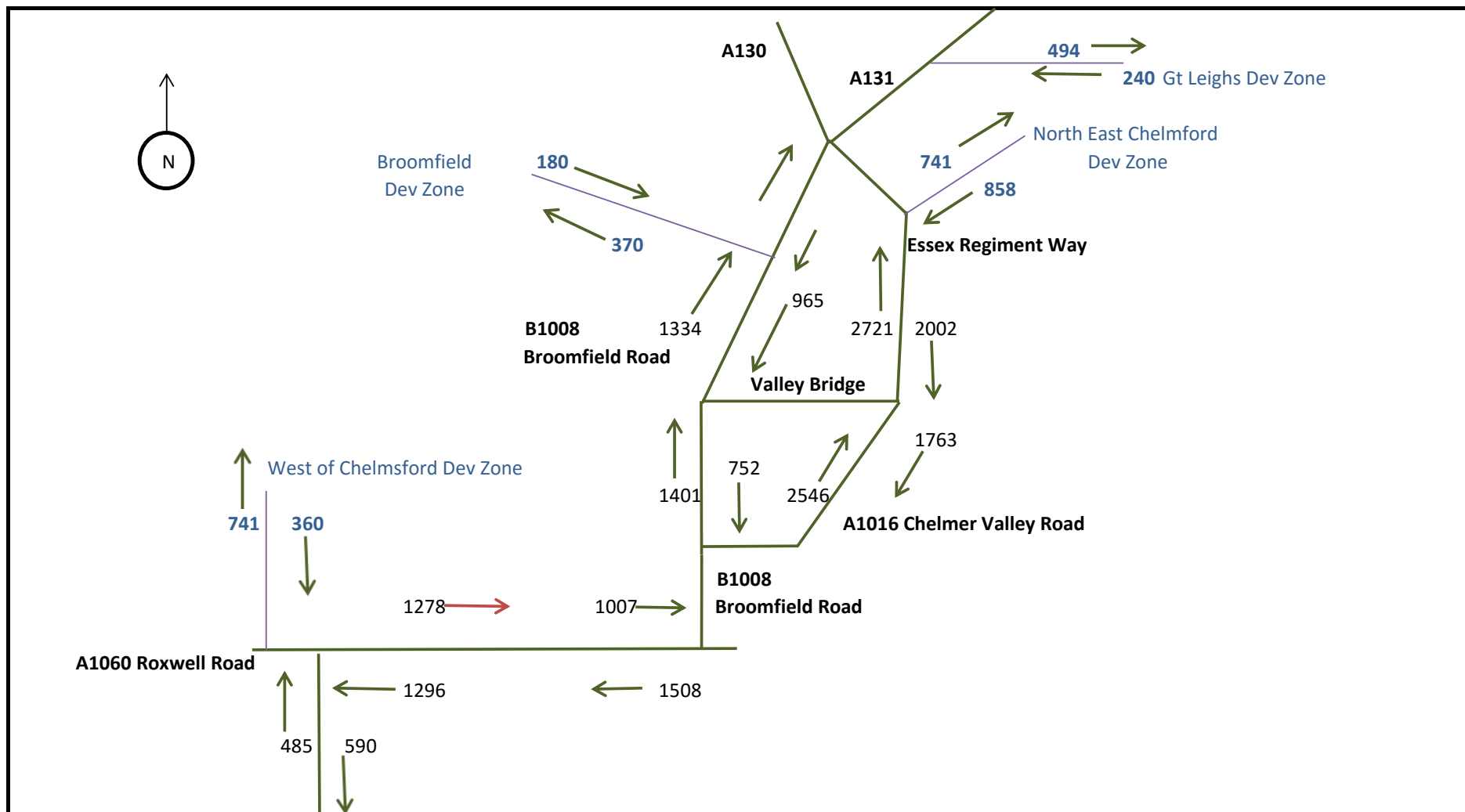
Drawing Title	AM Peak 08:00-09:00 Option 3 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 13	




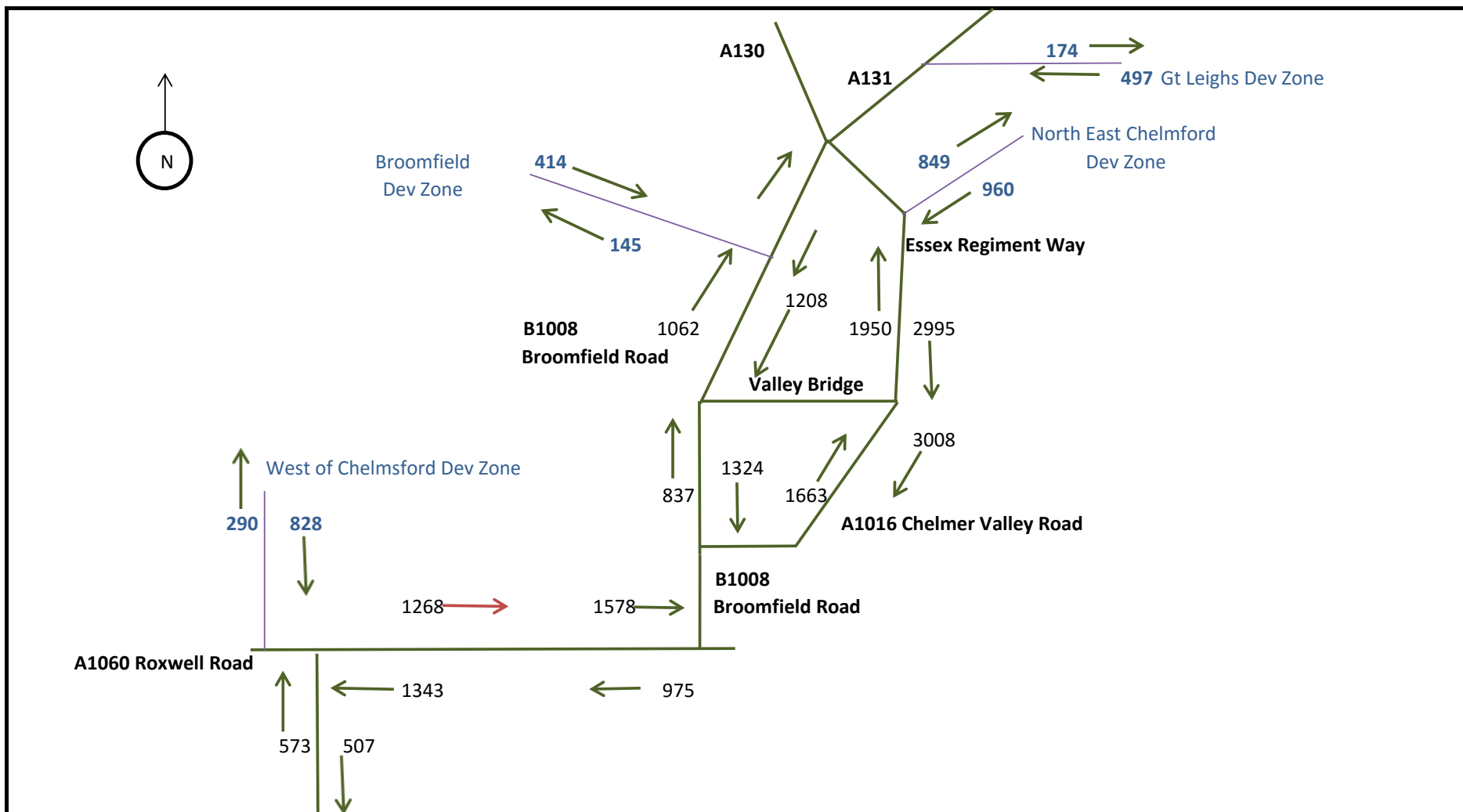
Drawing Title	PM Peak 17:00-18:00 Option 3 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 14	




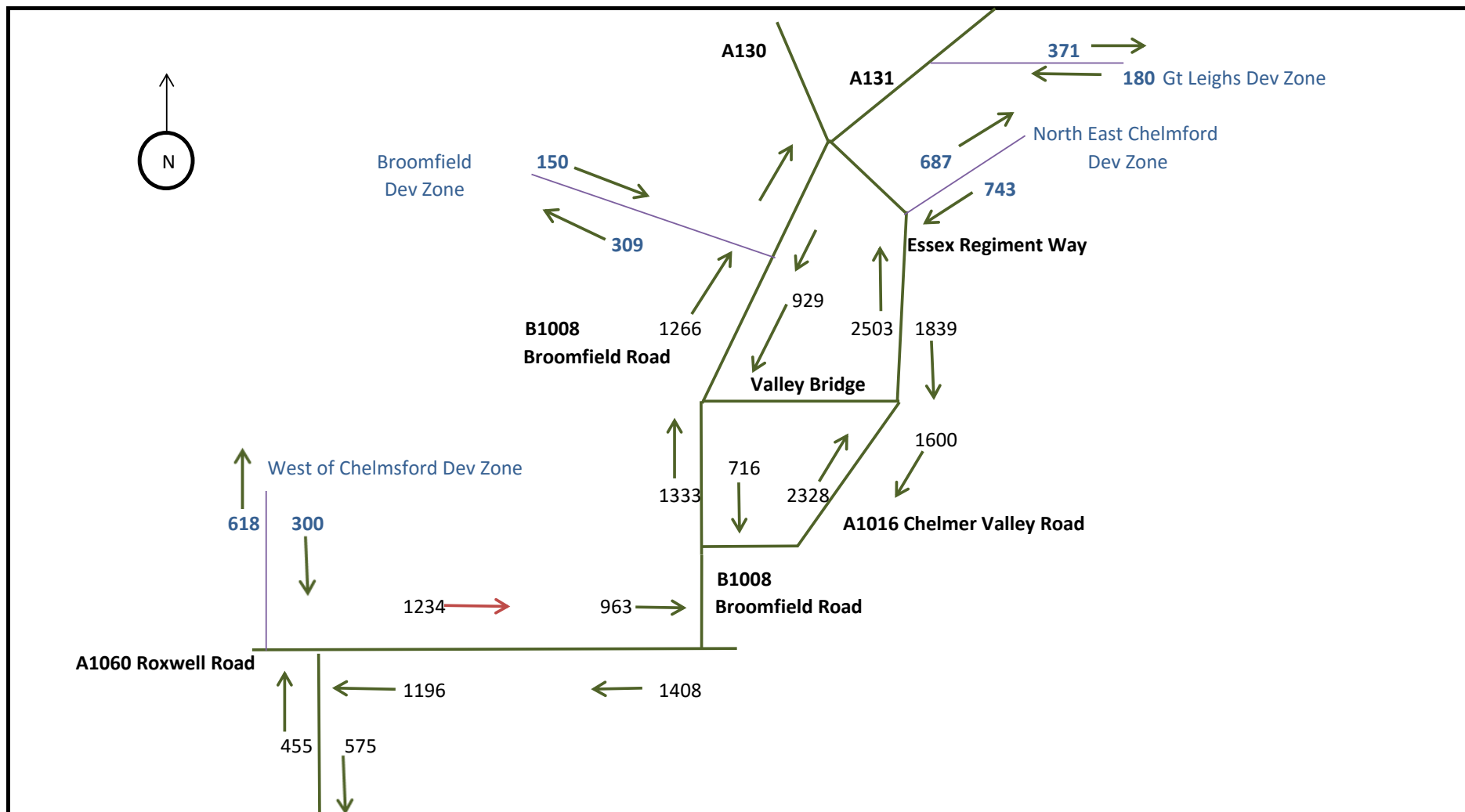
Drawing Title	AM Peak 08:00-09:00 Option 1 Total Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 15	




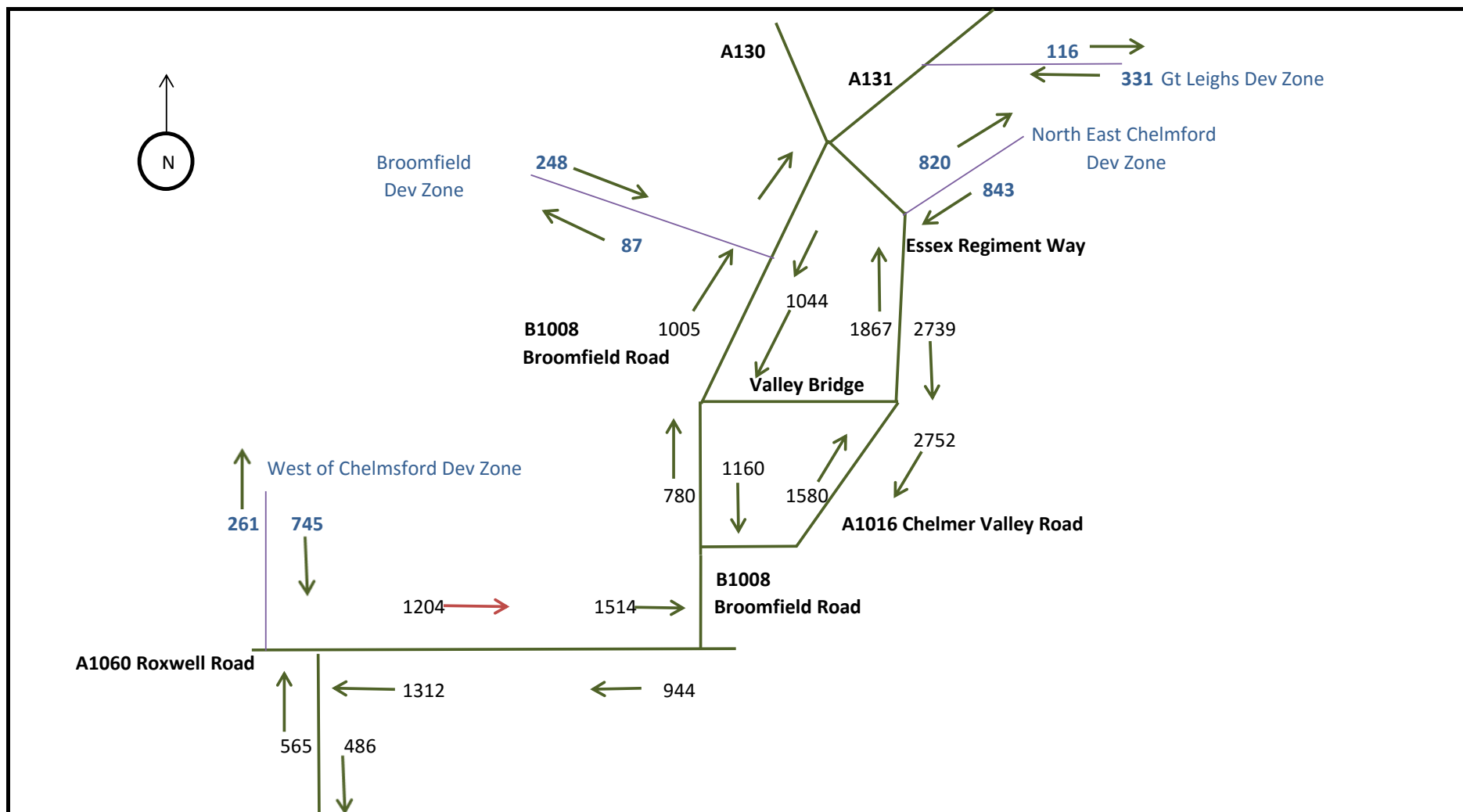
Drawing Title	PM Peak 17:00-18:00 Option 1 Development Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 16	




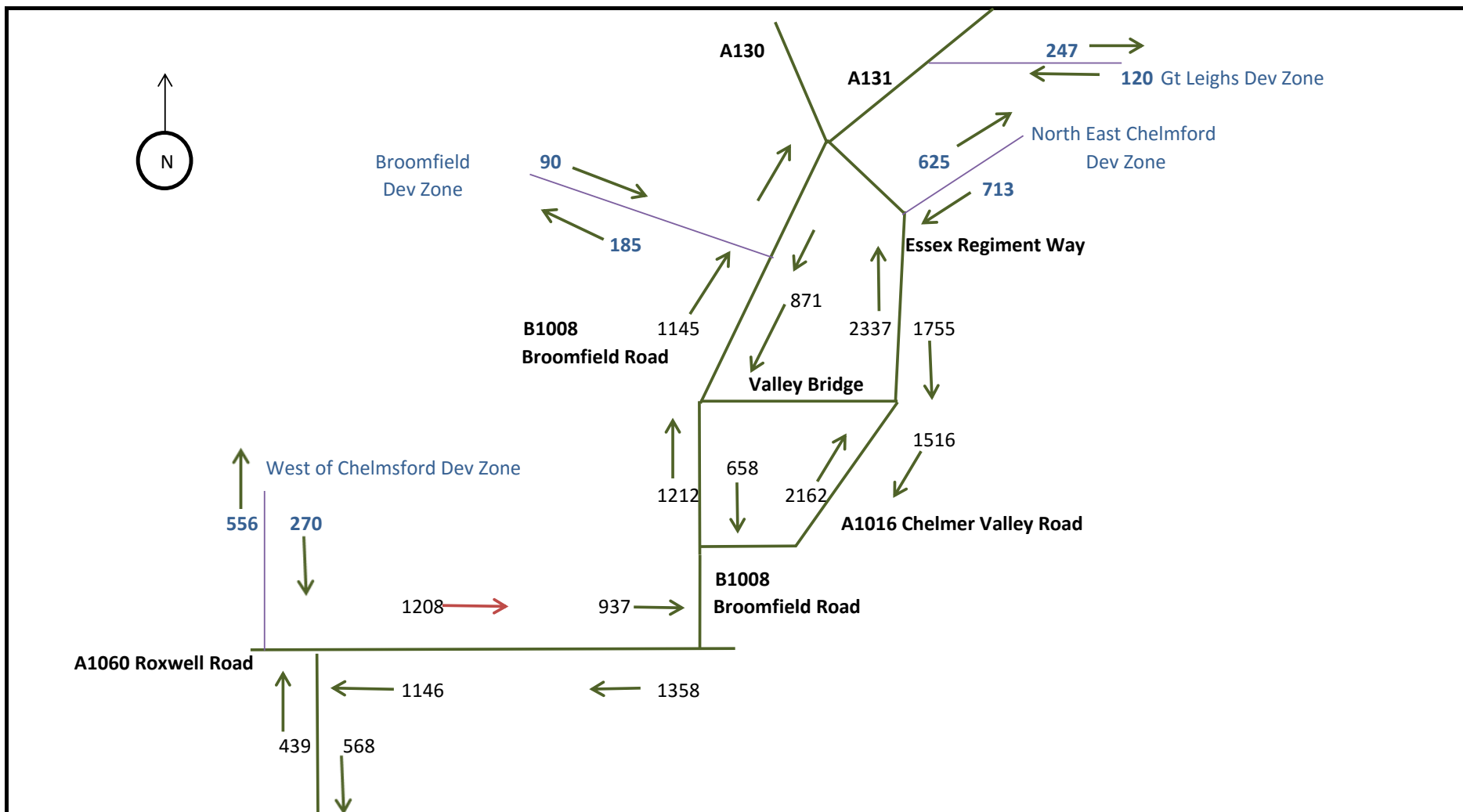
Drawing Title	AM Peak 08:00-09:00 Option 2 Total Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 17	




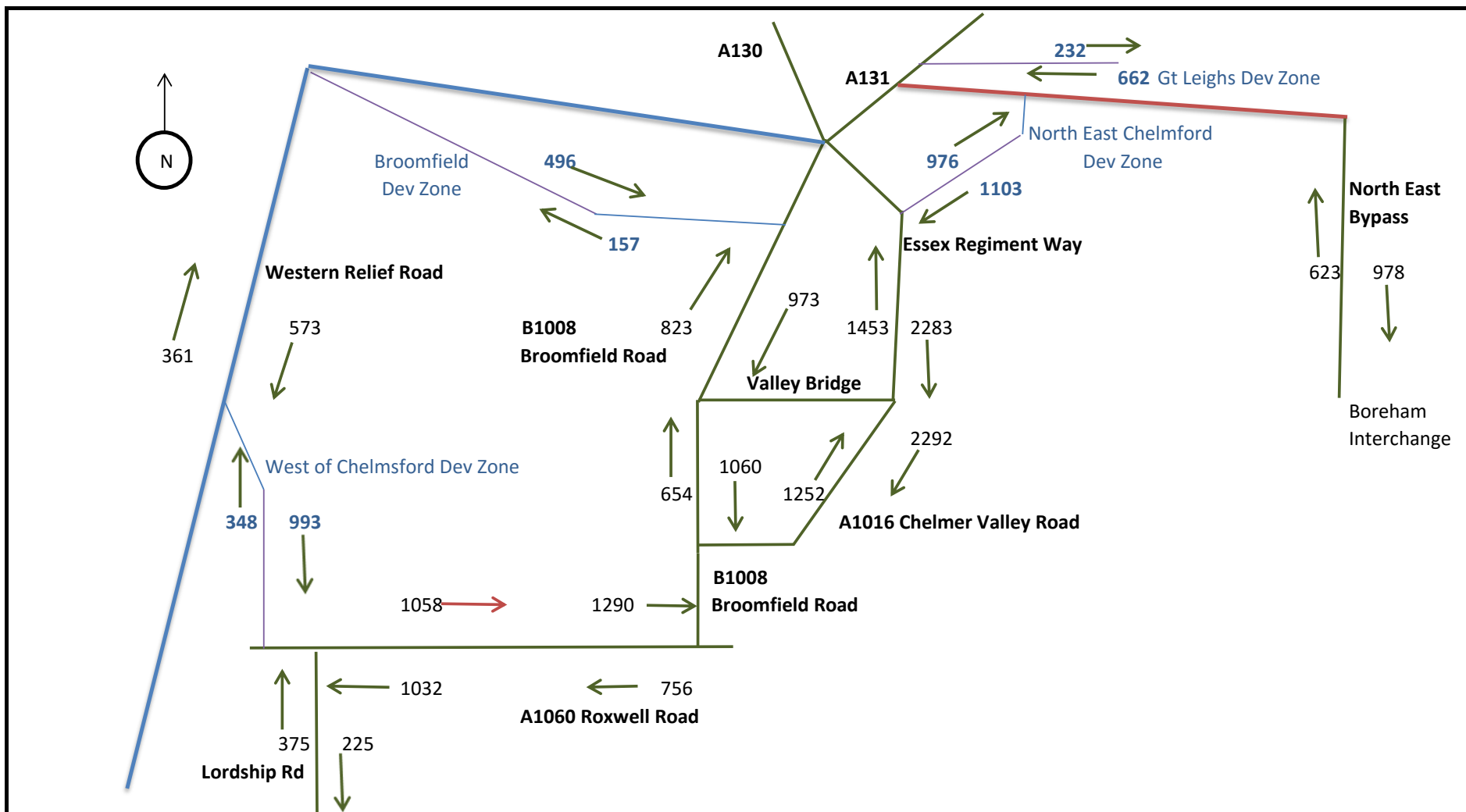
Drawing Title	PM Peak 17:00-18:00 Option 2 Total Flows Broomfield Network	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 18	




