

Technical note

Project	Oxford City LDF Testing Version 2	Date	16 June 2009
Note	Central Oxfordshire Transport Model Analysis	Ref	CTFANG510
Author	Halcrow Group Ltd		

1 *Introduction*

1.1 Oxfordshire County Council appointed Halcrow to develop a transport model of Central Oxfordshire (COTM). This model is to be used to support the development of the Major Scheme Bid for Access to Oxford and therefore assist with the development of the Central Oxfordshire Transport Strategy.

1.2 This model was used to undertake tests on the Oxford City Local Development Framework in July 2008. The COTM has now been used to test revised Oxford City LDF development numbers. This note outlines the findings of these tests.

2 *Methodology and Assumptions*

2.1 The model testing has been undertaken using the Central Oxfordshire Transport Model (COTM), a variable demand model which is able to simulate both highway and public transport elements. By comparing the cost of travel by public transport and by car, the COTM is able to decide on both mode and route choice. In addition, based on the results of the cost comparisons, the COTM is able to make changes to the destinations of trips or even conclude that the cost required to make this trip is prohibitive and thus stop the trip being made.

2.2 The COTM assumes that all users have a perfect knowledge of the public transport and highway networks. That is, each user understands how long it will take and the fuel cost to undertake any given trip by car, and how long and how much it will cost to make that same trip by public transport.

2.3 Reference case models have been developed for use in the Central Oxfordshire Transport Model, 2016 and 2026. The purpose of these models is to enable the model testing to take place on a network which reflects future year development assumptions across the Central Oxfordshire area.

2.4 The reference case models include committed development (housing and employment) and infrastructure, as well as development and infrastructure 'assumptions' in the Central Oxfordshire area, for both 2016 and 2026. The

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committed developments and assumptions included in the reference case models have been agreed with County Council Officers.

- 2.5 For the purposes of the Oxford City LDF testing, specific development in Oxford has been modelled. Oxford City Council provided a breakdown of changes in households and employment throughout Oxford between the base year of 2007 and the forecast years of 2016 and 2026. These numbers have been revised since the first stage of testing undertaken in July 2008. Whilst these amended numbers are still only approximates, they represent a best guess scenario and incorporate the most up-to-date site specific development numbers as of the 20th April.
- 2.6 Three different levels of growth have been provided; do nothing, low growth and high growth. Tables 1 and 2 shows the different housing and employment assumptions made under each of these growth scenarios up until 2016. Similarly Tables 3 and 4 show the additional development assumptions which occur between 2016 and 2026. It should be noted that the figures noted in Tables 3 and 4 are in addition to the development in Tables 1 and 2.
- 2.7 The 2016 scenarios indicate total housing growth numbers of 1807, 5461 and 5867 for the do nothing, low growth and high growth scenarios respectively. Employment growth of 4750, 7350 and 9750 jobs are also observed under these three scenarios.
- 2.8 Additional development has also been assumed between 2016 and 2026. This takes the form of 1190, 1715 and 2739 additional homes in the do nothing, low growth and high growth scenarios respectively, as well as 150, 2950 and 3500 extra jobs in each scenario. In addition, the high growth scenario includes 4000 extra homes and 1500 extra jobs associated with the SDA.
- 2.9 Each of these three scenarios includes housing and employment growth. Within Oxford, each new housing and employment zone is linked into the public transport network which ensures that these new residents and employees have access to high quality public transport. An exception to this is the SDA which is located on the city's fringe; this development has a new bus service with a 20 minute headway allowing access to the City Centre and rail station, note the SDA is only included in the High development scenario. The low growth scenario also includes Evergreen 3, a new rail service to London. This new service takes 66 minutes and routes via Bicester. It also includes a new station in proximity to the existing Water Eaton Park and Ride site.

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Location/ Neighbourhood Area	Do Nothing Growth Assumption	Low Growth Assumption	High Growth Assumption
Summertown			
Barton		525	630
Northern Gateway		140	140
SDA			
Barton and Sandhills	115	249	249
Blackbird Leys	9	83	88
City Centre (inc. West End)	14	727	730
East Oxford	456	807	903
Headington	291	539	598
Hinksey Park	42	42	57
Jericho and Osney	52	275	291
Littlemore	87	275	296
Lye Valley	110	140	168
Marston	70	140	156
Quarry and Risinghurst	122	155	188
Rose Hill	127	564	596
St Margarets	128	297	316
Summertown	93	188	214
Wolvercote	91	315	334
Total	1807	5461	5954