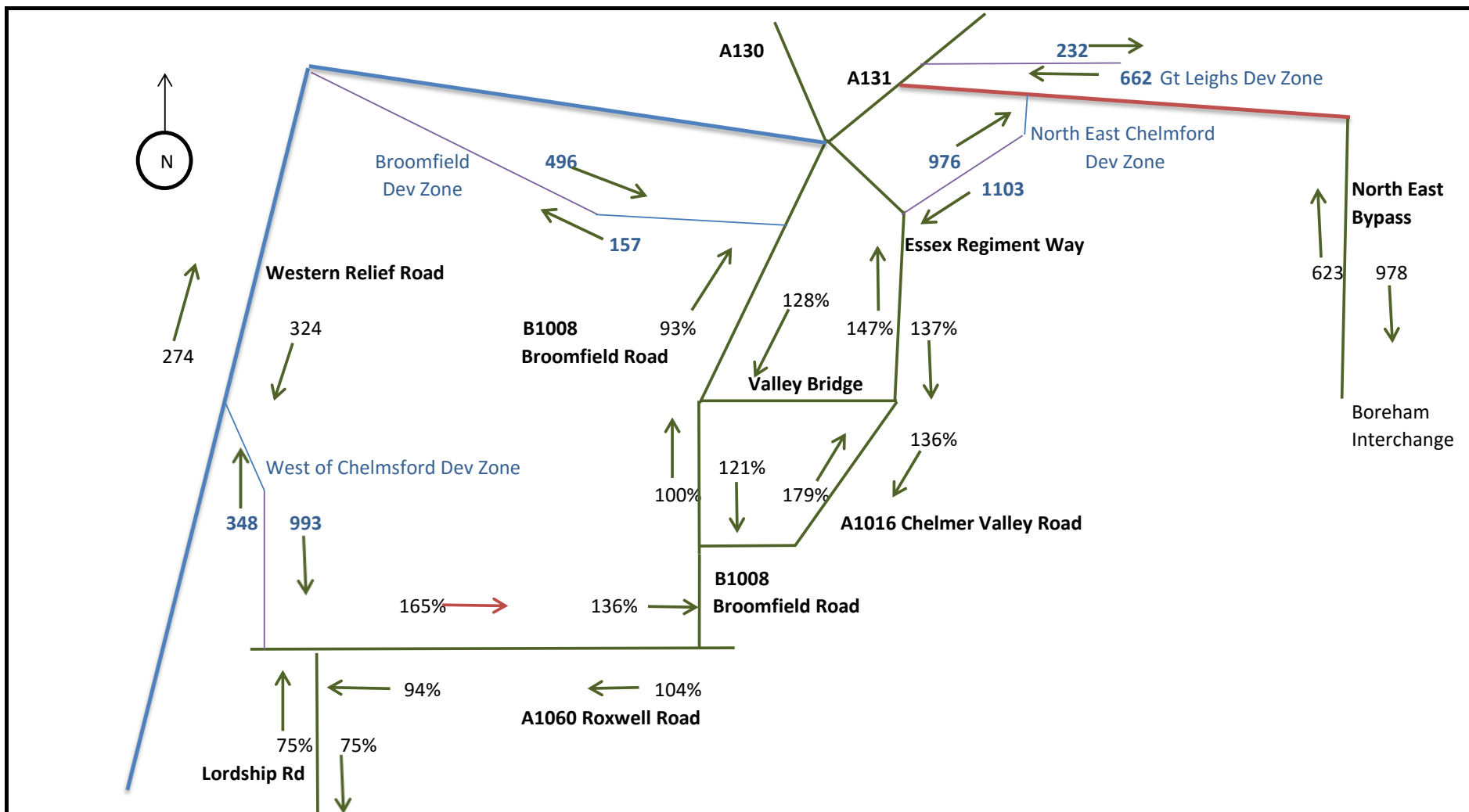
Drawing Title	AM Peak 08:00-09:00 Option 3 Total Flows Broomfield Network	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 19	




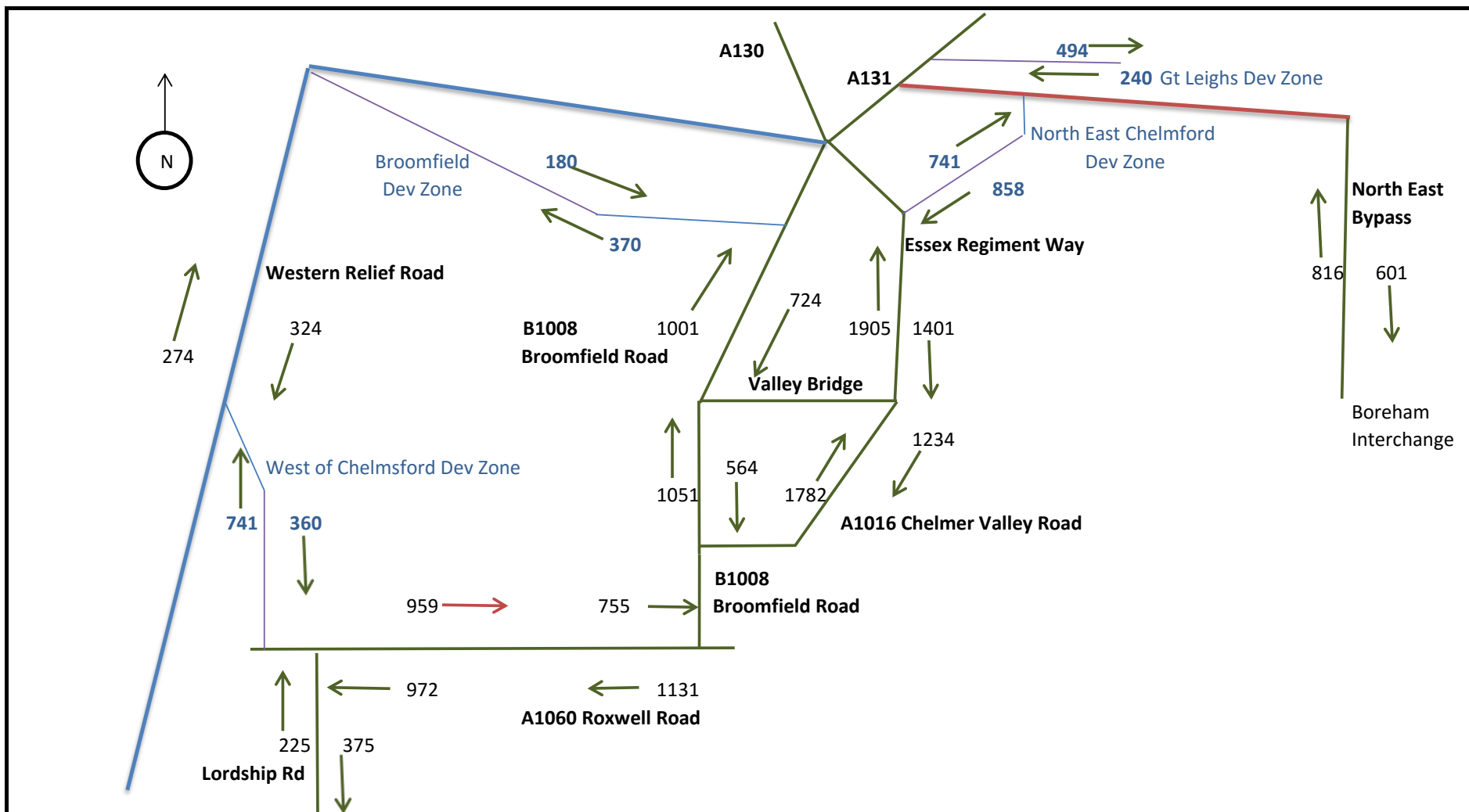
Drawing Title	PM Peak 17:00-18:00 Option 3 Total Flows Broomfield Network	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 20	




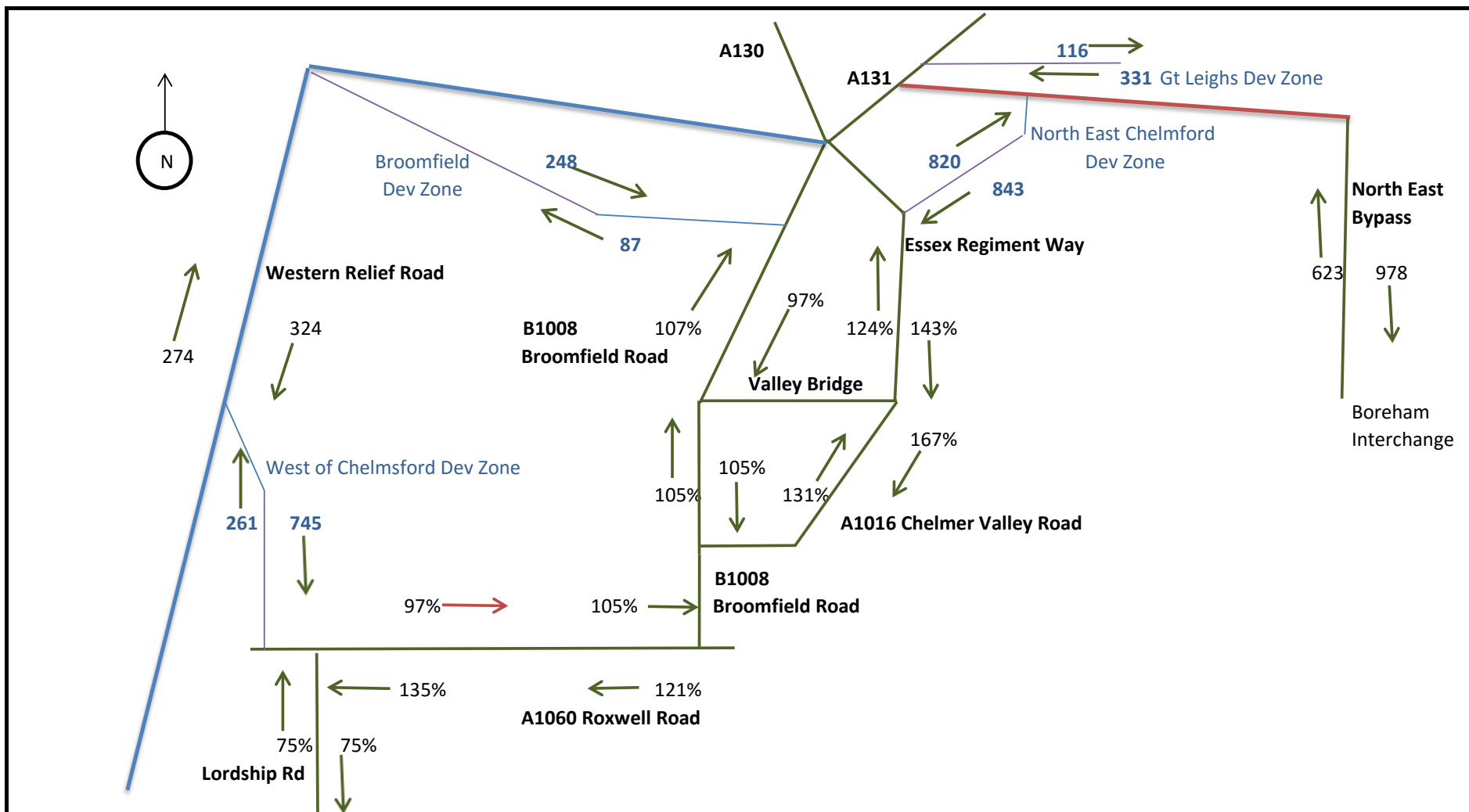
Drawing Title	AM Peak 08:00-09:00 Option 1 Total Flows with Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 21	




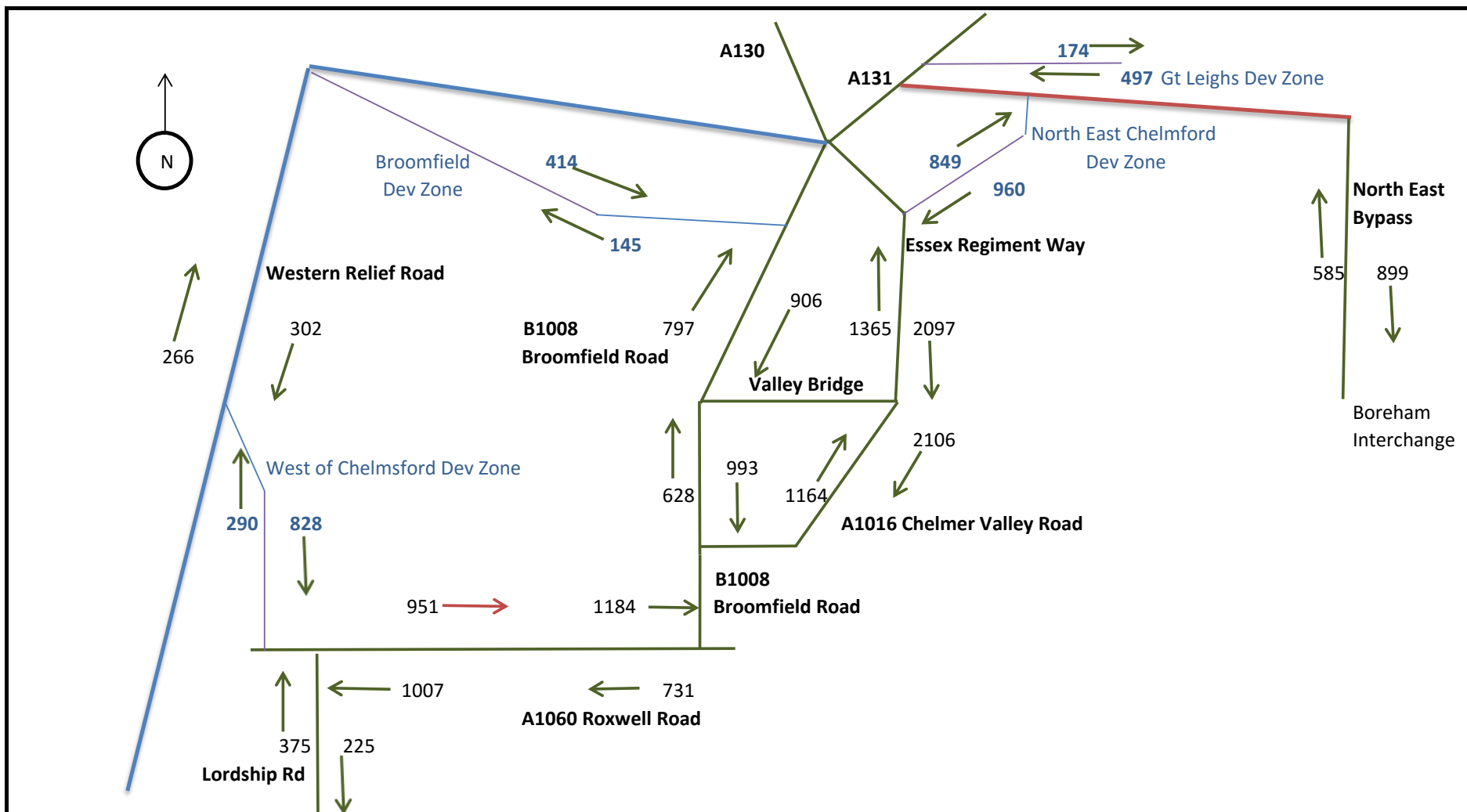
Drawing Title	AM Peak 08:00-09:00 Option 1 Percentage Increase Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 22	




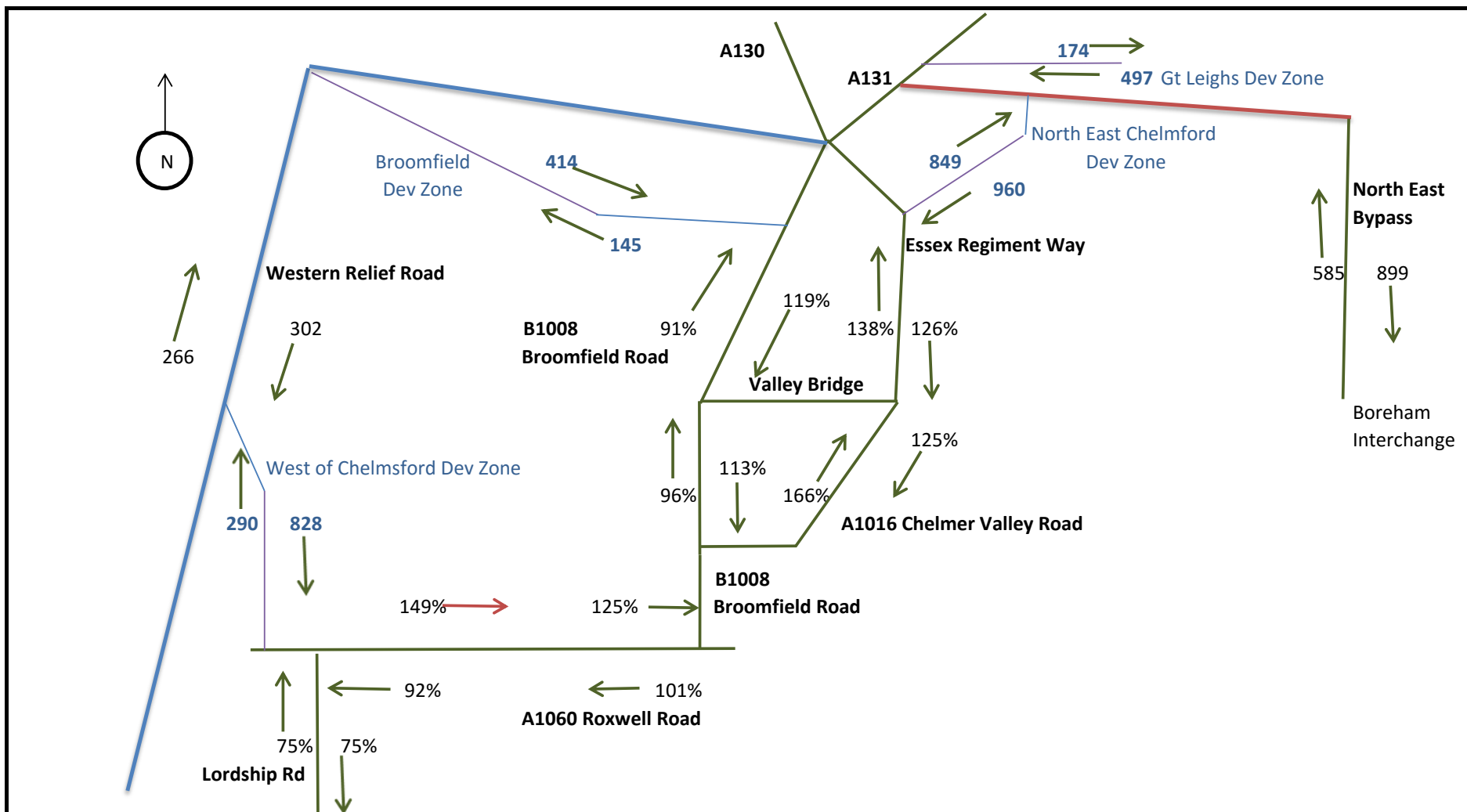
Drawing Title	PM Peak 17:00-18:00 Option 1 Total Flows with North East Bypass and Western Relief Road	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 23	