Location/ Neighbourhood Area	Do Nothing Growth Assumption	Low Growth Assumption	High Growth Assumption
Northern Gateway		1250	1500
Land r/o Retail Park	50	50	50
Nuffield Trading Estate		50	450
Harrow Rd Trading Estate		35	300
Beckett Street/Oxpens		800	800
Osney Mead		40	350
Science Park	1150	1150	1150
Business Park	1450	1535	2200
Jordan Hill			350
Blackbird Leys Centre		55	100
Queen Street/Westgate	2100	2100	2100
Rest of Centre		90	150
Cowley Centre		120	500
Summertown Centre		35	50
Total	4750	7350	9750

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Location/ Neighbourhood Area	Do Nothing Growth Assumption	Low Growth Assumption	High Growth Assumption
Summertown			500
Barton		475	570
Northern Gateway			
SDA			4000
Barton and Sandhills	56	56	
Blackbird Leys	15	15	21
City Centre (inc. West End)	10	10	14
East Oxford	280	280	399
Headington	173	173	247
Hinksey Park	44	44	63
Jericho and Osney	45	45	64
Littlemore	61	111	137
Lye Valley	83	83	119
Marston	48	48	70
Quarry and Risinghurst	95	95	135
Rose Hill	95	95	136
St Margarets	55	55	79
Summertown	75	75	107
Wolvercote	55	55	78
Total	1190	1715	2739 (+4000)

Location/ Neighbourhood Area	Do Nothing Growth Assumption	Low Growth Assumption	High Growth Assumption
Northern Gateway		1900	2250
SDA			1500
Land r/o Retail Park			
Nuffield Trading Estate		90	50
Harrow Rd Trading Estate		60	35
Beckett Street/Oxpens			
Osney Mead			40
Science Park			
Business Park		150	85
Jordan Hill			40
Blackbird Leys Centre			
Queen Street/Westgate	150	150	150
Rest of Centre		350	350
Cowley Centre		250	500
Summertown Centre			
Total	150	2950	3500 (+1500)

3 **2016 Results**

- 3.1 This section sets out the results of the 2016 Oxford City tests. It should be noted that the figures provided are for the entire COTM area.
- 3.2 The summary statistics provided include the total time spent on the network, total time being the sum of three components. These are transient time, over-capacity queues and free flow time. Transient queues correspond to the time spent travelling through a junction as a result of the delay incurred by the junction characteristics rather than delay incurred as a result of the junction performing over-capacity. The over-capacity queues only occur for turning movements in excess of capacity where a permanent queue builds up which is unable to clear in a single cycle. Free flow time simply relates to the time on the network which is not spent in a queue.
- 3.3 Total distance spent on the network is also shown and this provides an indication of the total cumulative distance of every trip which travels on the network. The total number of trips which travel on the network is also provided. This includes trips with both origins and destinations in the COTM area, as well as trips which have either one of their origin or destination in this area. In addition it includes trips which have neither their origin nor destination in the COTM area but are simply passing through the COTM buffer area.
- 3.4 The simulation summary statistics for the 2016 AM and PM peaks are shown in Tables 5 and 6 respectively. Table 5 indicates that there is a 27%, 29% and 30% growth in trips the do nothing, low growth and high growth scenarios respectively in the AM peak. These increases in trips result in between a 55% and 61% growth in total time spent on the network, and up to a 41% growth in distance travelled on the network.
- 3.5 Table 6 shows that there is a 25%, 27% and 28% growth in trips in the do nothing, low growth and high growth scenarios respectively in the PM peak. These increases in trips result in between a 54% and 60% growth in total time spent on the network, and up to a 43% growth in distance travelled on the network.

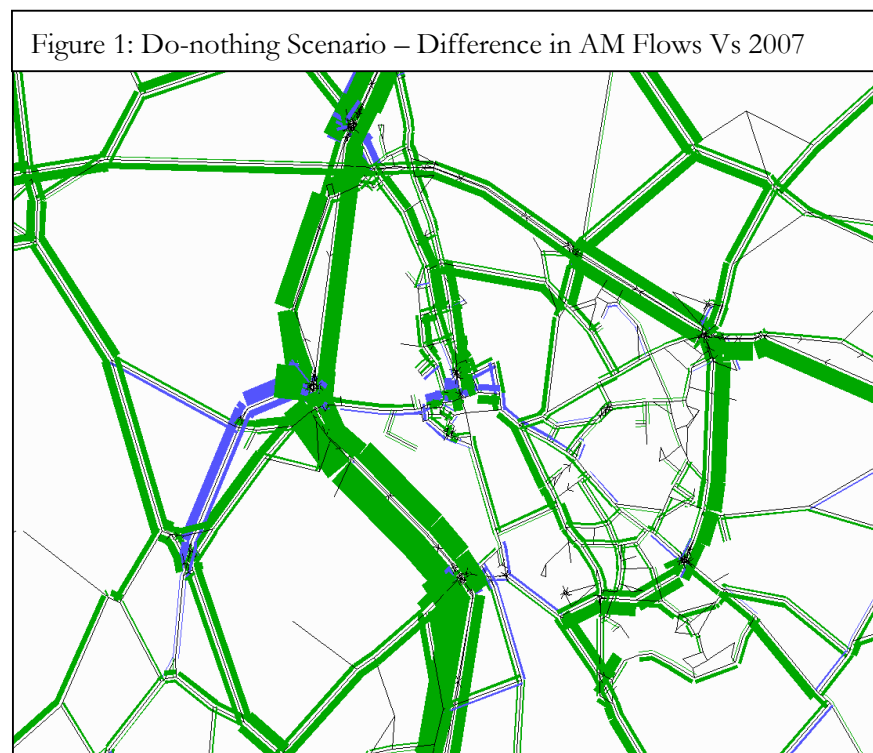
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AM Peak	Base	2016 Do Nothing	2016 Low Growth	2016 High Growth
Transient Queues	1860	3220	3330	3400
Over Capacity Queues	1240	3280	3530	3710
Free flow time (pcu/h)	22300	32610	33090	33360
Total time (pcu/h)	25640	39850	40780	41380
Total distance (pcu/km)	1592720	2209310	2234370	2248950
Speed (kph)	62.1	55.4	54.8	54.3
Trips	101470	128480	130640	131640
Growth in trips		27%	29%	30%
Growth in time		55%	59%	61%
Growth in distance		39%	40%	41%

PM Peak	Base	2016 Do Nothing	2016 Low Growth	2016 High Growth
Transient Queues	1820	3080	3160	3210
Over Capacity Queues	1440	2970	3210	3440
Free flow time (pcu/h)	21660	32270	32650	32970
Total time (pcu/h)	25520	39310	40100	40790
Total distance (pcu/km)	1555390	2191660	2213580	2231310
Speed (kph)	61	55.8	55.2	54.7
Trips	102270	127870	129950	130980
Growth in trips		25%	27%	28%
Growth in time		54%	57%	60%
Growth in distance		41%	42%	43%

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- 3.6 The change in actual flows between the 2007 base and the 2016 future year scenario are shown in figures 1, 2 and 3 for the do nothing, low growth and high growth scenarios respectively. Green and blue lines indicate increases and decreases in actual flows with thicker lines indicating larger changes.
- 3.7 Figures 1, 2 and 3 all show a large increase in actual flows on the network in and around Oxford. Large increases are experienced on the A34 with increases on the A40 and A4142 also observed. Smaller increases are seen throughout Oxford with only a limited number of links experiencing a decrease. The largest decrease is observed on the A420 in the vicinity of Botley junction. The model suggests that this is caused by traffic rerouting through Cumnor Hill to avoid the increased congestion at the Botley junction, which is in turn caused by capacity issues on the A34.
- 3.8 However whilst Figures 1, 2 and 3 all clearly indicate the trends which are likely to occur between 2007 and 2016, they do not provide a clear illustration of the differences between the different growth scenarios. Figure 4 specifically illustrates the difference in actual flows between the low growth scenario and the high growth scenario; this indicates that up until 2016, there is very little difference in terms of link flows between the two scenarios.



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Figure 2: Low Growth Scenario – Difference in AM Flows Vs 2007