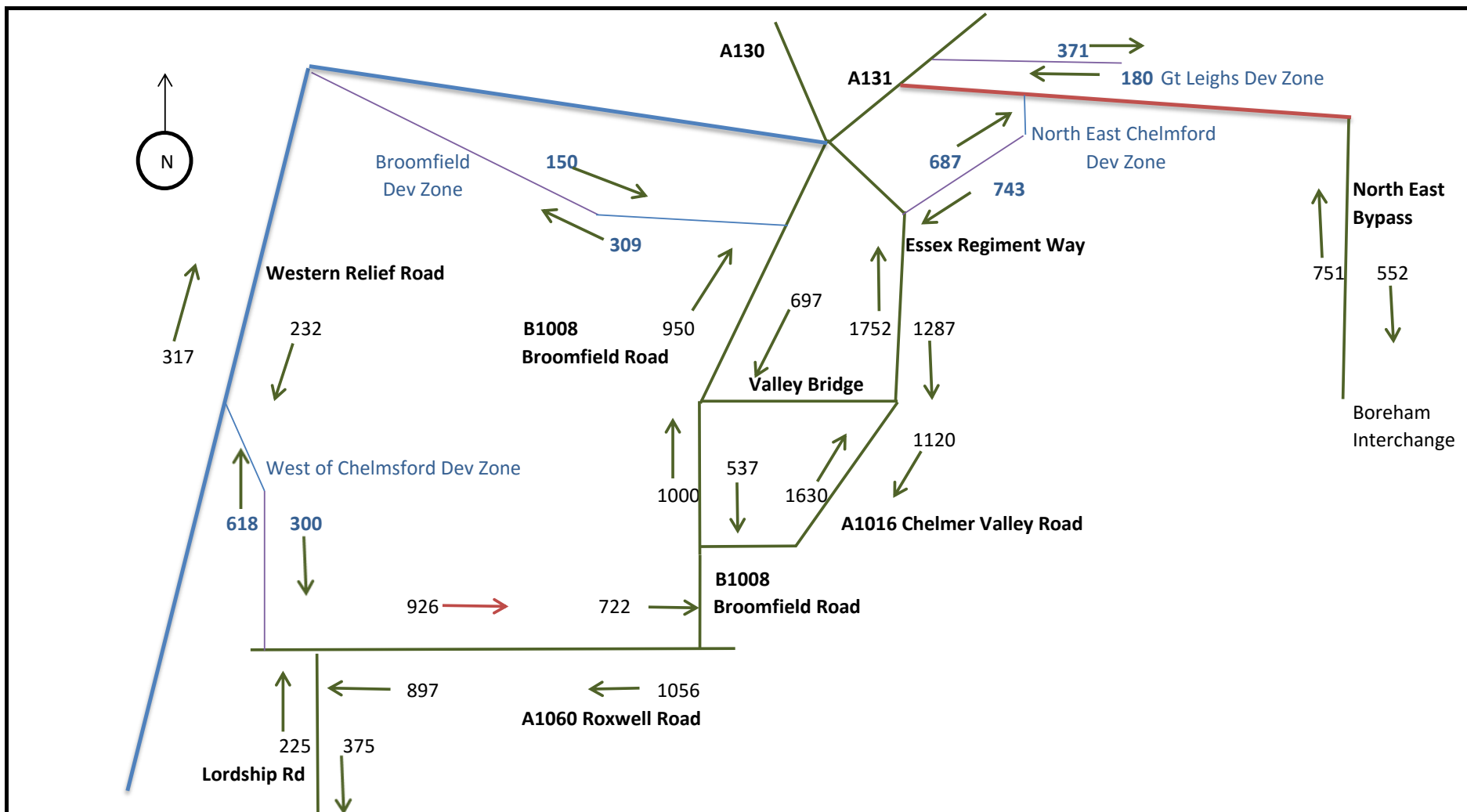
Drawing Title	PM Peak 17:00-18:00 Option 1 Percentage Increase Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 24	




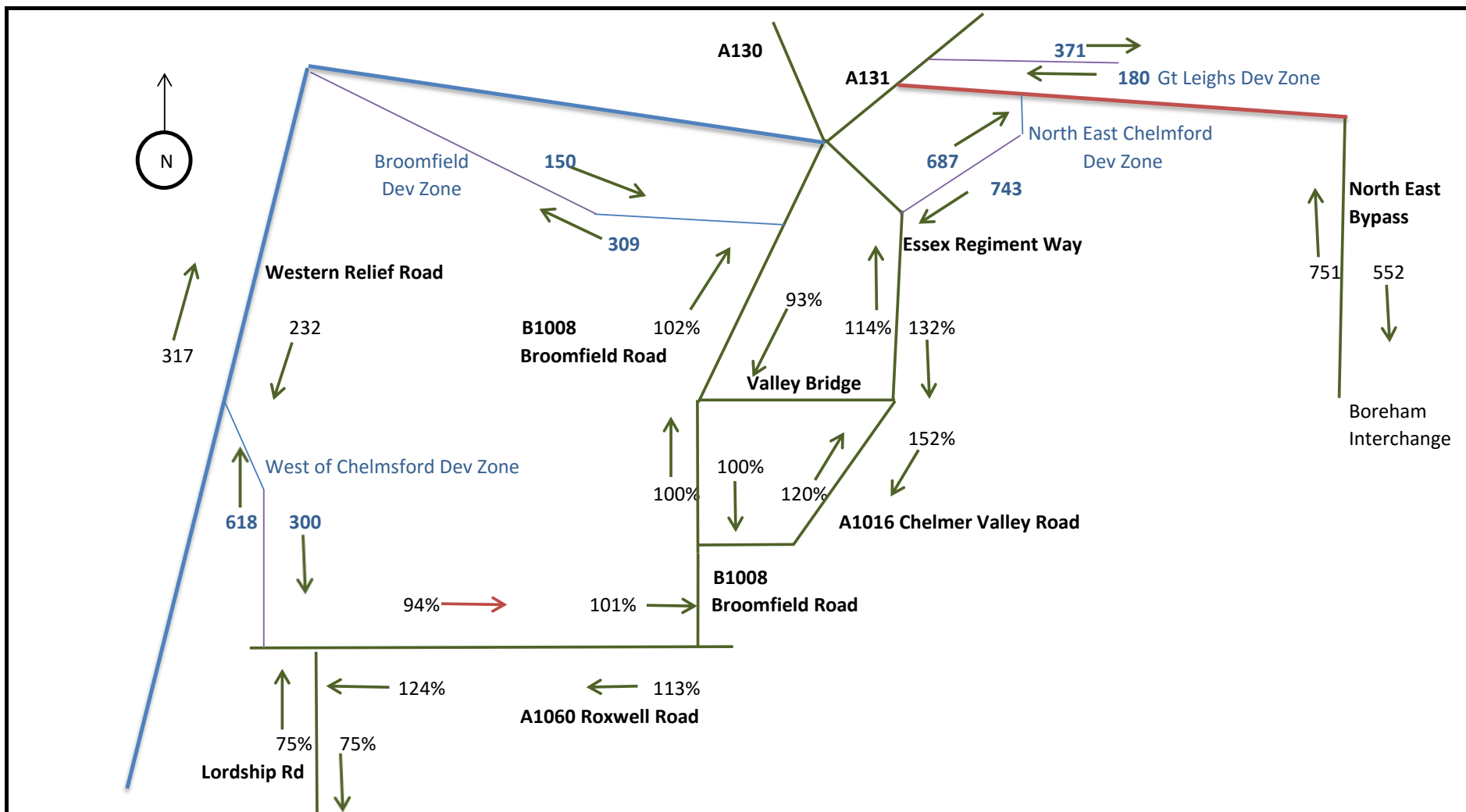
Drawing Title	AM Peak 08:00-09:00 Option 2 Total Flows with Western Relief Road North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 25	




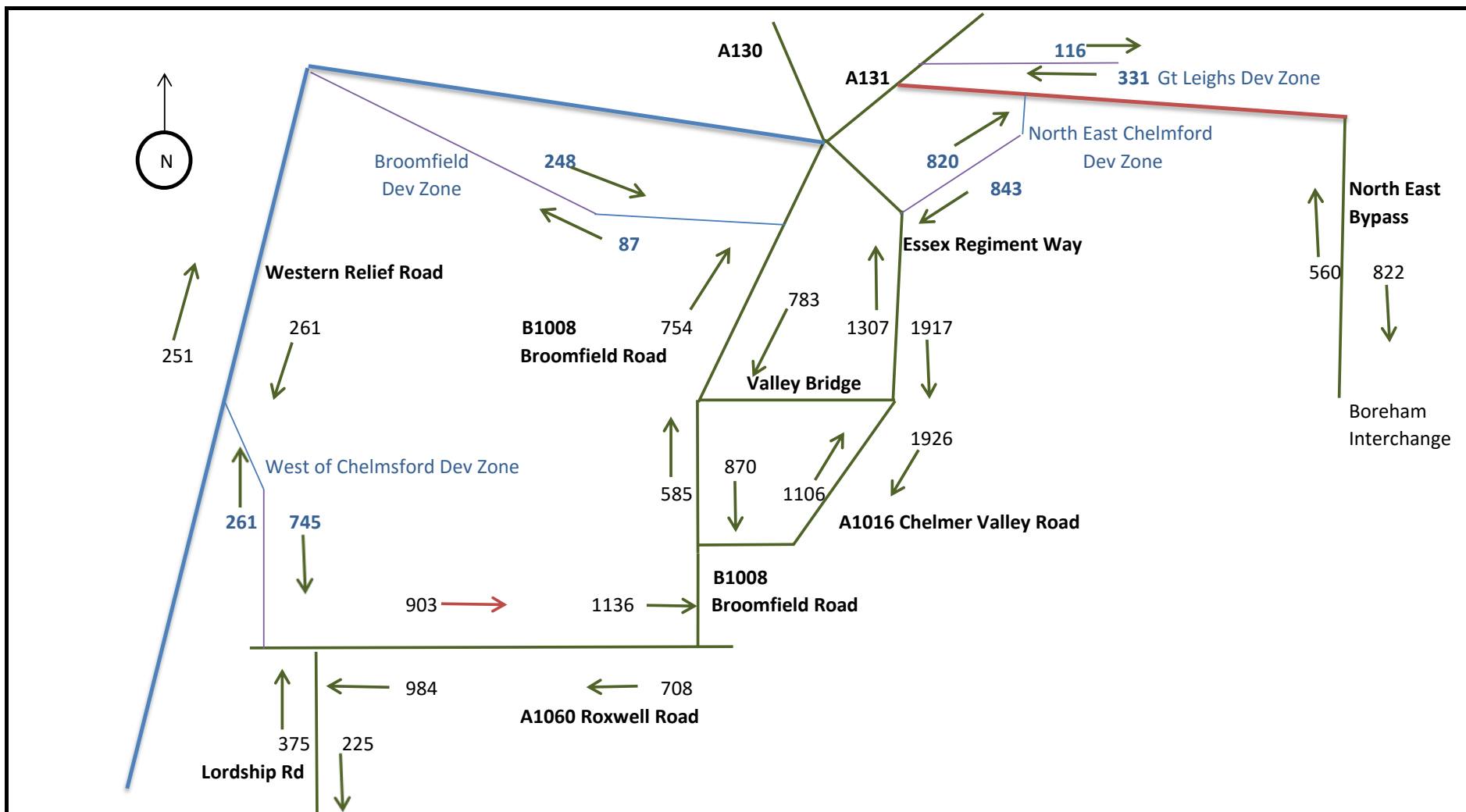
Drawing Title	AM Peak 08:00-09:00 Option 2 Percentage Increase Western Relief Road North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 26	




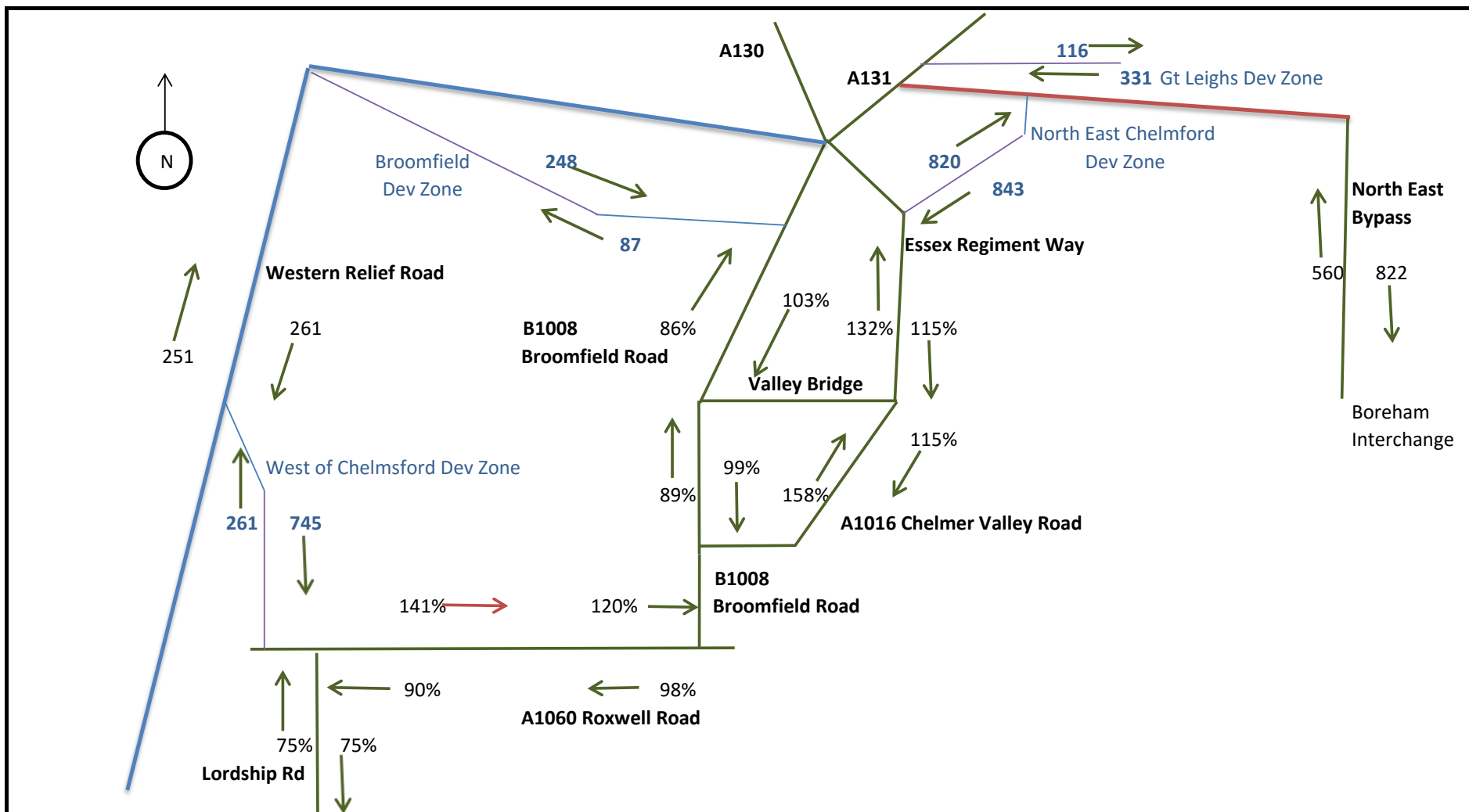
Drawing Title	PM Peak 17:00-18:00 Option 2 Total Flows with North East Bypass and Western Relief Road	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 27	




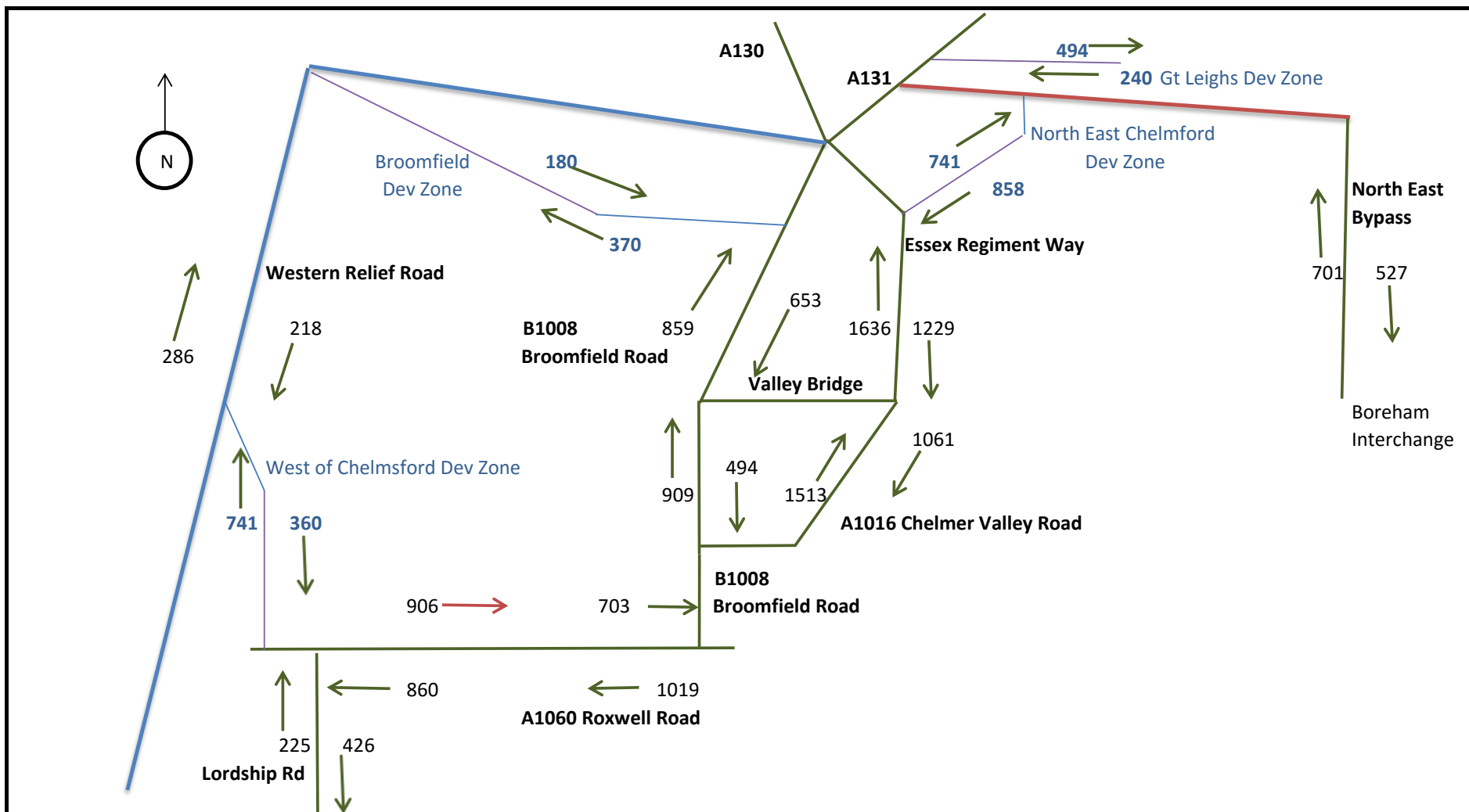
Drawing Title	PM Peak 17:00-18:00 Option 2 Percentage Change with North East Bypass and Western Relief Road	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 28	




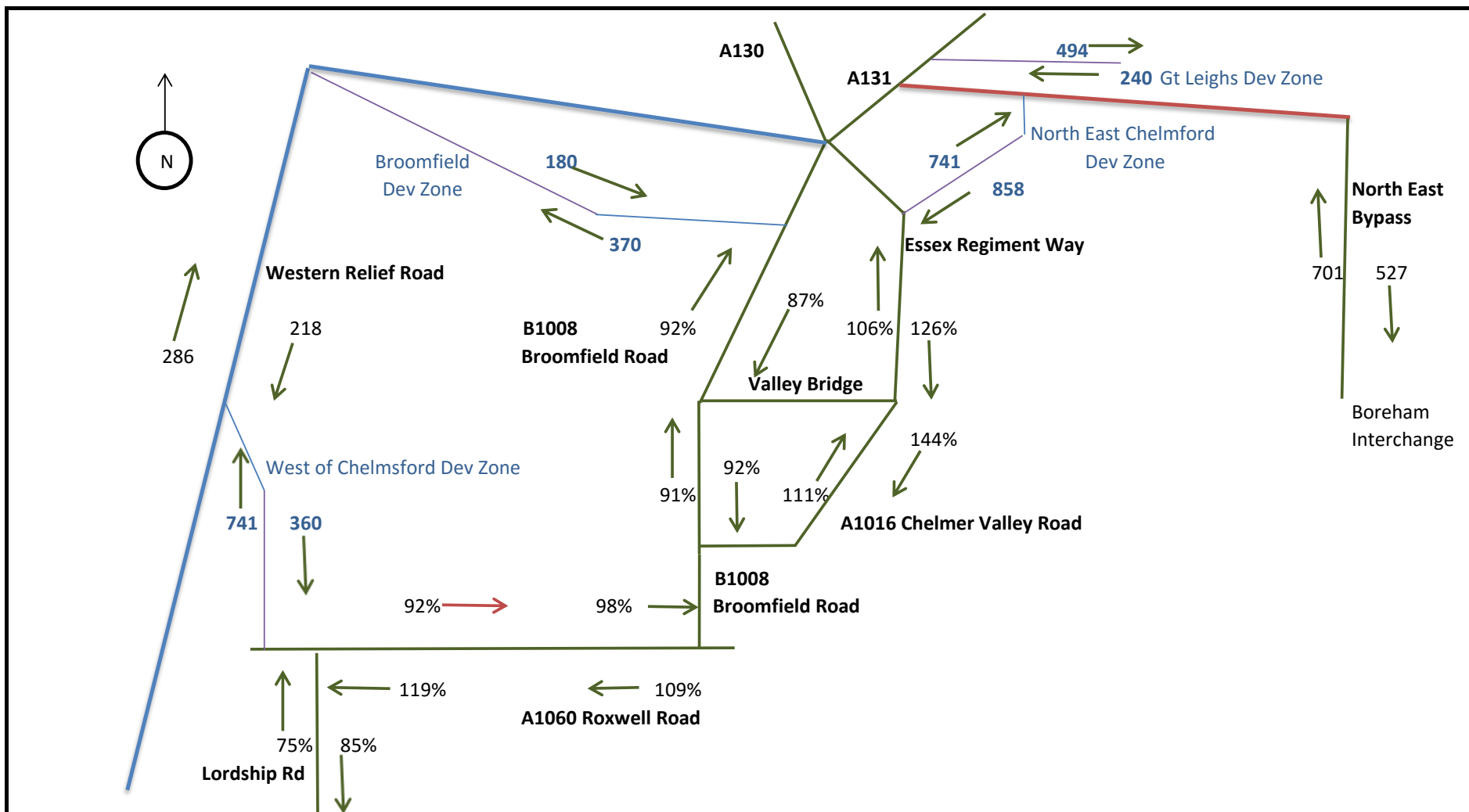
Drawing Title	AM Peak 08:00-09:00 Option 3 Total Flows with Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 29	




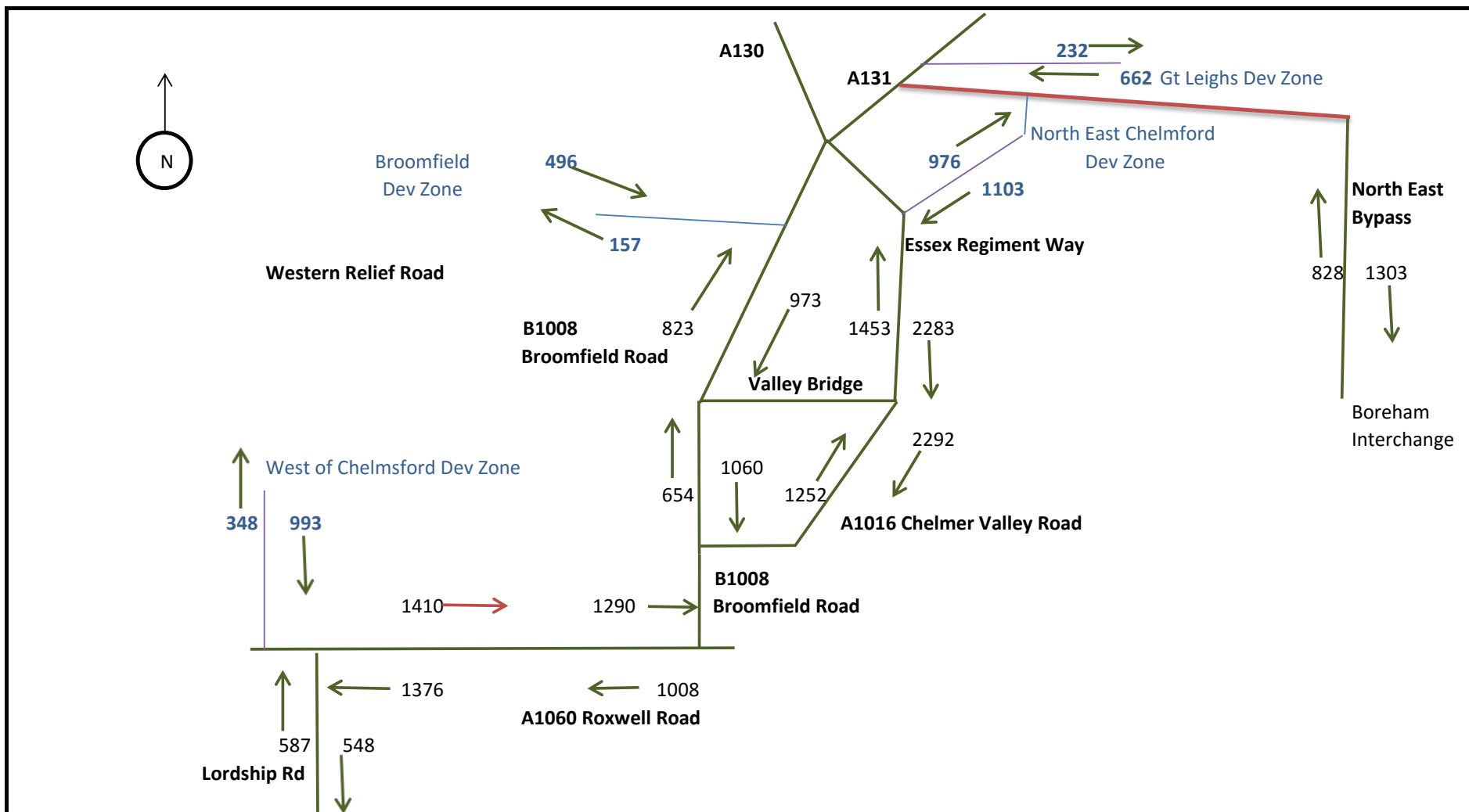
Drawing Title	AM Peak 08:00-09:00 Option 3 Percentage Change with Western Relief Road and North East Bypass	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 30	




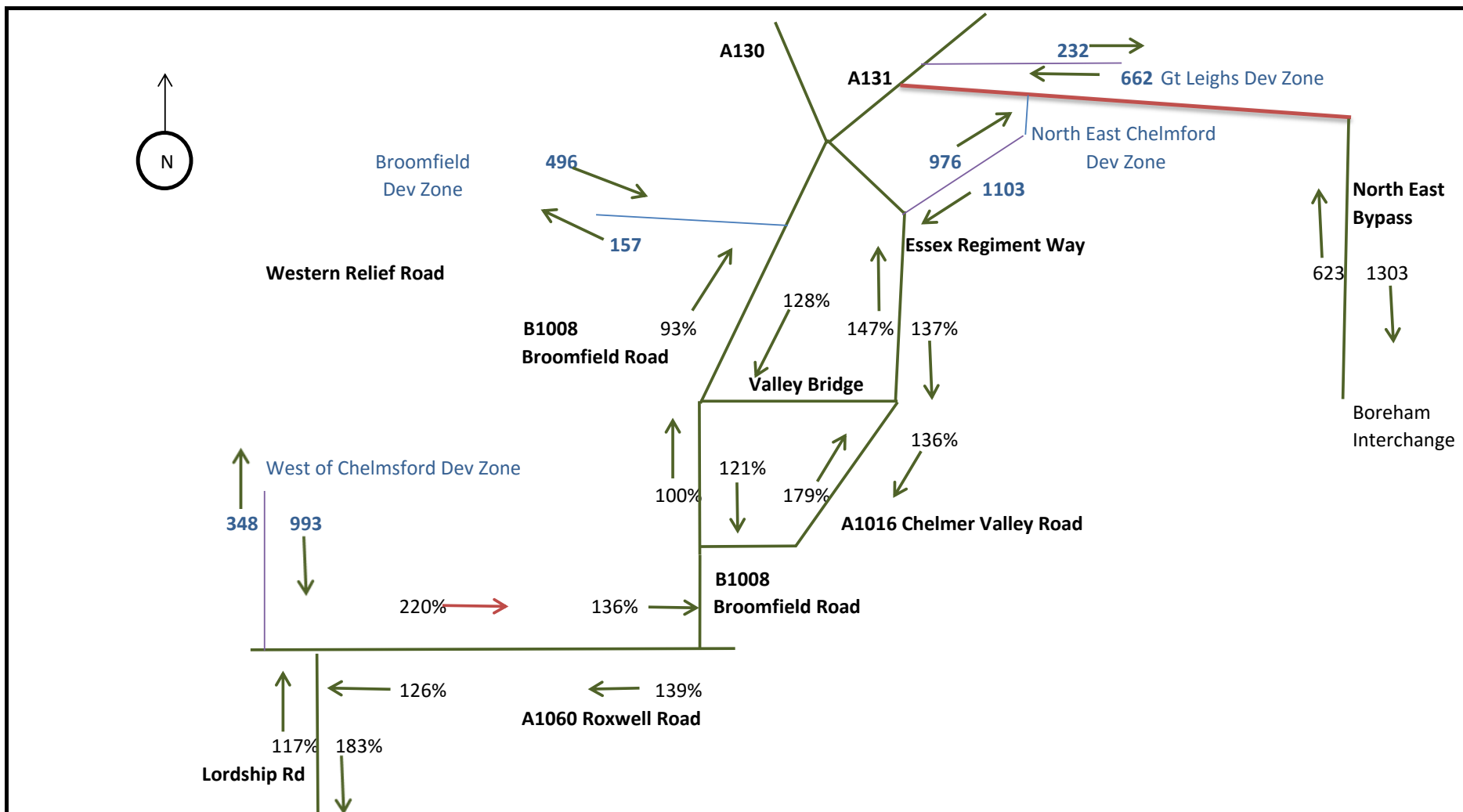
Drawing Title	PM Peak 17:00-18:00 Option 3 Total Flows with North East Bypass and Western Relief Road	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 31	




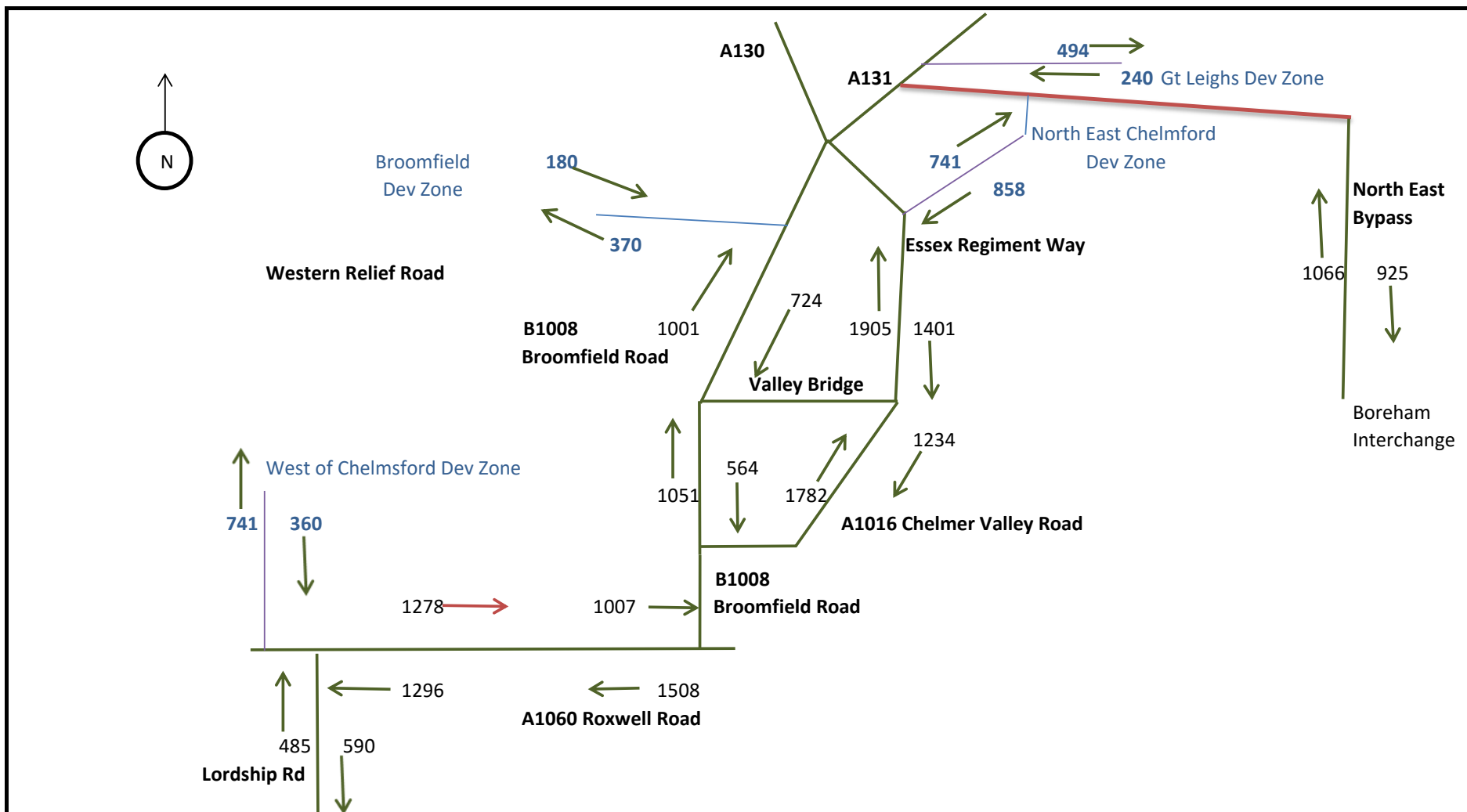
Drawing Title	PM Peak 17:00-18:00 Option 3 Total Flows with North East Bypass and Western Relief Road	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 32	




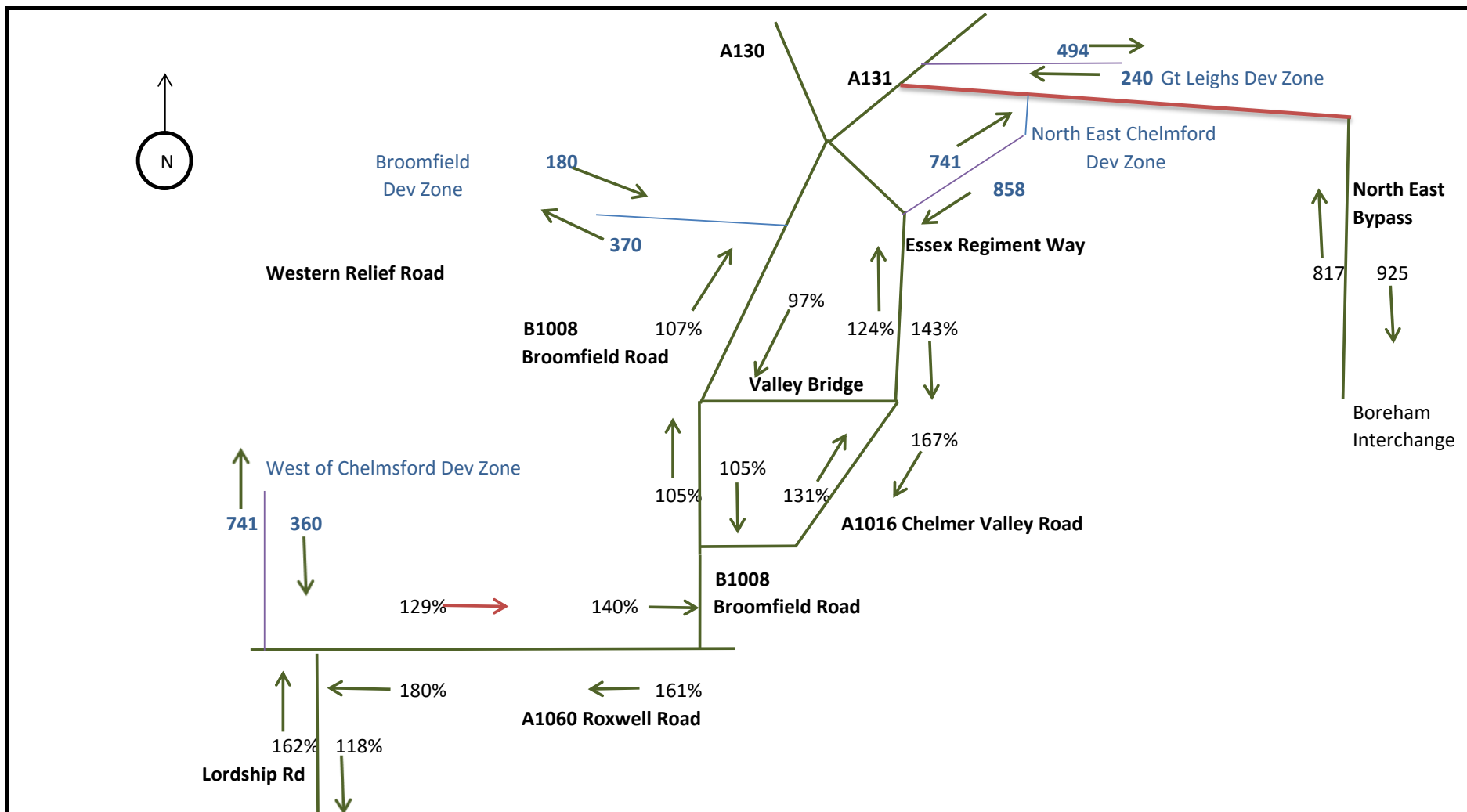
Drawing Title	AM Peak 08:00-09:00 Option 1 Total Flows with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 32	




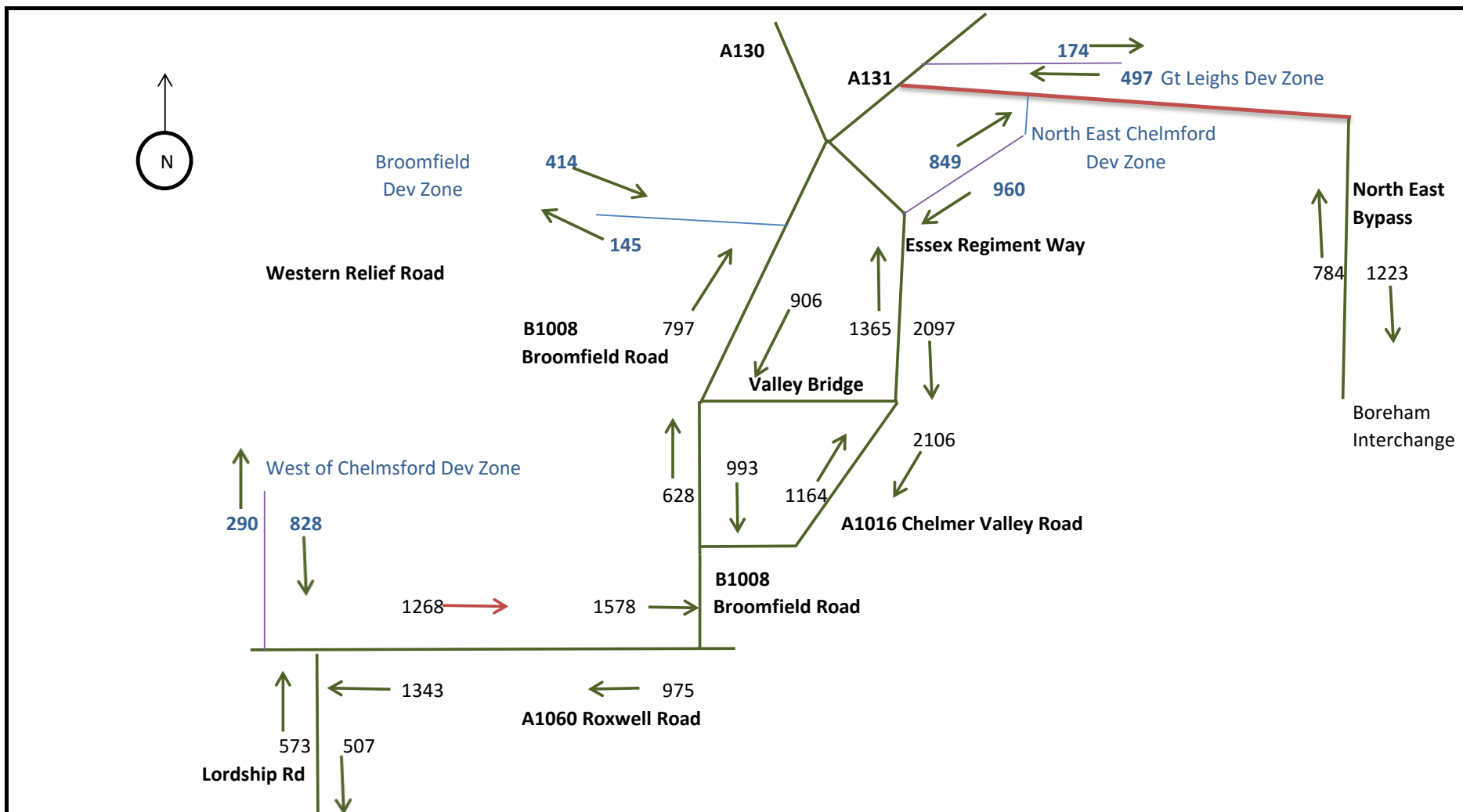
Drawing Title	AM Peak 08:00-09:00 Option 1 Percentage Change with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 33	




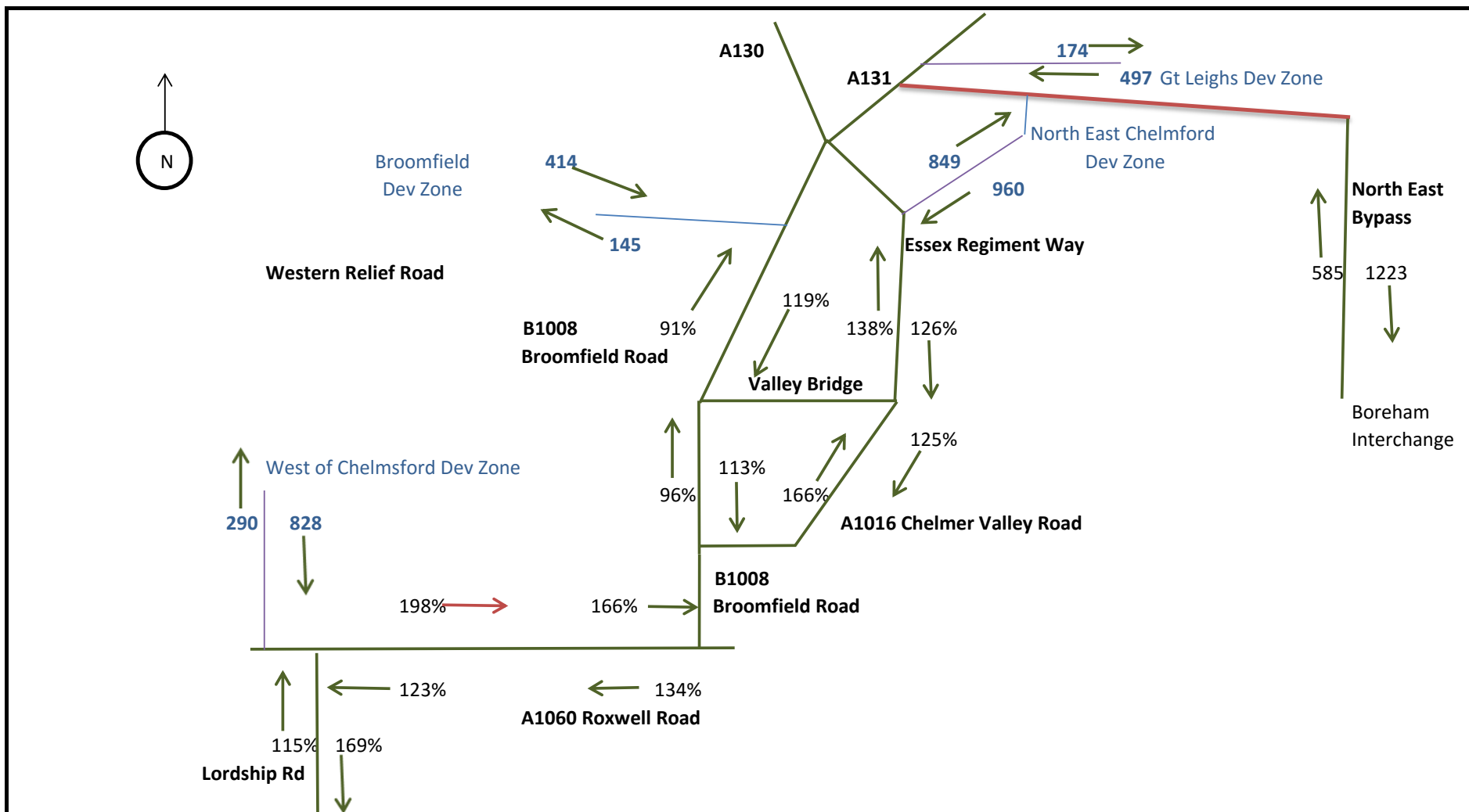
Drawing Title	PM Peak 17:00-18:00 Option 1 Total Flows with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 34	