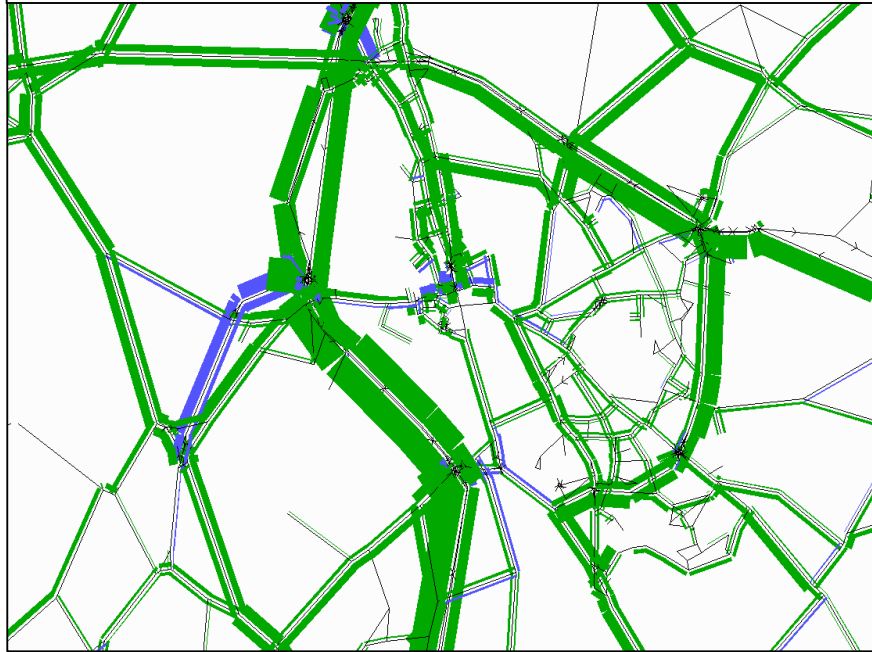
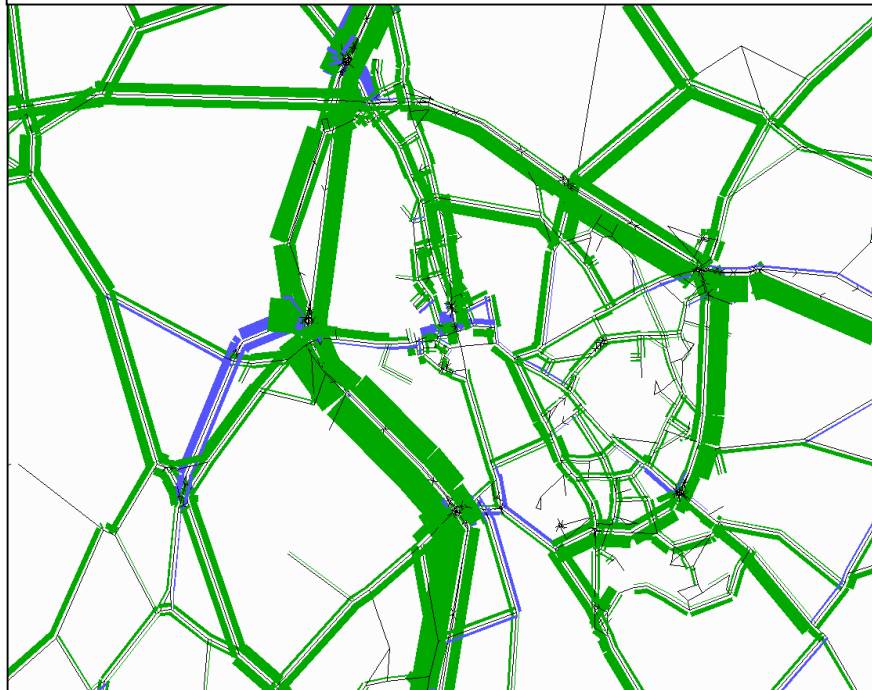
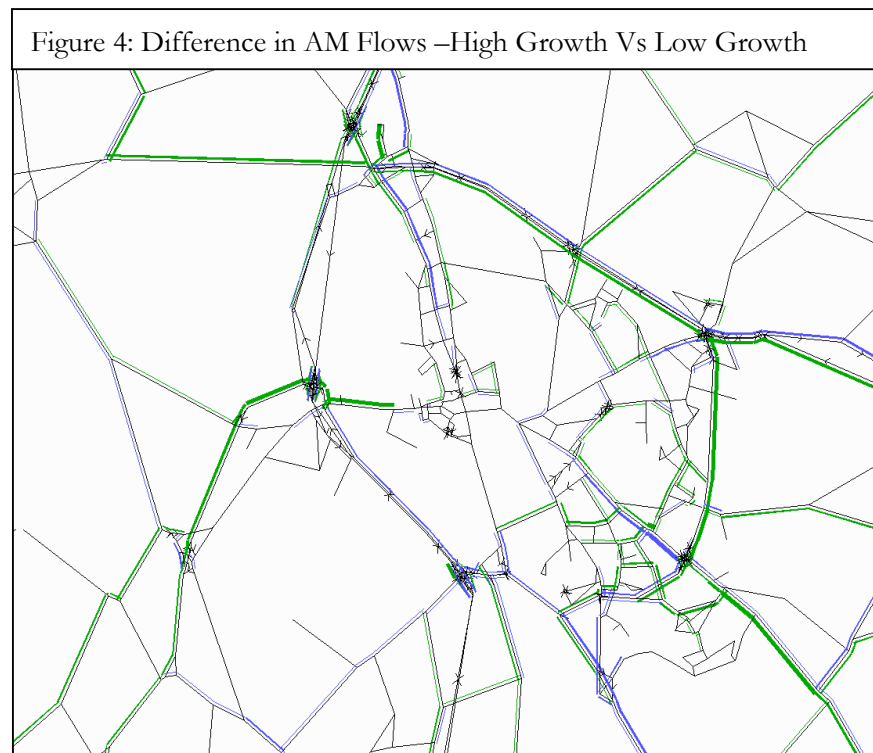