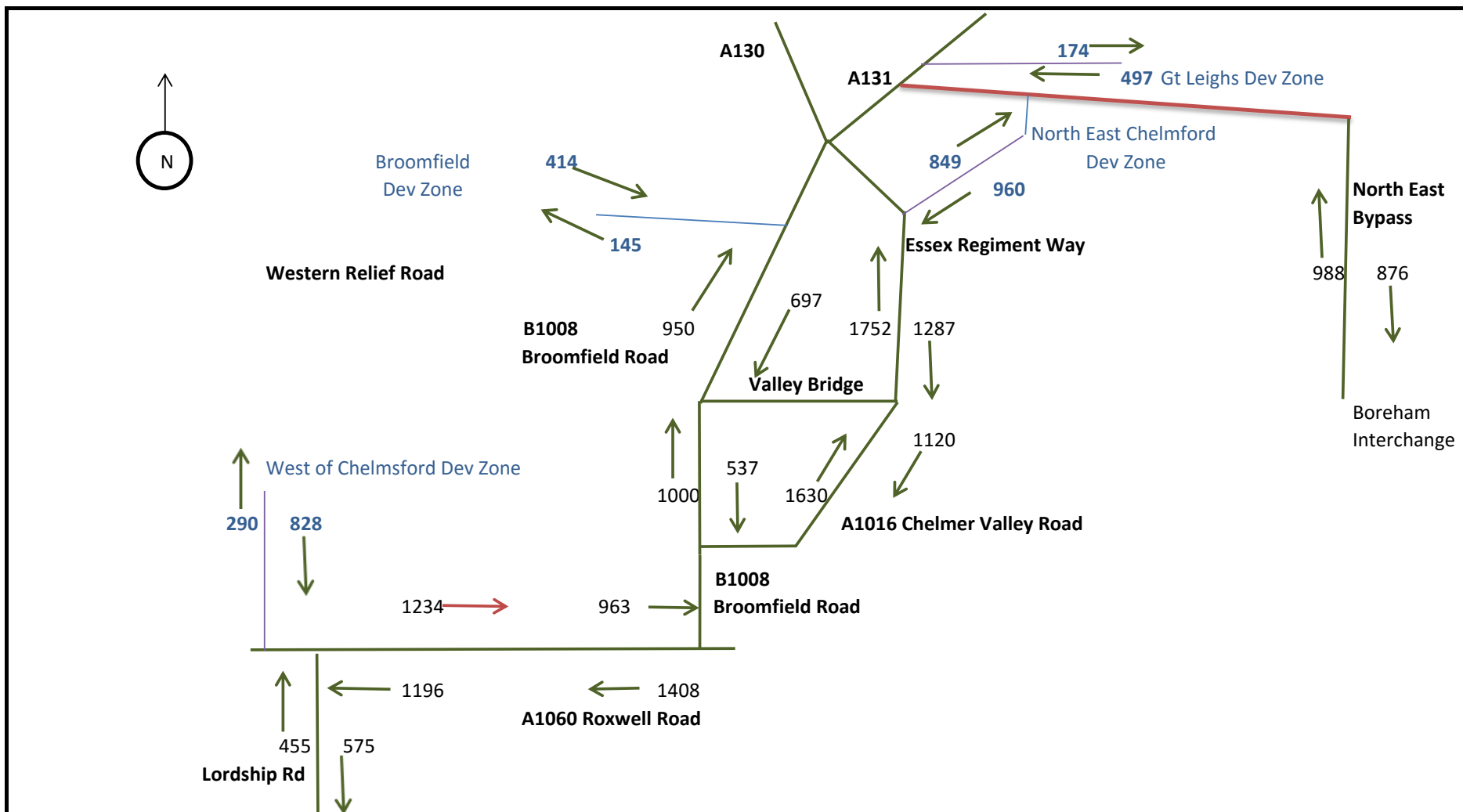
Drawing Title	PM Peak 17:00-18:00 Option 1 Percentage Change with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 35	




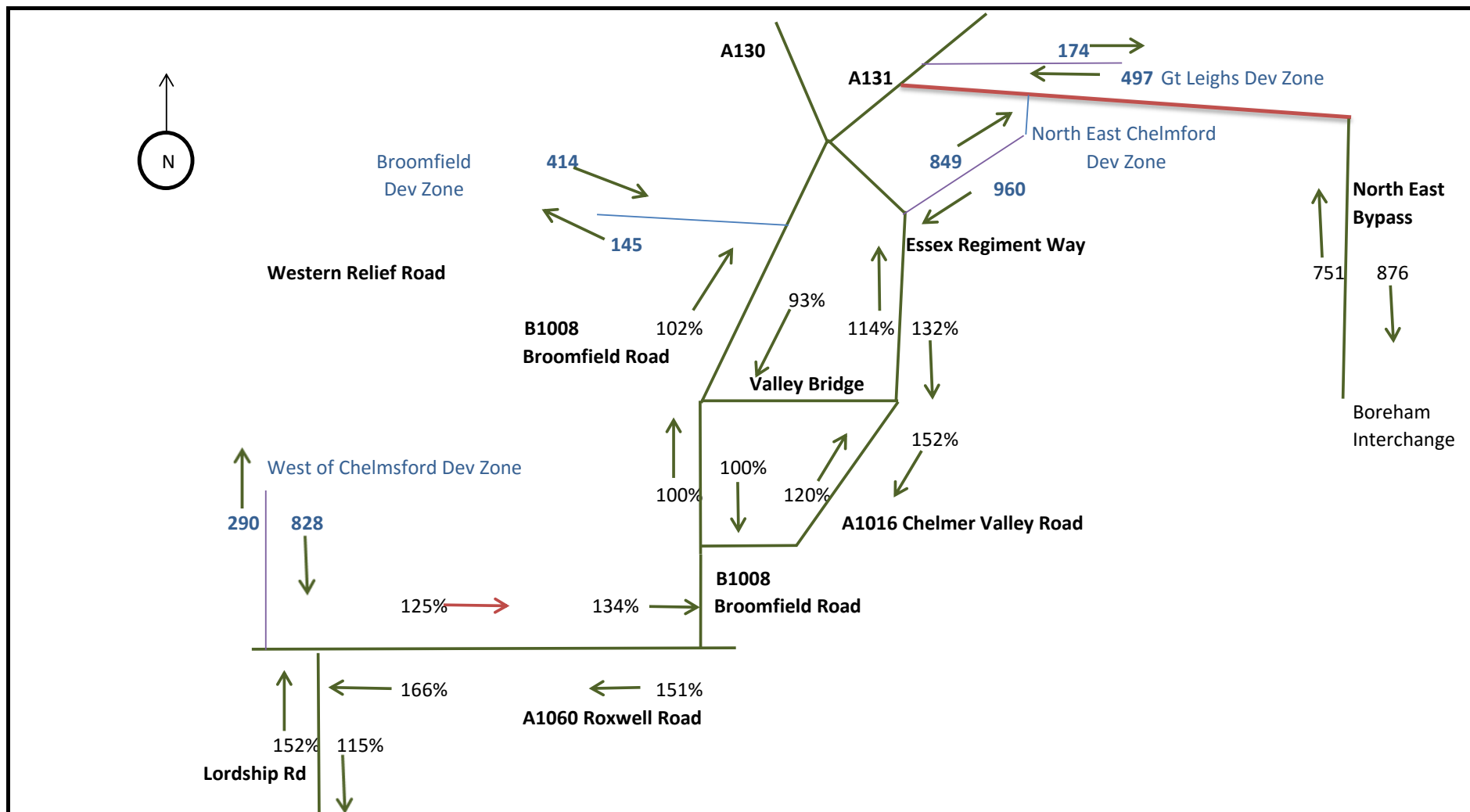
Drawing Title	AM Peak 08:00-09:00 Option 2 Total Flows with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 36	




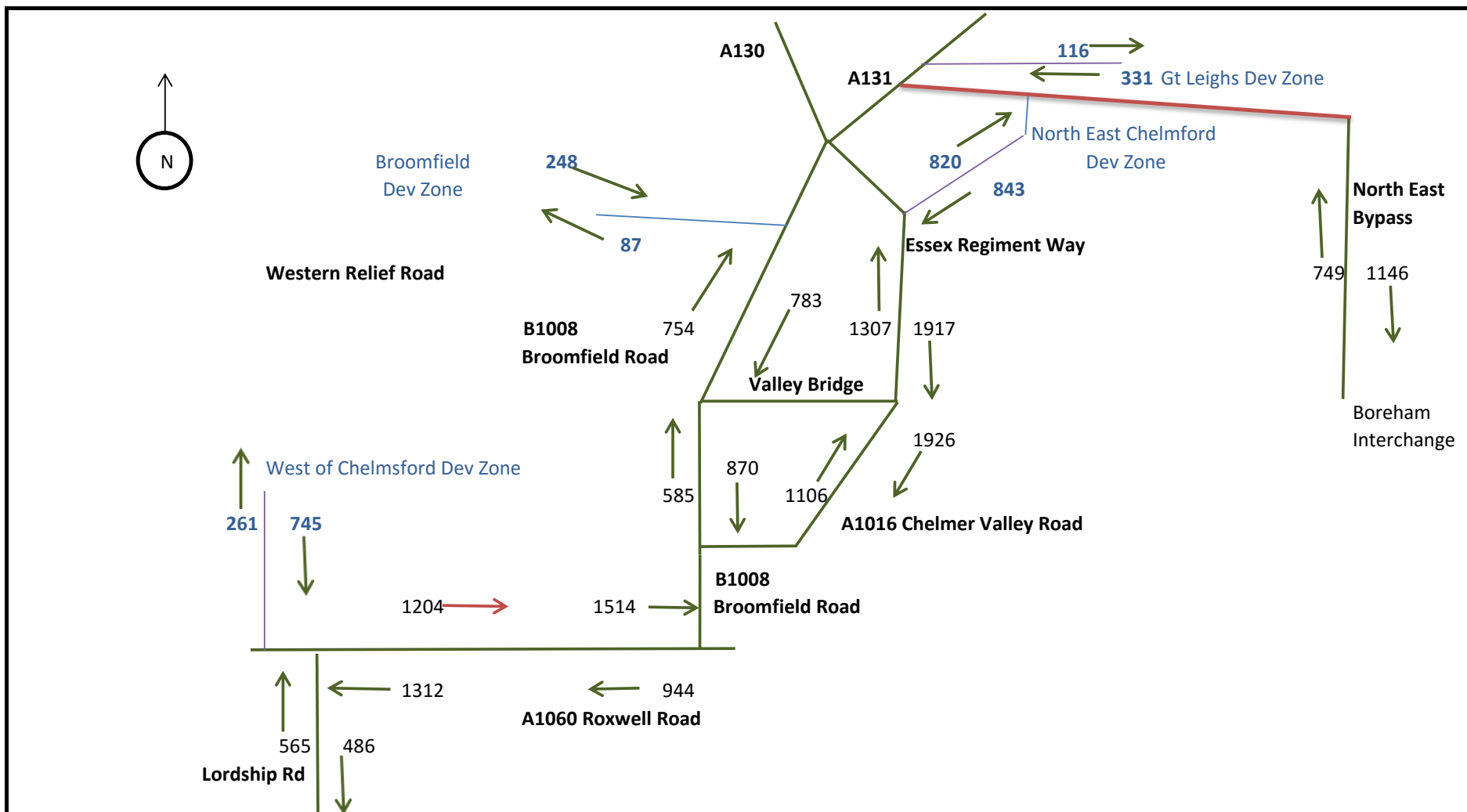
Drawing Title	AM Peak 08:00-09:00 Option 2 %age Change with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 37	




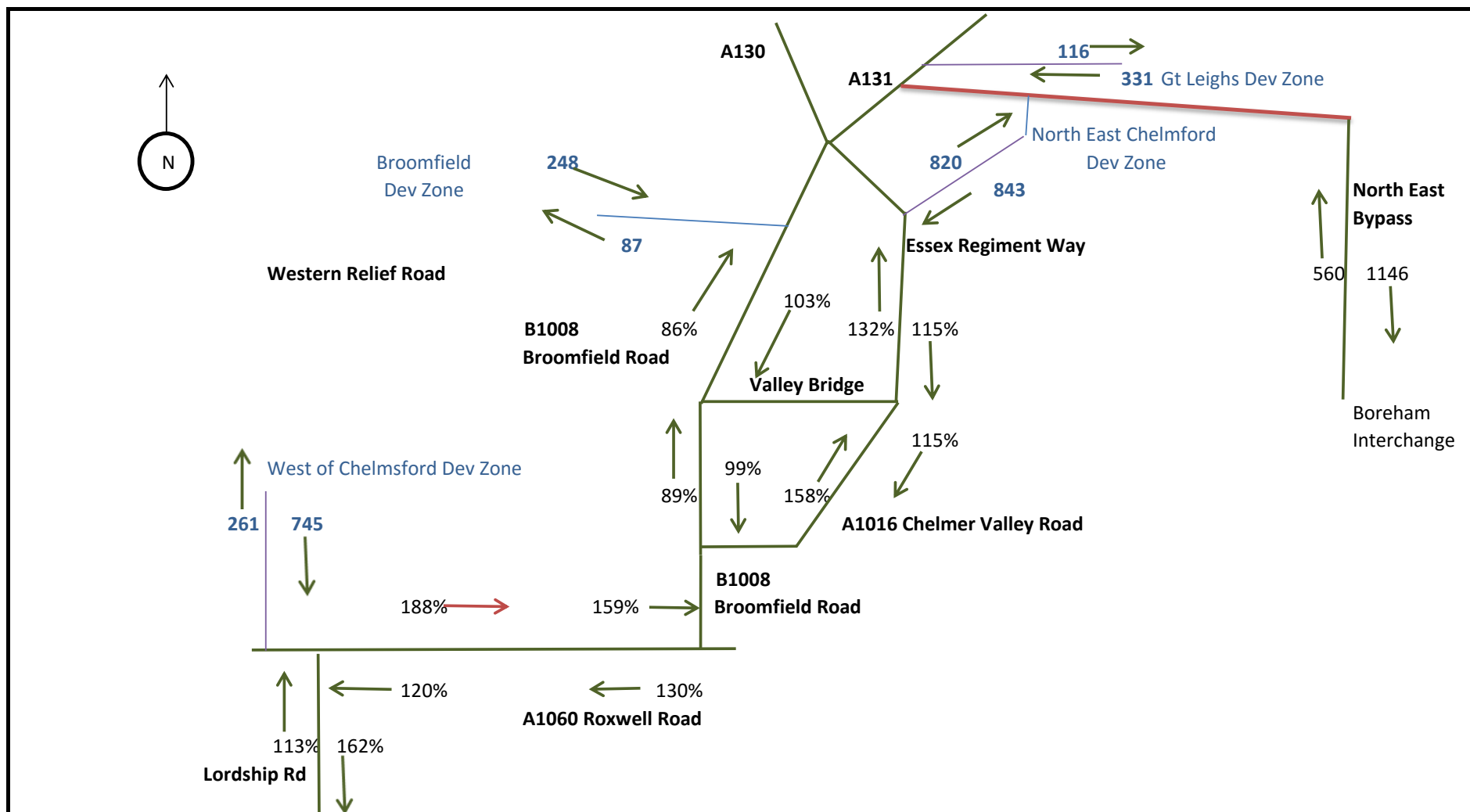
Drawing Title	PM Peak 17:00-18:00 Option Total Flows with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 38	




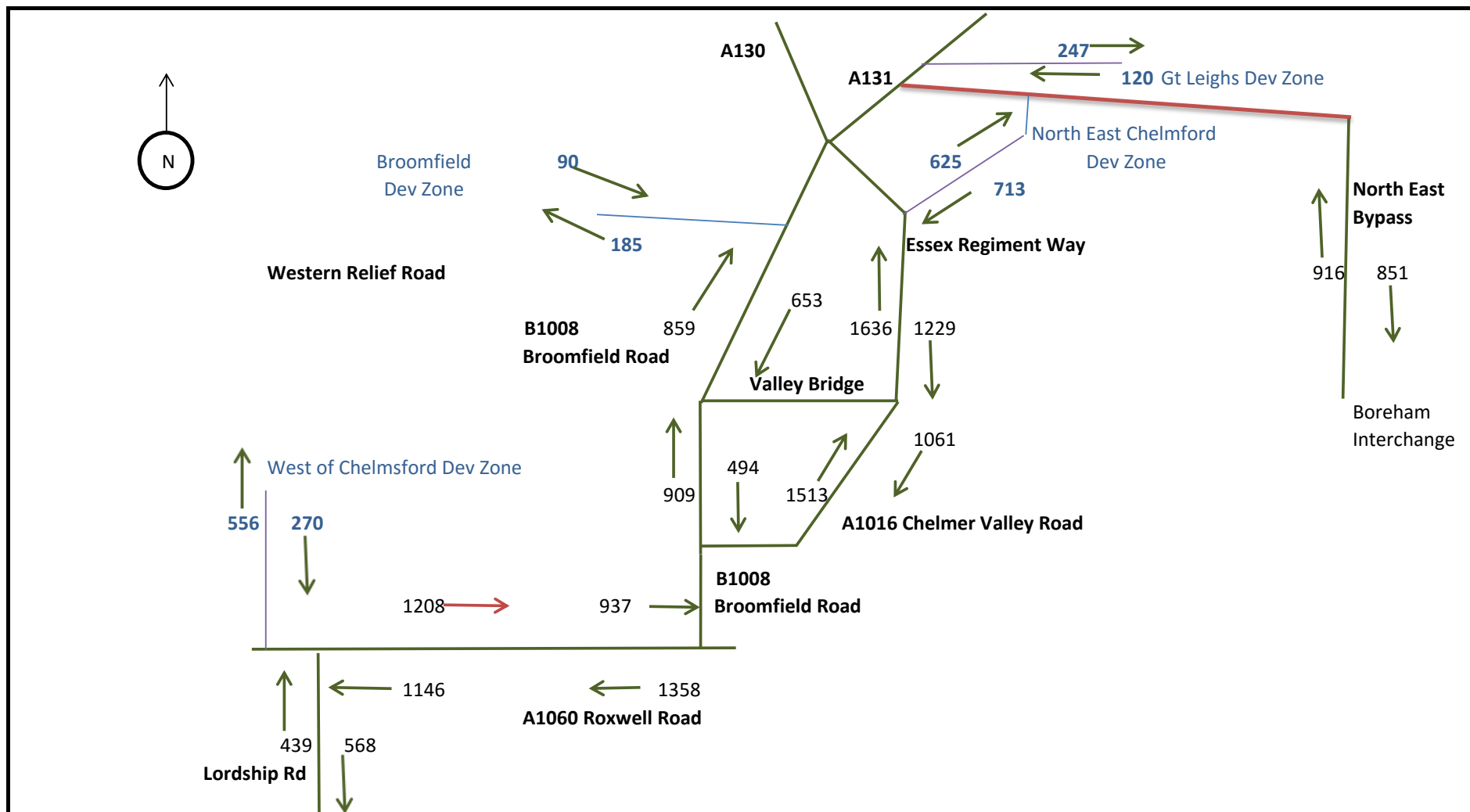
Drawing Title	PM Peak 17:00-18:00 Option 2 %age Change with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 39	