Figure 3: High Growth Scenario – Difference in AM Flows Vs 2007



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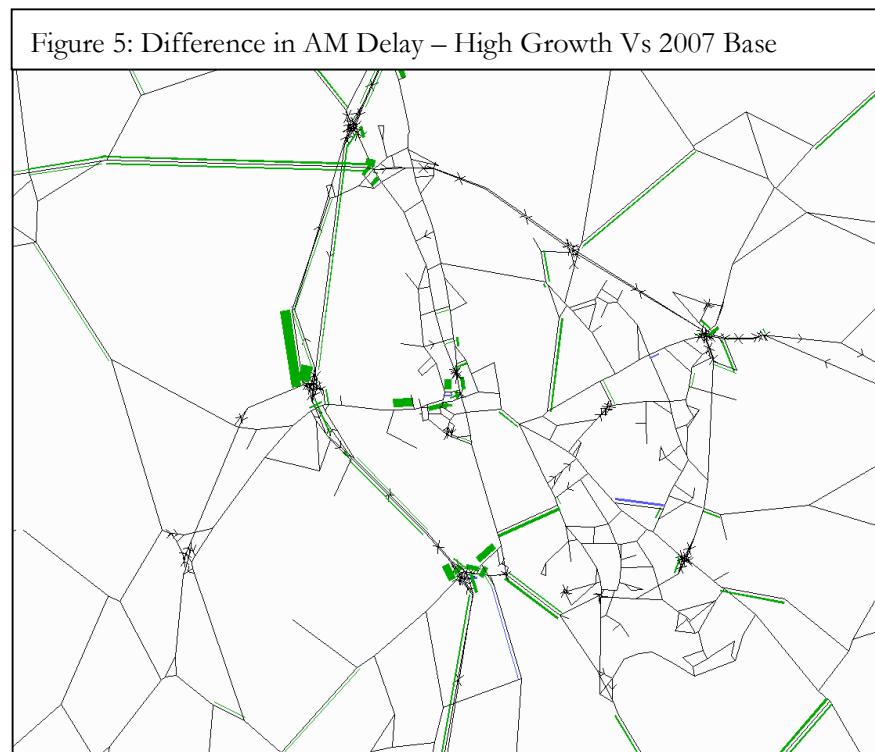


3.9 Delay difference plots have been produced for the 2016 morning peak for each of the three growth scenarios; these compare the change in delay from the 2007 base with the 2016 future year scenarios. The patterns and extent of delay are very similar for each of these scenarios. Figure 5 illustrates the change in delay in the worst case scenario, that of high growth.

3.10 The key areas which experience increases in delay between 2007 and 2016 are set out below:

- Wolvercote Roundabout
- Botley Junction (particularly joining the A34 NB)
- Hinksey Hill Junction
- Kennington Roundabout
- Heyford Hill Roundabout
- Marston Road
- Donnington Bridge
- Central Oxford

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*3.11*

Figures 6, 7 and 8 show the change in actual flows between the 2007 base and the 2016 future year scenarios in the PM peak. As seen in the AM peak, actual flows in the PM peak see large increases on the A34 and A40. Similarly increases are observed on the Eastern Bypass and several of the arterial routes into Oxford City such as Woodstock Road, Banbury Road, Iffley Road and Cowley Road. Only a limited number of links experience a reduction in actual flows between 2007 and 2016 and these are likely to be caused by a change in dominant flow direction or strength.

3.12

However whilst these changes in link flows provide an indication of the future year traffic patterns, it is very difficult to establish differences between each scenario. Figure 9 specifically illustrates the difference in actual flows between the low growth scenario and the high growth scenario. As with the AM time period, this plot indicates that up until 2016, there is very little difference in terms of link flows between the two scenarios.