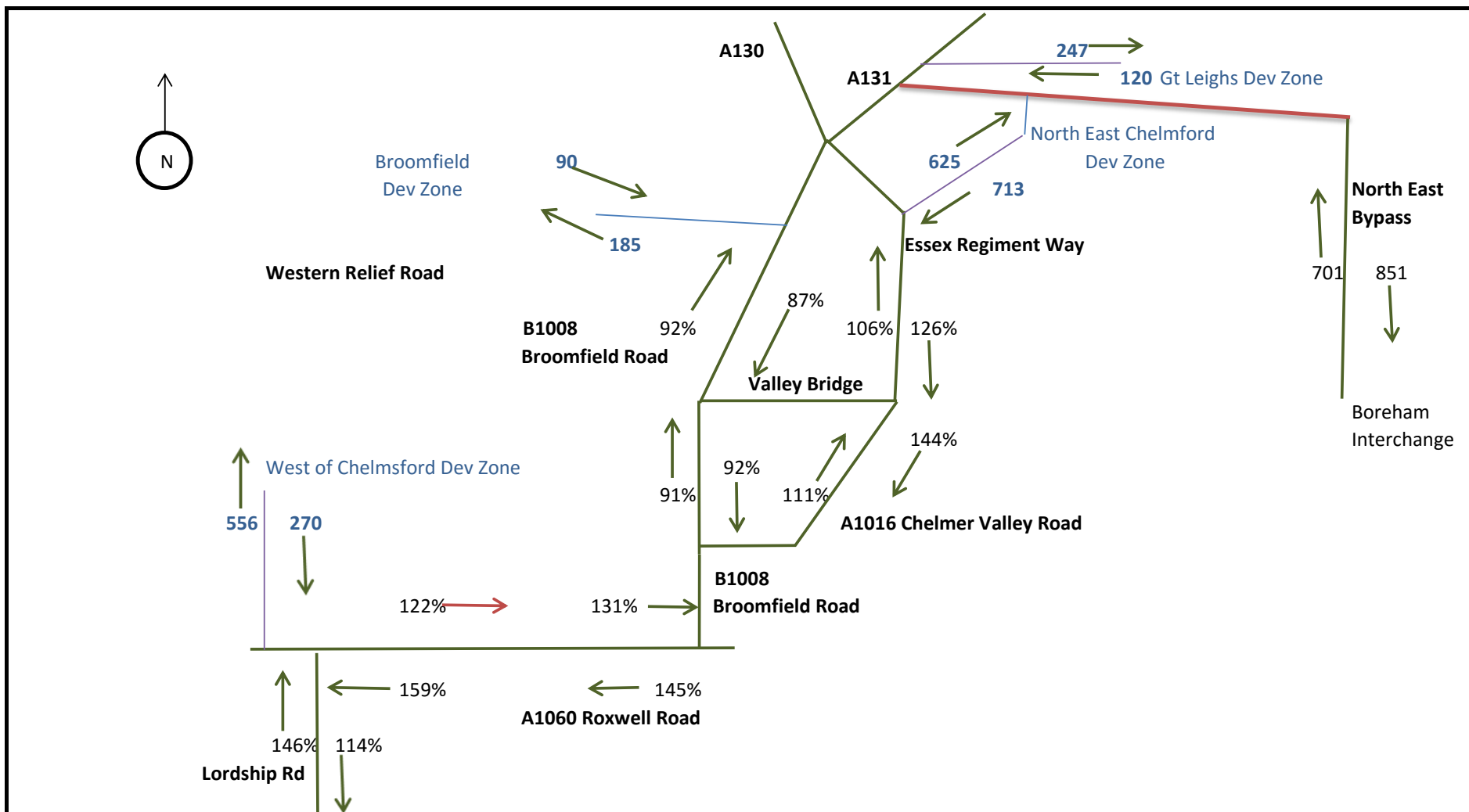
Drawing Title	AM Peak 08:00-09:00 Option 3 Total Flows with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 40	




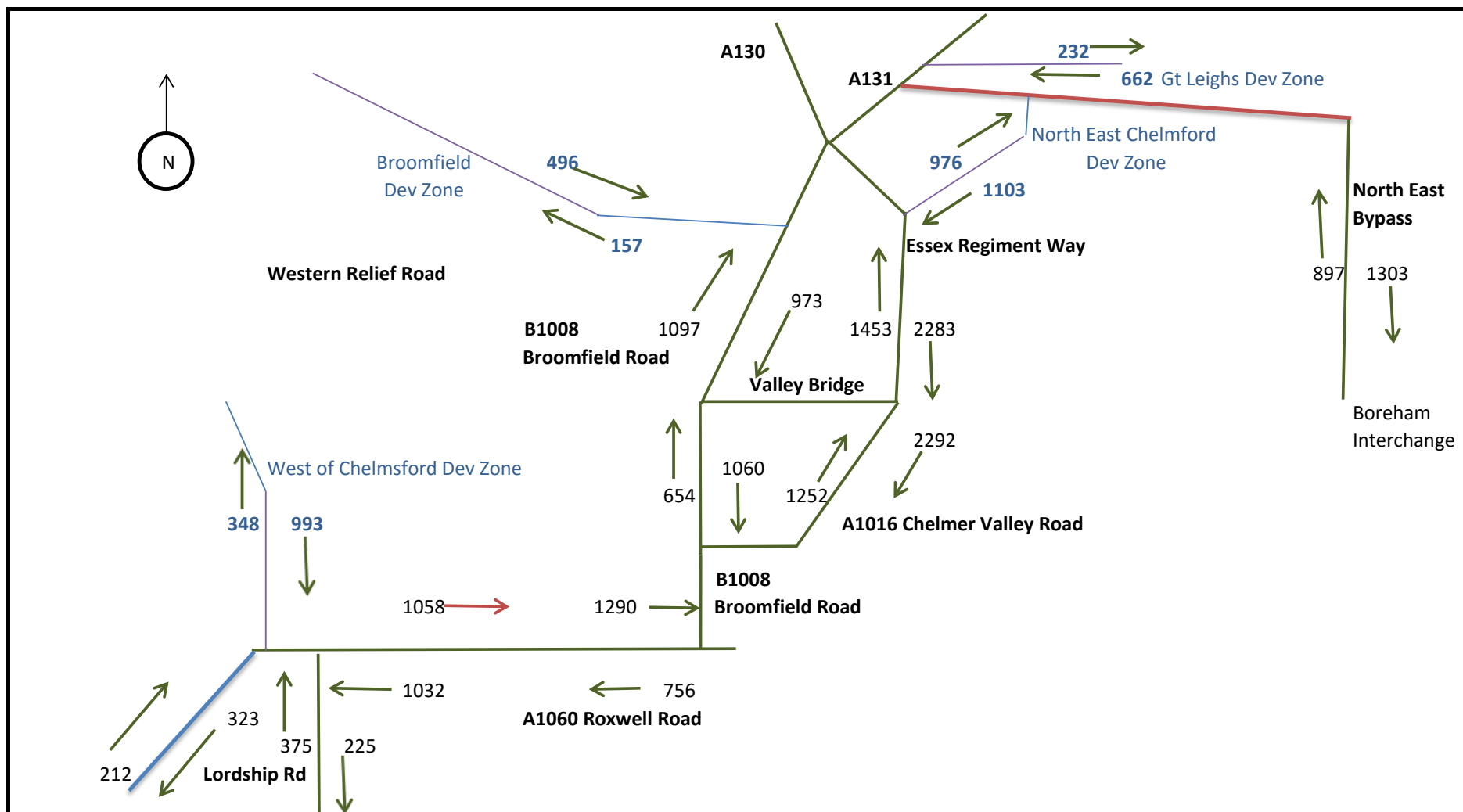
Drawing Title	AM Peak 08:00-09:00 Option 3 %age Change with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 41	




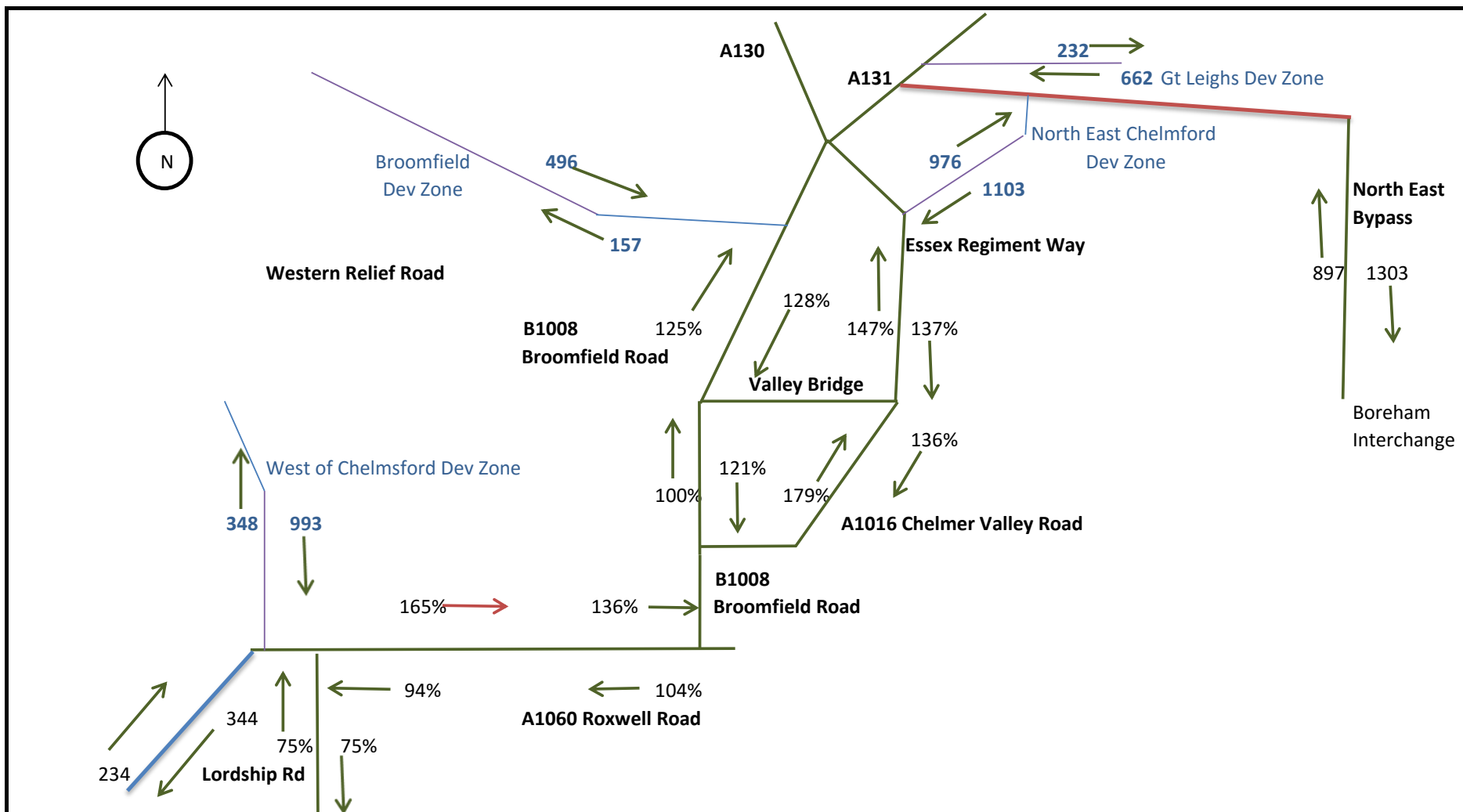
Drawing Title	PM Peak 17:00-18:00 Option 3 Total Flows with North Eastern Bypass	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 42	




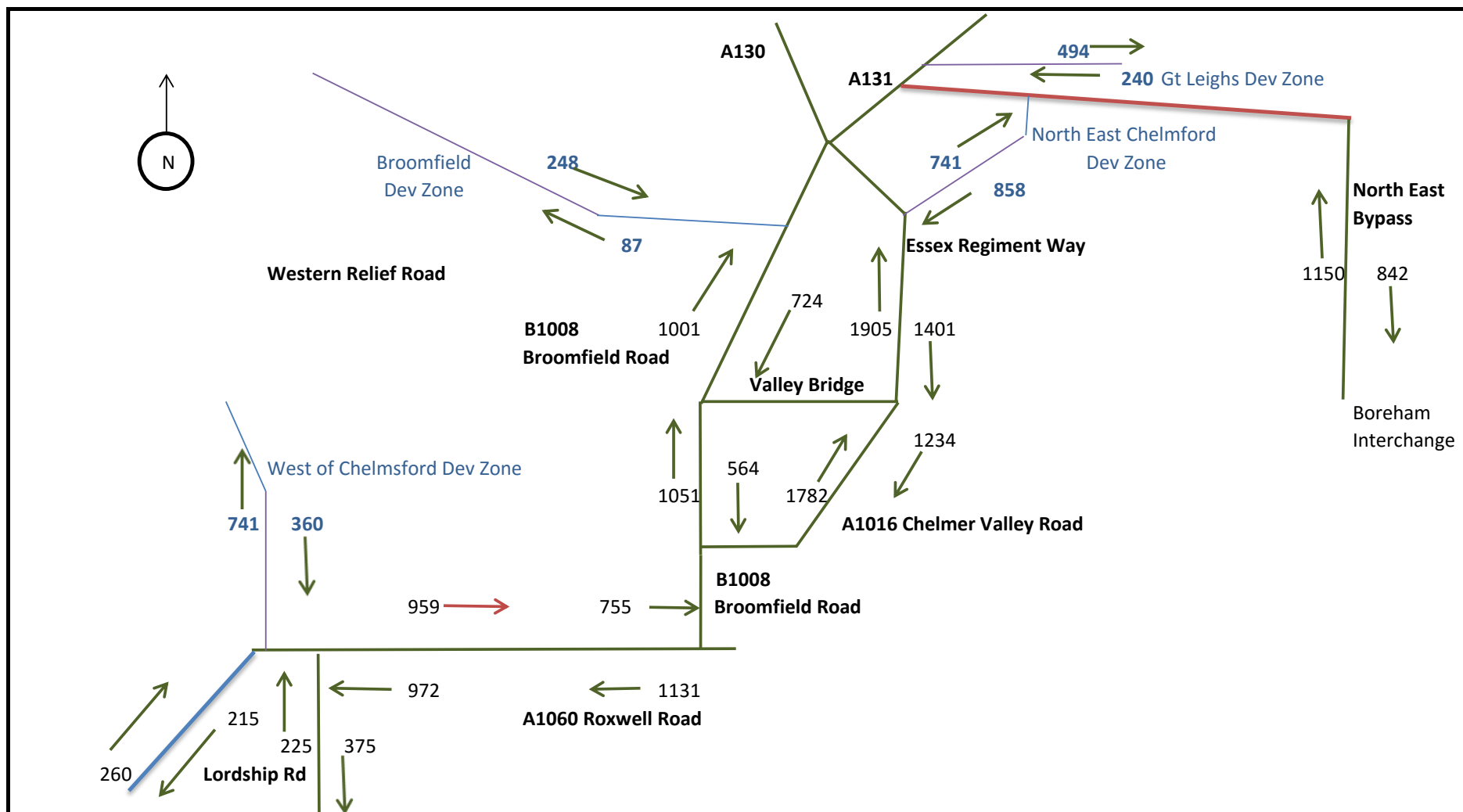
Drawing Title	PM Peak 17:00-18:00 Option 3 %age Change with North Eastern Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 43	




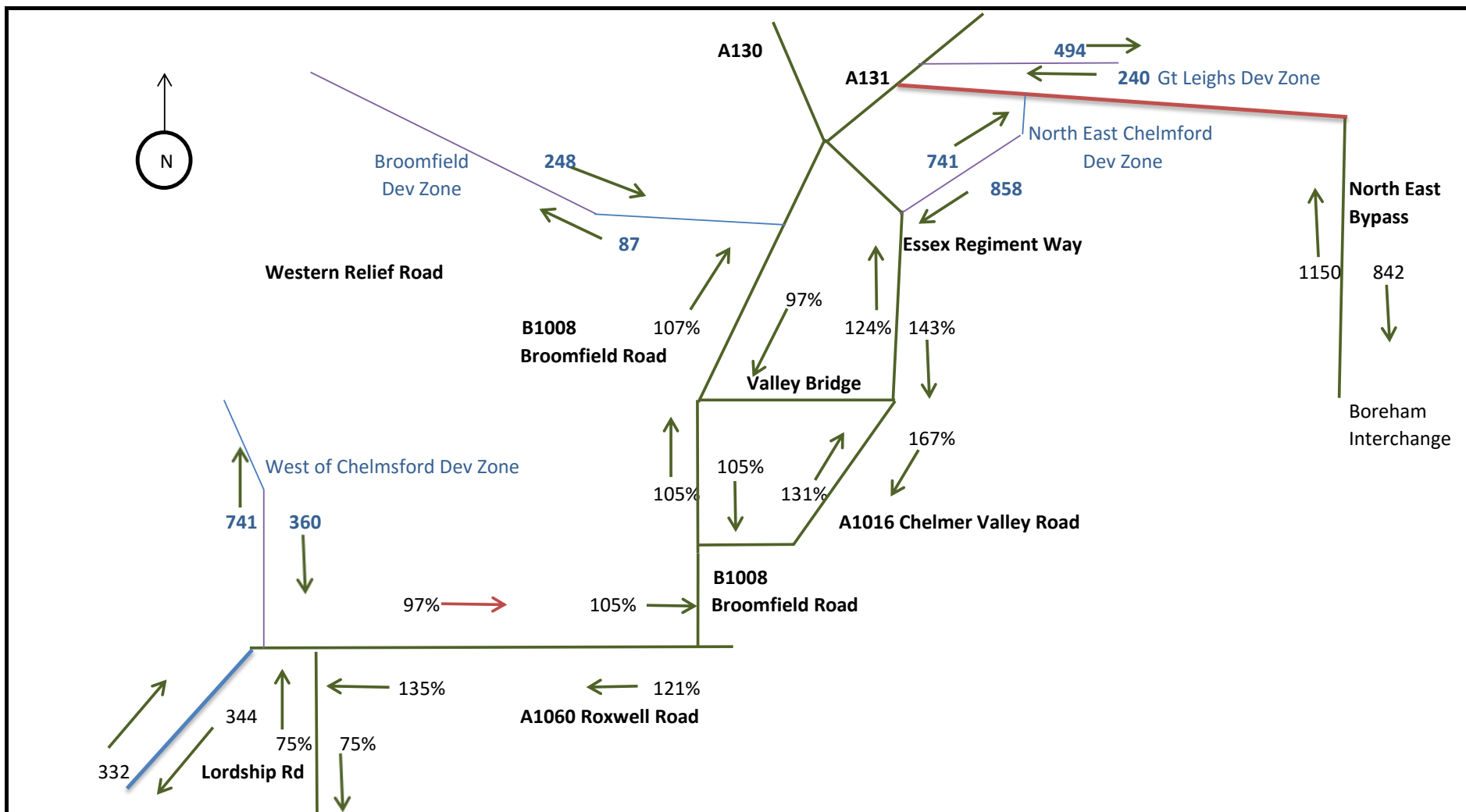
Drawing Title	AM Peak 08:00-09:00 Option 1 Total Flows with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
Project Title	Broomfield Traffic Study	Date	4/1/2016	
		Ref	Figure 44	




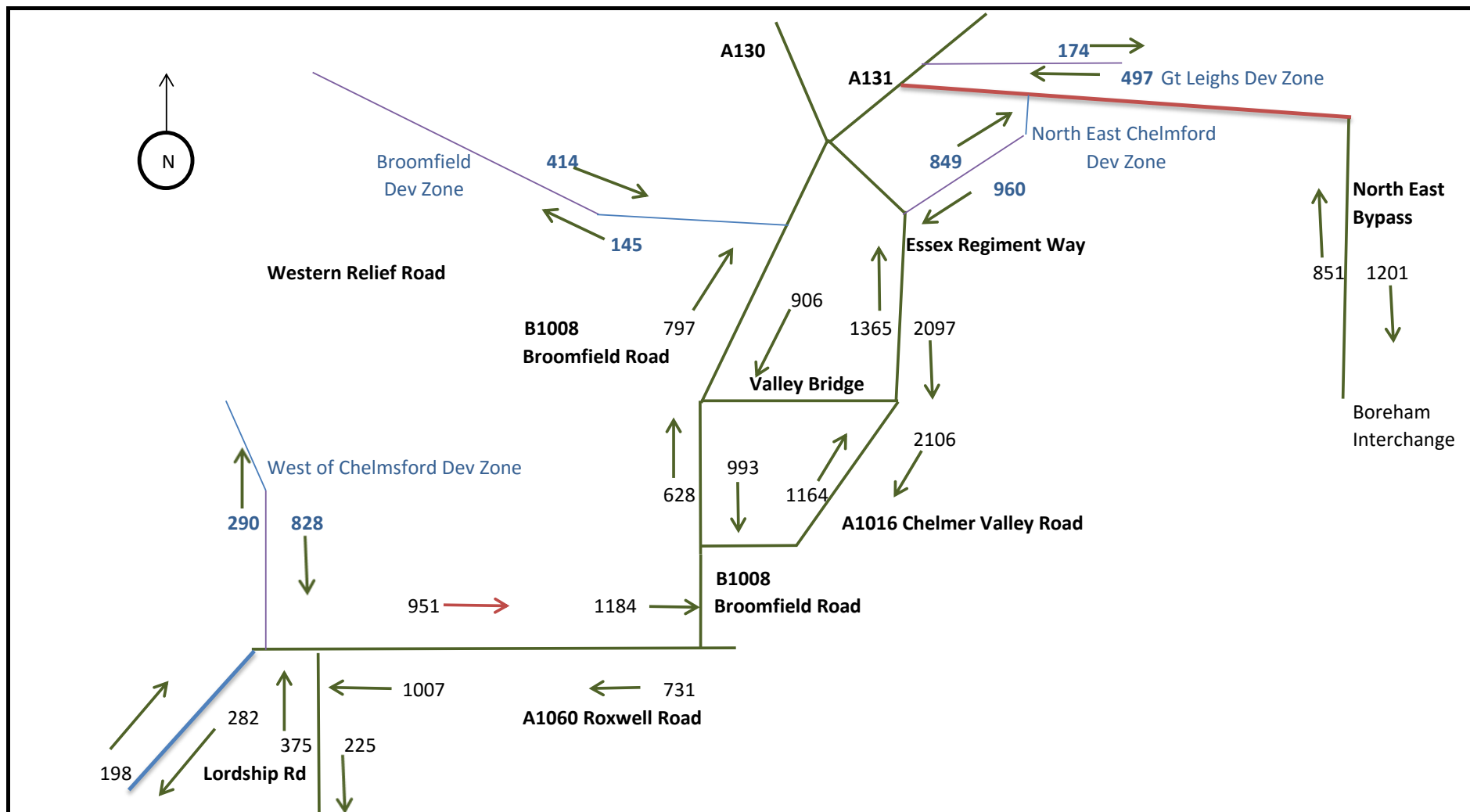
Drawing Title	AM Peak 08:00-09:00 Option 1 %age Change with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 45	