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Figure 6: Do-nothing Scenario – Difference in PM Flows Vs 2007

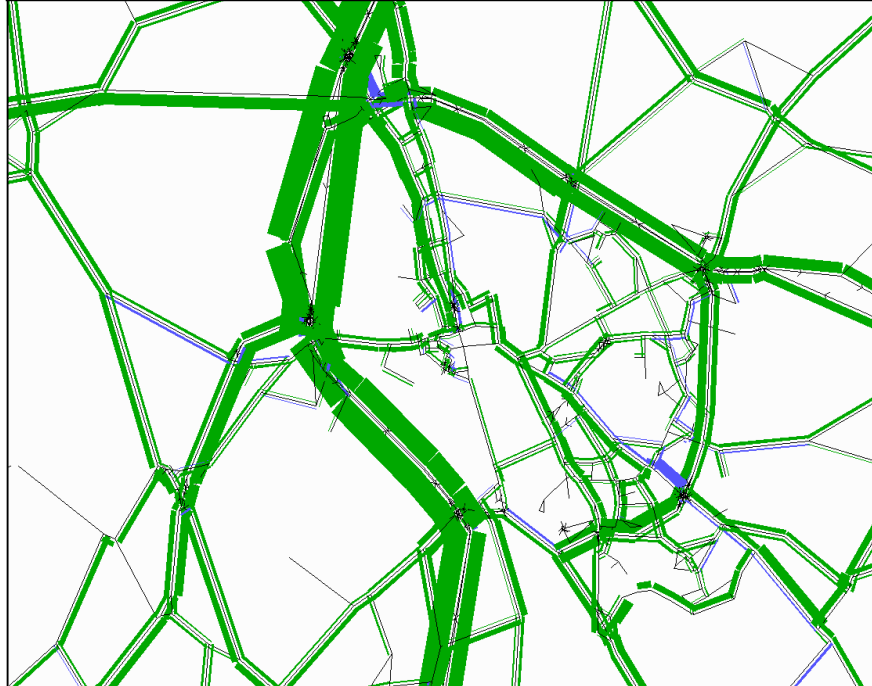
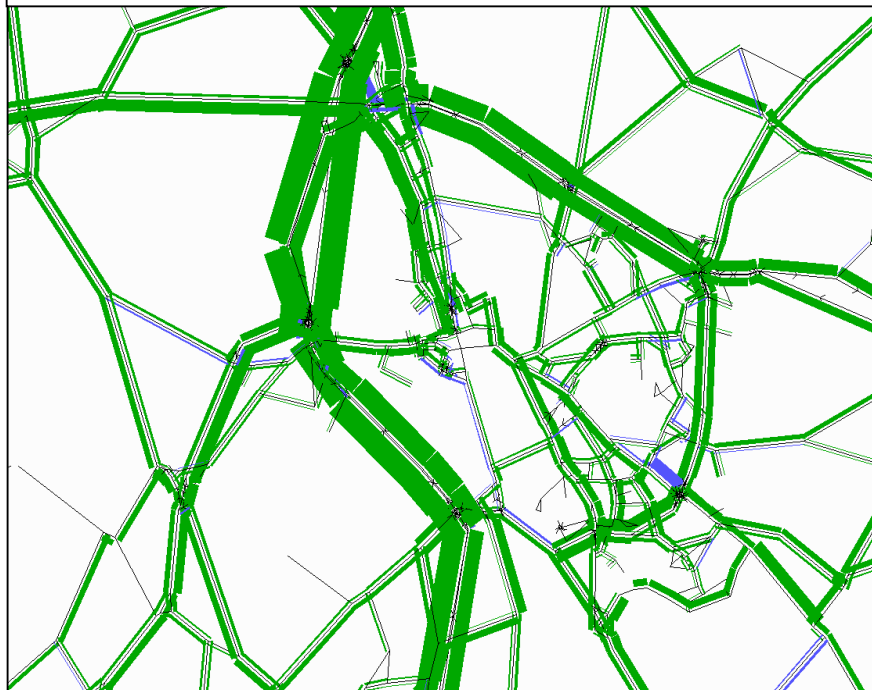
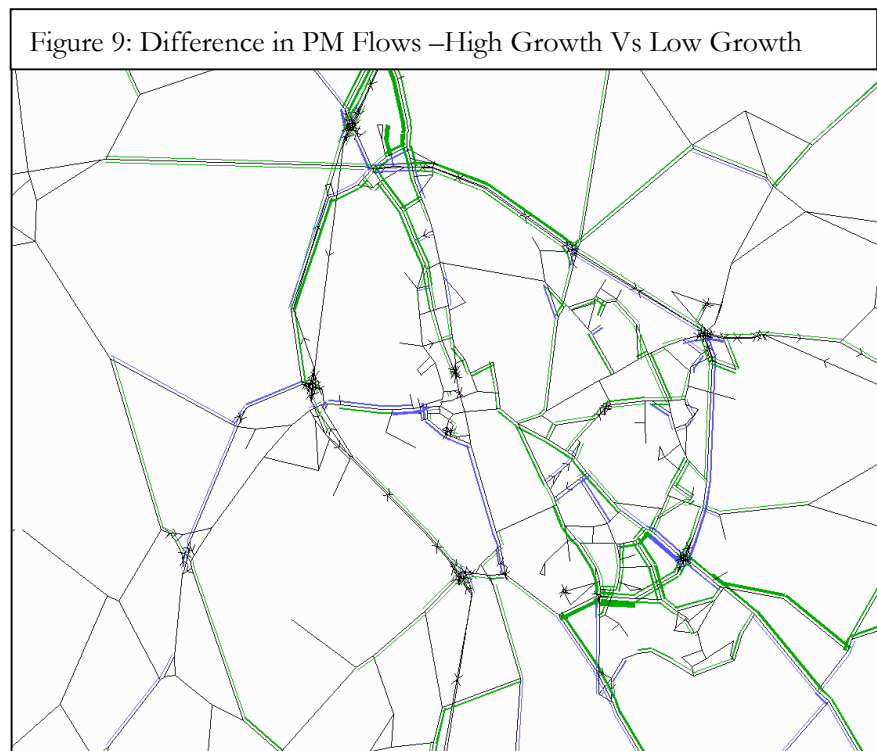
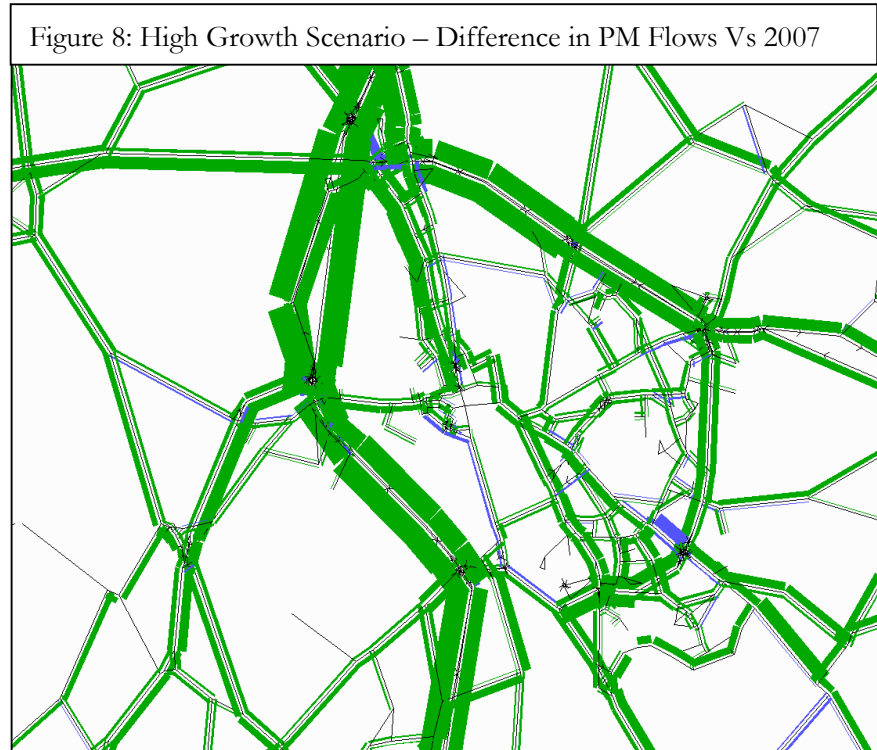