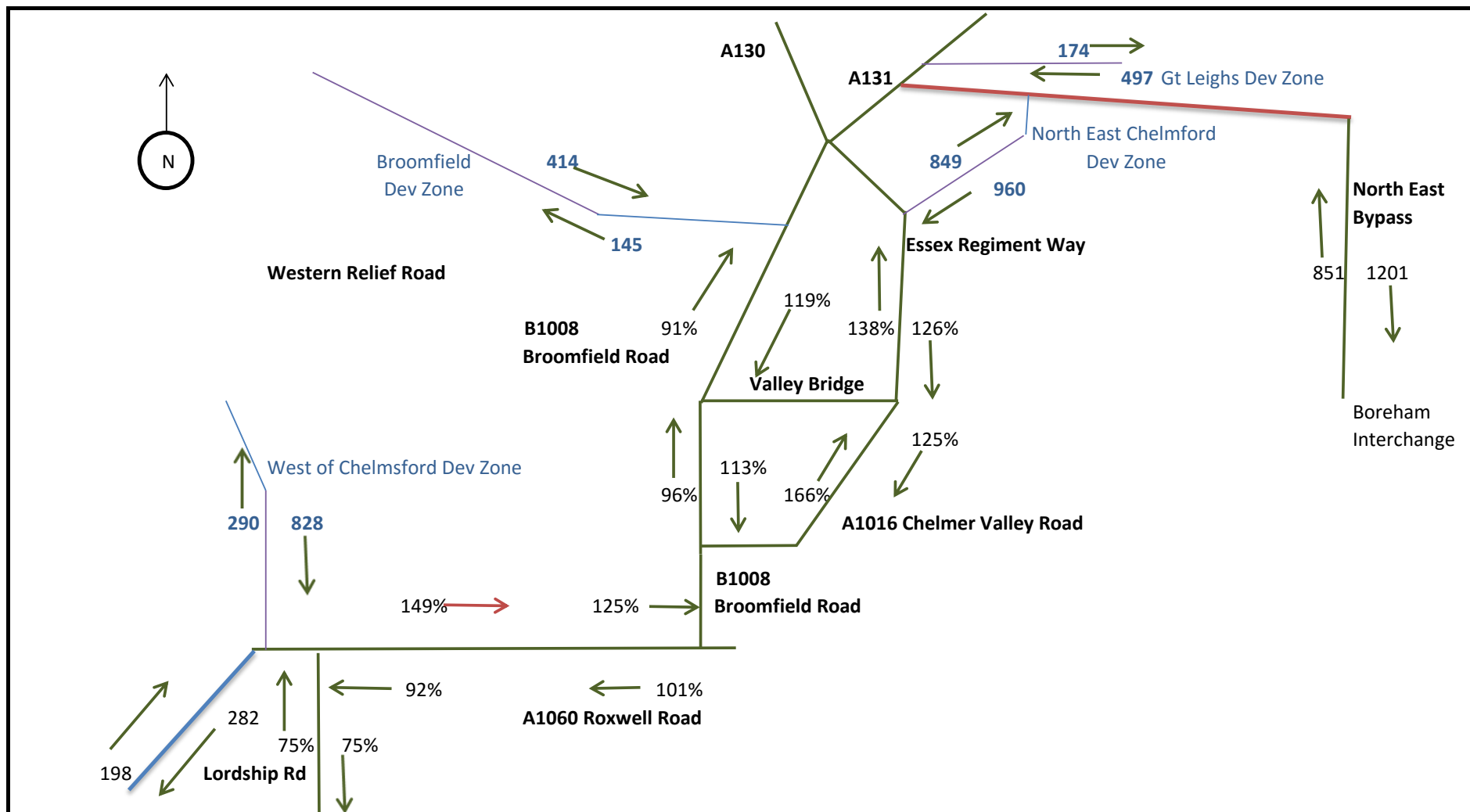
Drawing Title	PM Peak 17:00-18:00 Option 1 Total Flows with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 46	




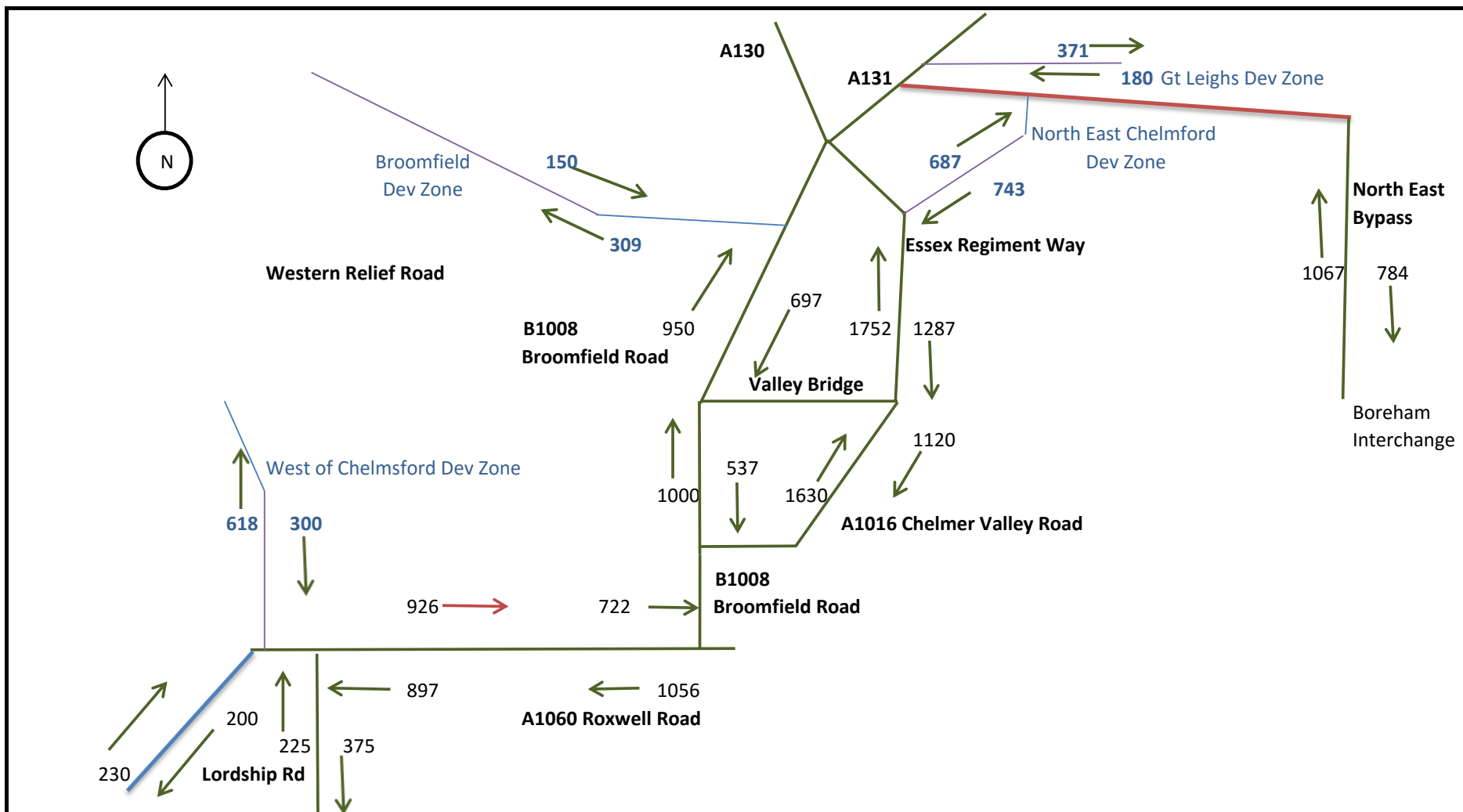
Drawing Title	PM Peak 17:00-18:00 Option 1 %age Change with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 47	




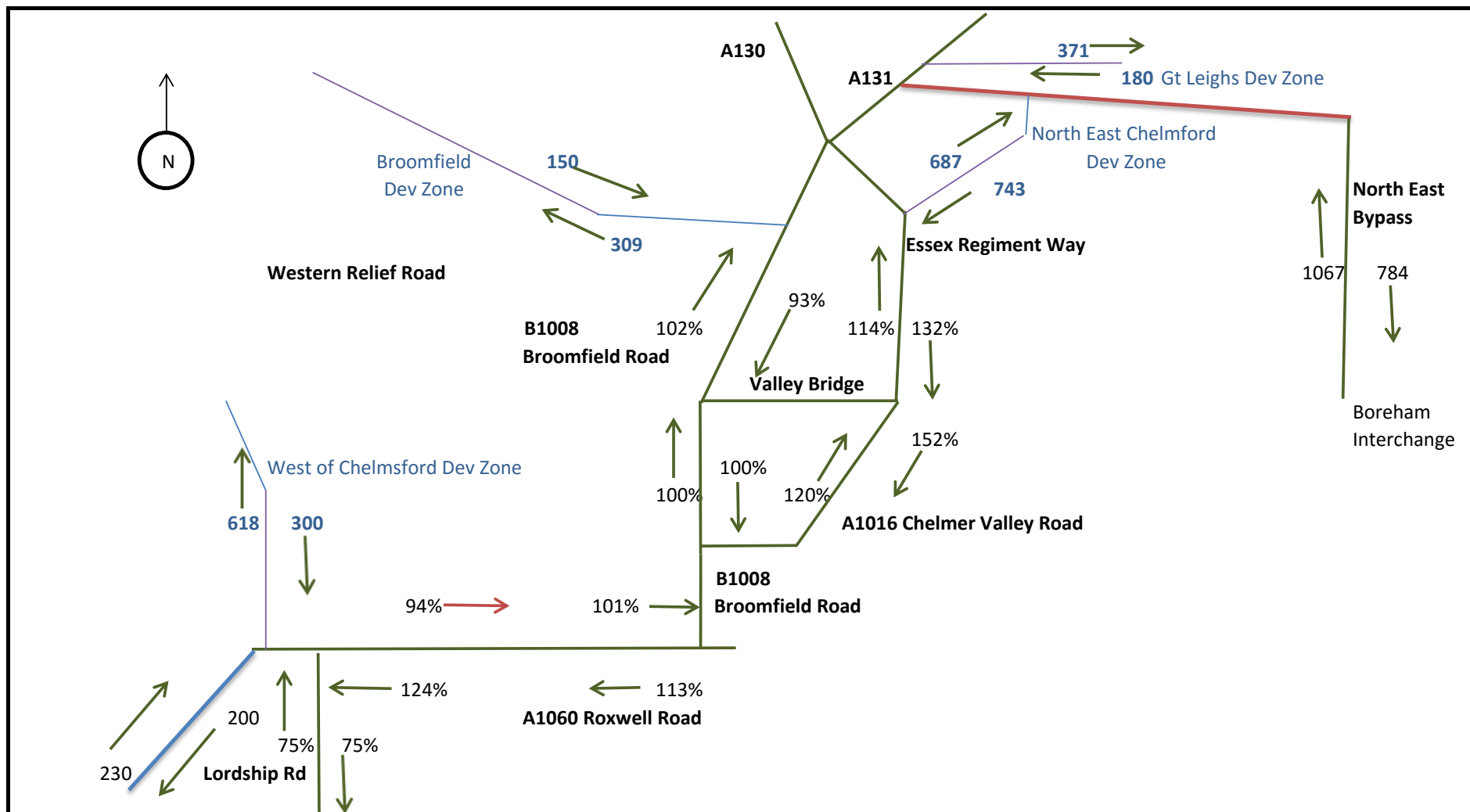
Drawing Title	AM Peak 08:00-09:00 Option 2 Total Flows with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 48	




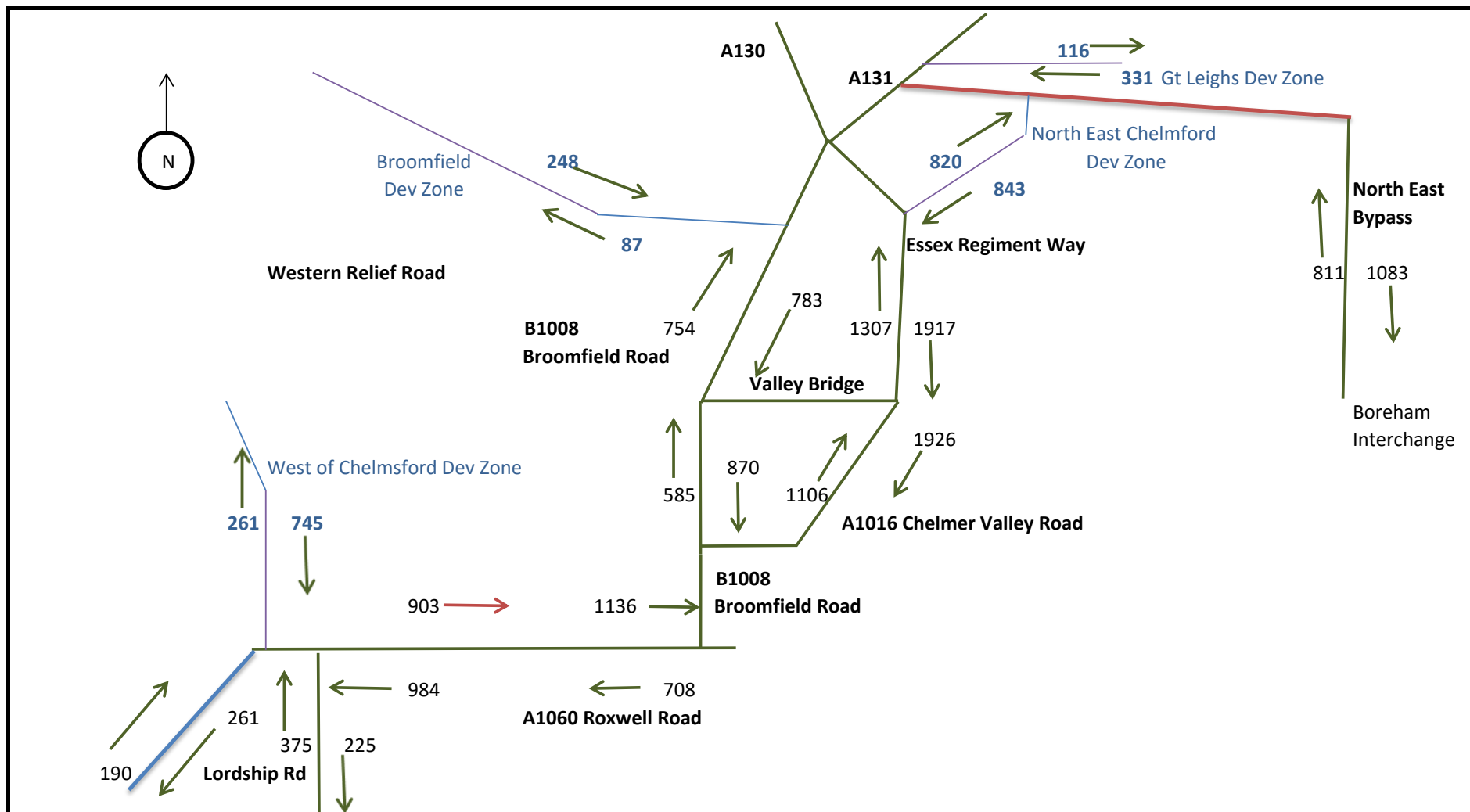
Drawing Title	AM Peak 08:00-09:00 Option 2 %age Change with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 49	




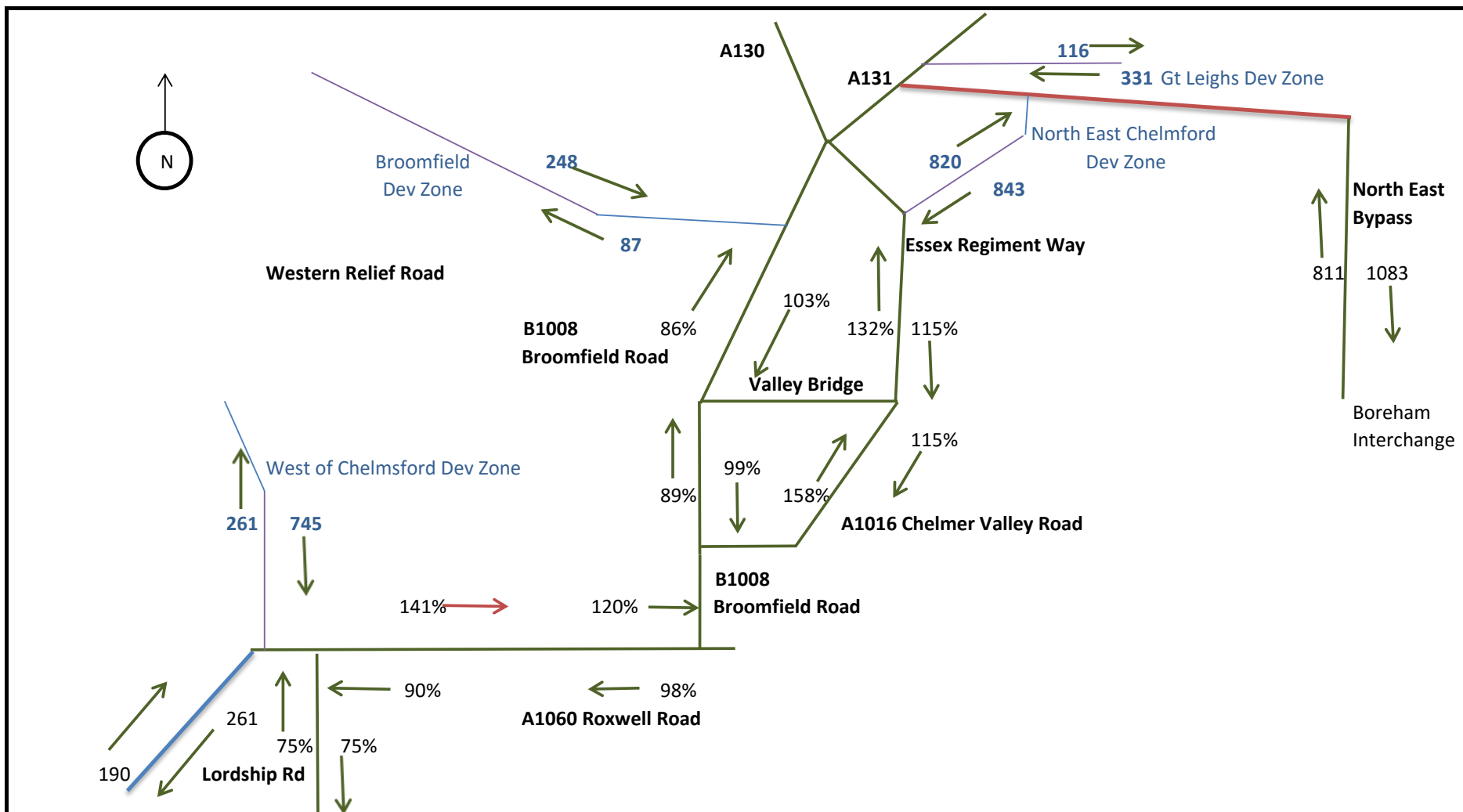
Drawing Title	PM Peak 17:00-18:00 Option 2 Total Flows with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 50	




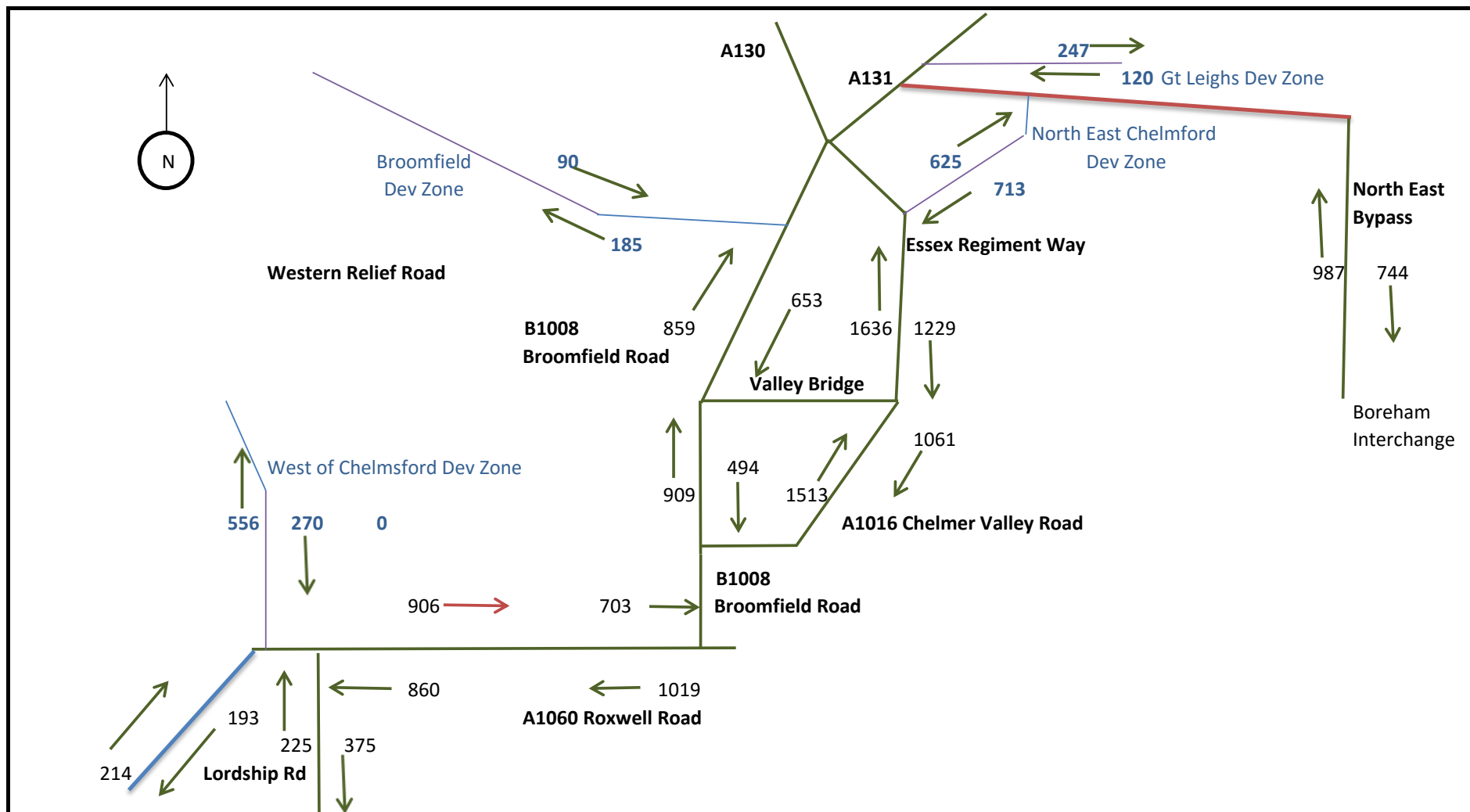
Drawing Title	PM Peak 17:00-18:00 Option 2 %age Change with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 51	




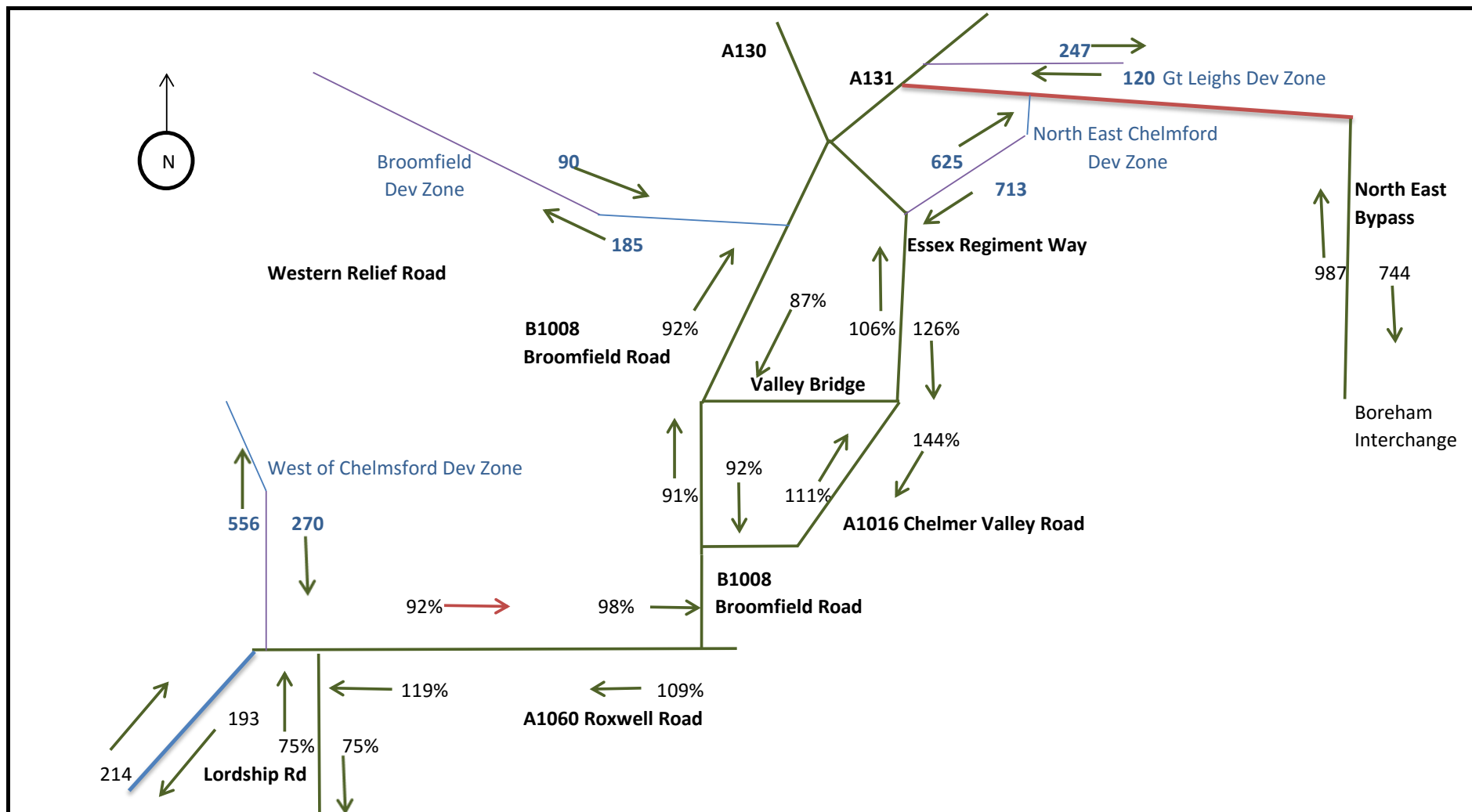
Drawing Title	AM Peak 08:00-09:00 Option 3 Total Flows with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 52	




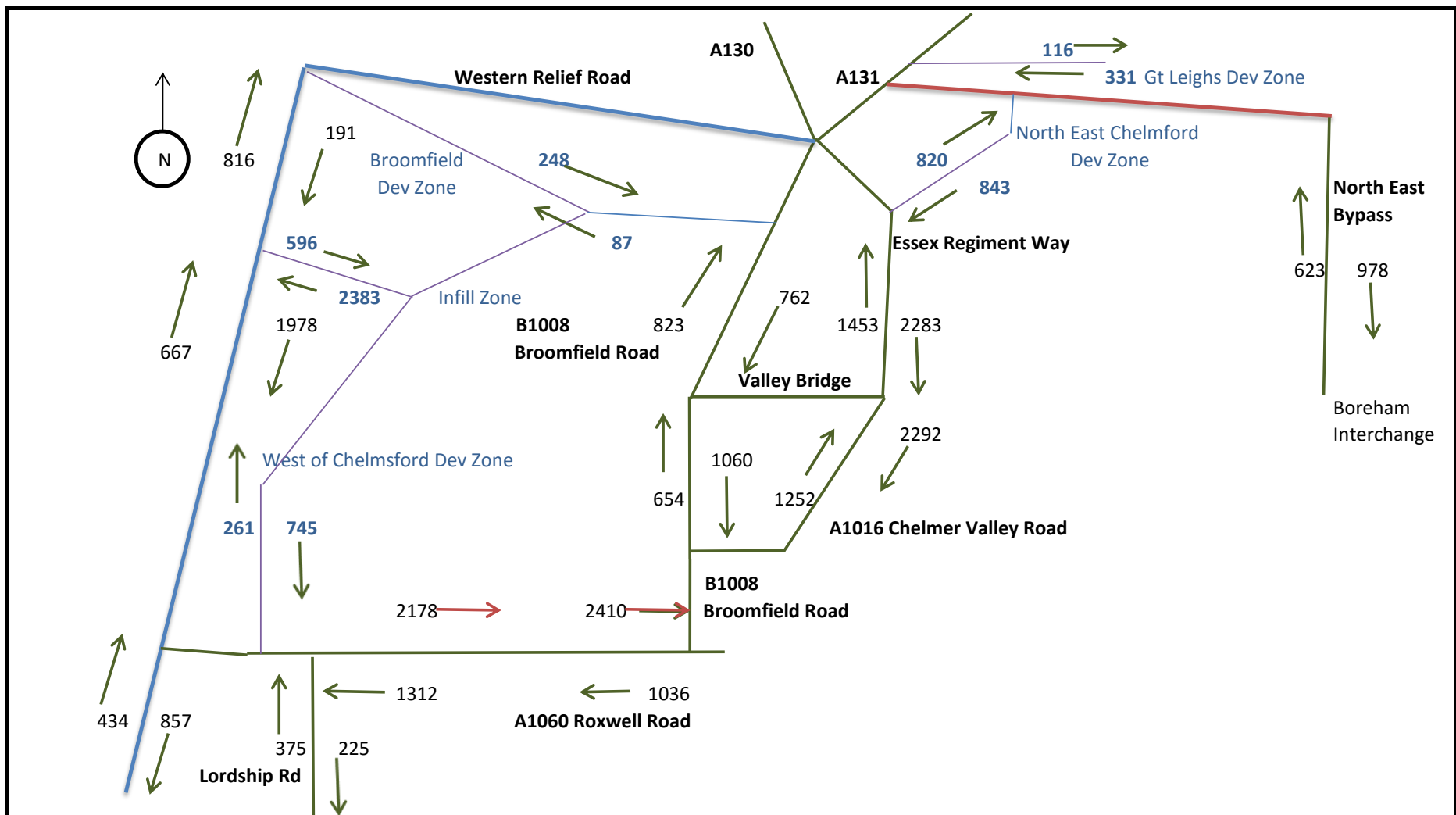
Drawing Title	AM Peak 08:00-09:00 Option 3 %age Change with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 53	




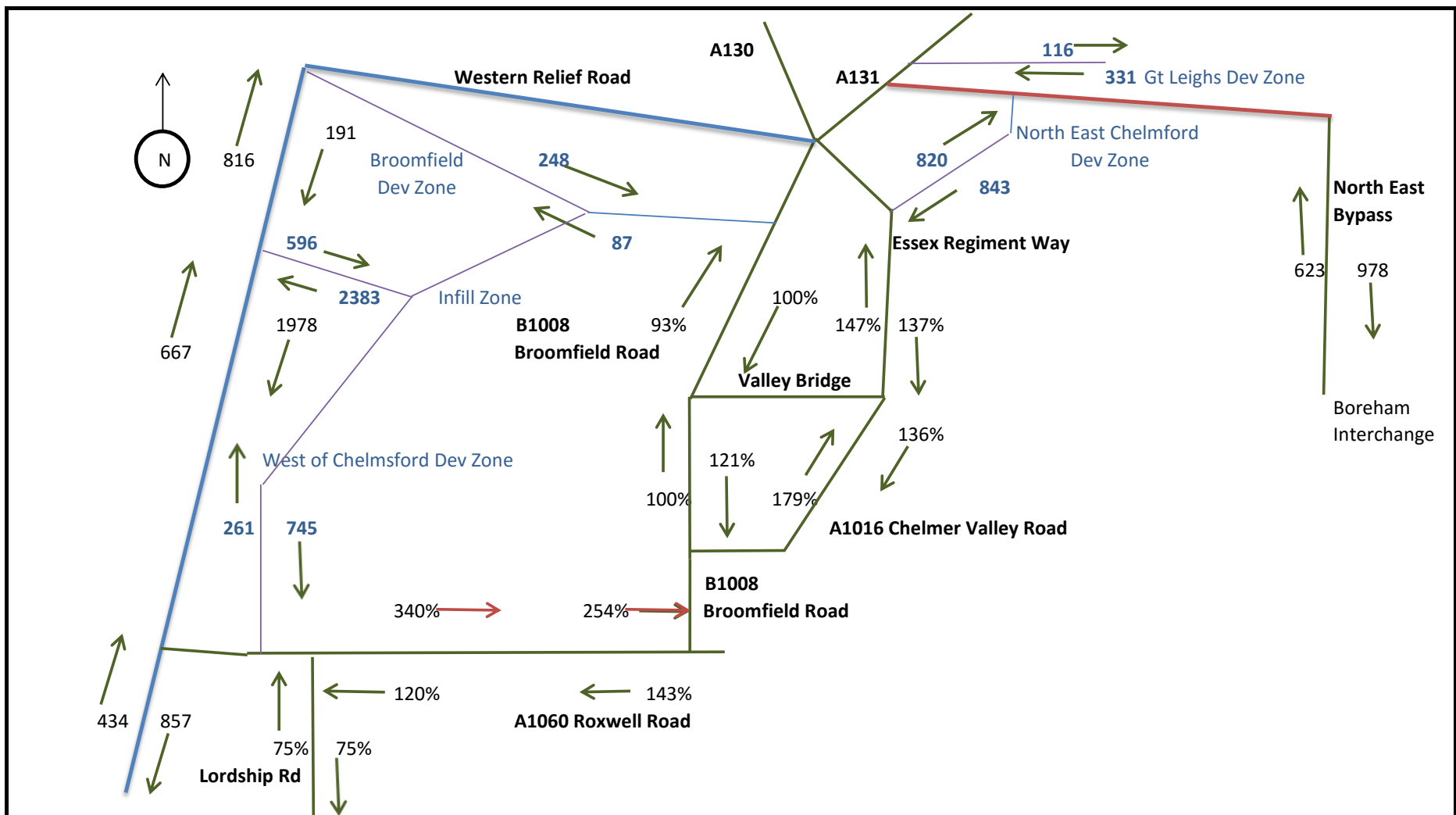
Drawing Title	PM Peak 17:00-18:00 Option 3 Total Flows with Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 54	




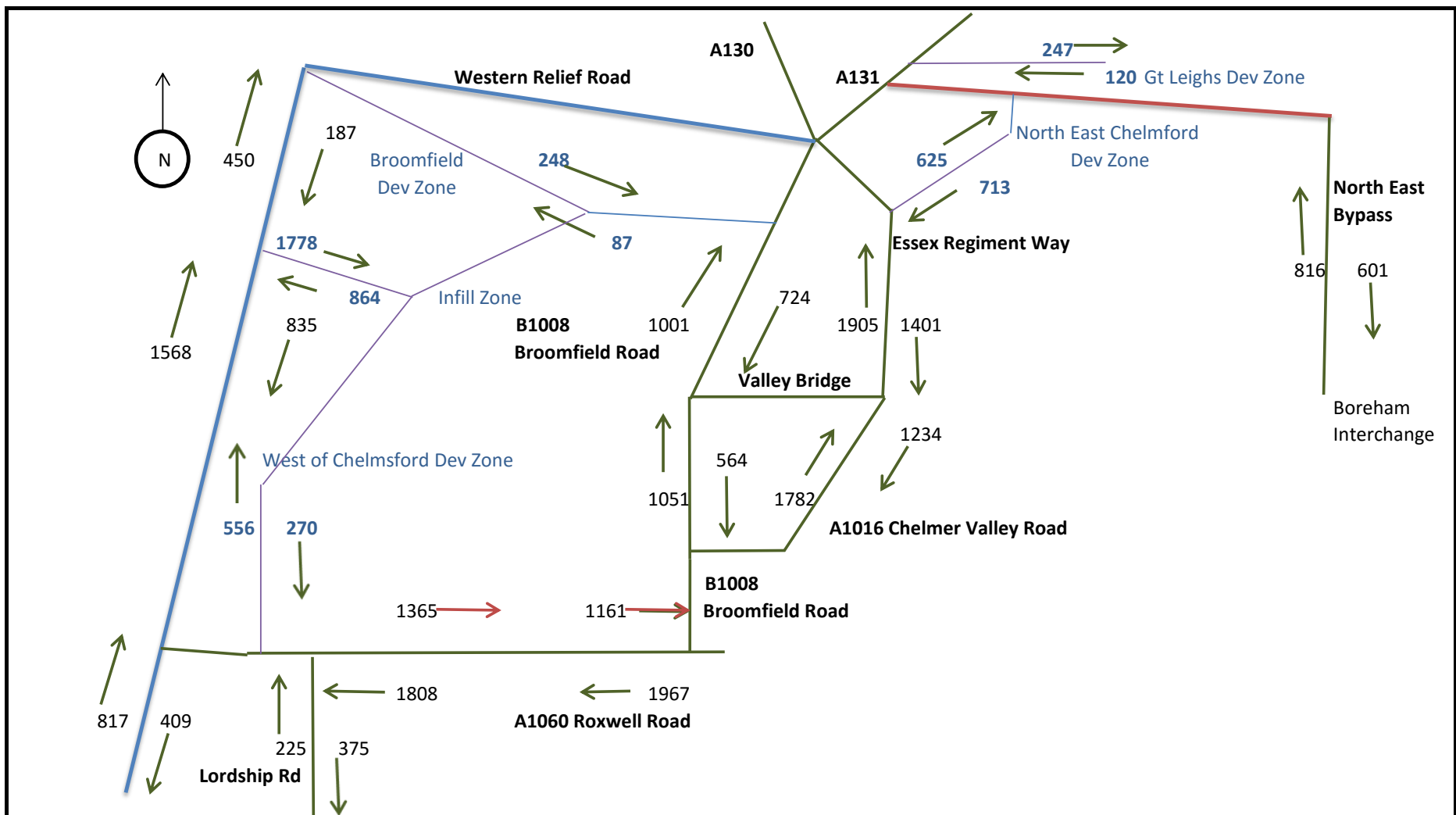
Drawing Title	PM Peak 17:00-18:00 Option 3 %age Changewith Partial Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 55	




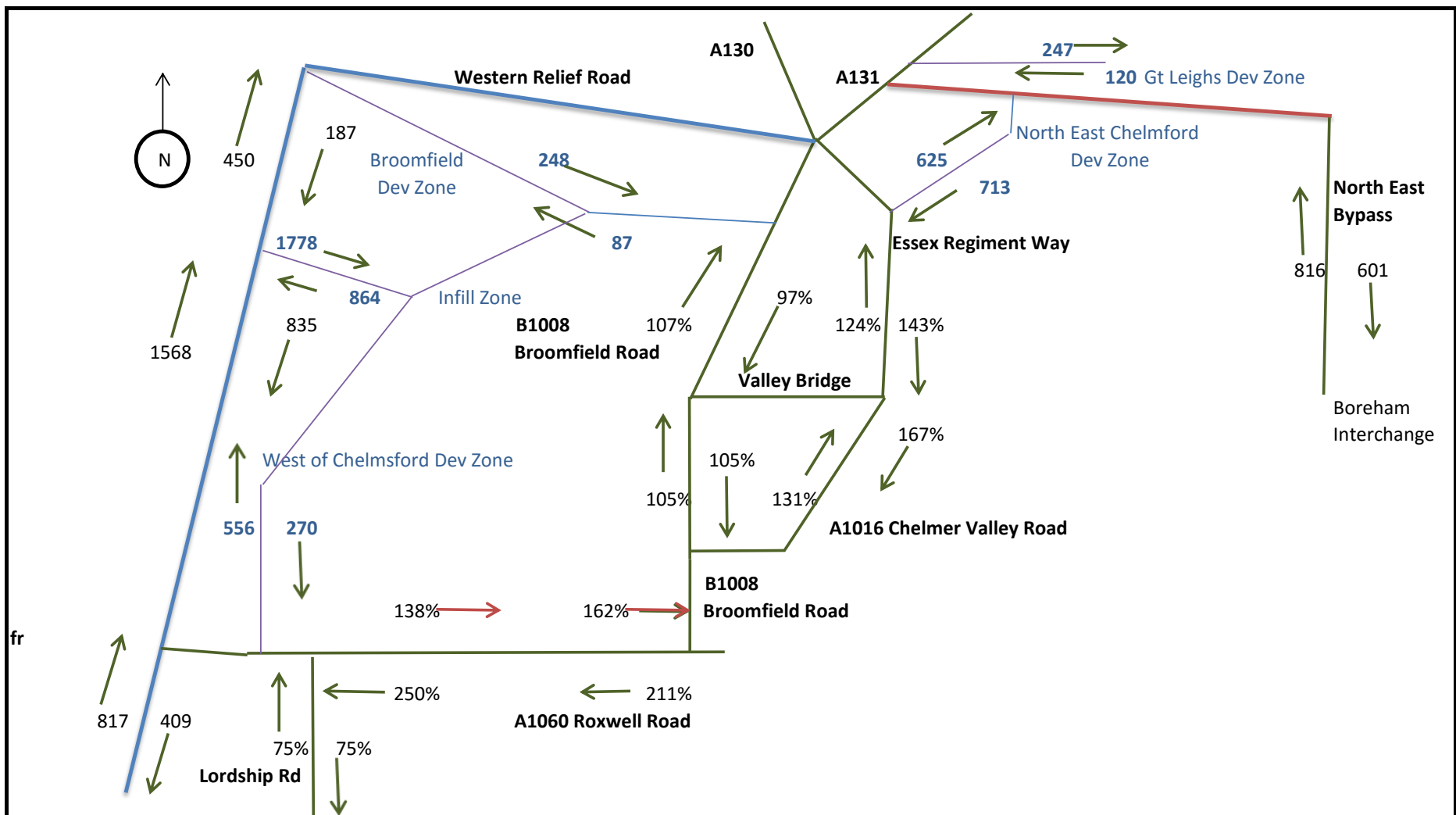
Drawing Title	AM Peak 08:00-09:00 Option 1 Total Flows +Infil with Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 56	




Drawing Title	AM Peak 08:00-09:00 Option 1 %age Change +Infil with Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 57	



Drawing Title	PM Peak 17:00-18:00 Option 1 Total Flows +Infil with Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 58	



Drawing Title	PM Peak 17:00-18:00 Option 1 % Change +Infil with Western Relief Road and North East Bypass	Drawn By	SAA	
		Date	4/1/2016	
Project Title	Broomfield Traffic Study	Ref	Figure 59	