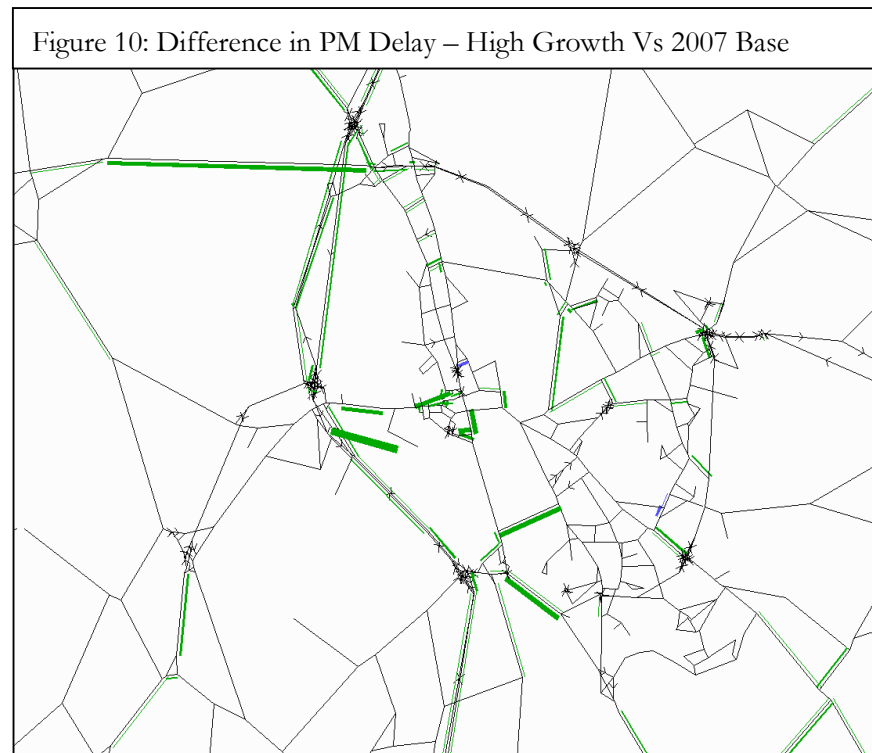
Figure 7: Low Growth Scenario – Difference in PM Flows Vs 2007



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3.13 Delay difference plots have been produced for the 2016 evening peak for each of the three growth scenarios; these compare the change in delay from the 2007 base with the 2016 future year scenarios. The patterns and extent of delay are very similar for each of these scenarios. Figure 10 illustrates the change in delay in the worst case scenario, that of high growth.

3.14 The key areas which experience increases in delay between 2007 and 2016 are set out below:

- Wolvercote Roundabout
- Botley Junction
- Hinksey Hill Junction
- Kennington Roundabout
- Heyford Hill Roundabout
- Cowley Interchange
- Marston Road
- Donnington Bridge
- Central Oxford

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4 2026 Results

4.1 This section sets out the results of the 2026 Oxford City tests.

4.2 The simulation summary statistics for the 2016 AM and PM peaks are shown in Tables 7 and 8 respectively. Table 7 indicates that there is a 42%, 46% and 49% growth in trips the do nothing, low growth and high growth scenarios respectively in the AM peak. These increases in trips result in between a 80% and 91% growth in total time spent on the network, and up to a 55% growth in distance travelled on the network.

4.3 Table 8 shows that there is a 40%, 43% and 47% growth in trips in the do nothing, low growth and high growth scenarios respectively in the PM peak. These increases in trips result in between a 76% and 92% growth in total time spent on the network, and up to a 59% growth in distance travelled on the network.

Table 7: SATURN summary statistics AM peak hour – Simulation Area

AM Peak	Base	2026 Do Nothing	2026 Low Growth	2026 High Growth
Transient Queues	1860	3920	4130	4220
Over Capacity Queues	1240	4750	5590	5630
Free flow time (pcu/h)	22300	36180	37340	37410
Total time (pcu/h)	25640	46080	48740	48850
Total distance (pcu/km)	1592720	2405540	2467950	2467030
Speed (kph)	62.1	52.2	50.6	50.5
Trips	101470	144250	147940	151380
Growth in trips		42%	46%	49%
Growth in time		80%	90%	91%
Growth in distance		51%	55%	55%

Table 8: SATURN summary statistics PM peak hour – Simulation Area

PM Peak	Base	2026 Do Nothing	2026 Low Growth	2026 High Growth
Transient Queues	1820	3730	3900	4020
Over Capacity Queues	1440	4340	5180	5620
Free flow time (pcu/h)	21660	35530	36540	37320
Total time (pcu/h)	25520	44800	47330	49000
Total distance (pcu/km)	1555390	2373960	2430430	2470880
Speed (kph)	61	53	51.4	50.4
Trips	102270	142870	146520	150380
Growth in trips		40%	43%	47%
Growth in time		76%	85%	92%
Growth in distance		53%	56%	59%

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- 4.4 The change in actual flows between the 2007 base and the 2026 future year scenario are shown in figures 11, 12 and 13 for the do nothing, low growth and high growth scenarios respectively. As before, green and blue lines indicate increases and decreases in actual flows with thicker lines indicating larger changes.
- 4.5 Figures 11, 12 and 13 all show a large increase in actual flows on the network in and around Oxford. Large increases are experienced on the A34 with increases on the A40 and A4142 also observed. Smaller increases are seen throughout Oxford with only a limited number of links experiencing a decrease. The largest decrease is observed on the A420 in the vicinity of Botley junction. The model suggests that this is caused by traffic rerouting through Cumnor Hill to avoid the increased congestion at the Botley junction, which is in turn caused by capacity issues on the A34.
- 4.6 Figures 11, 12 and 13 clearly illustrate a large growth in flows between the 2007 base and the 2026 future year scenarios. Many of the links in these figures appear to experience very similar impacts in all three growth scenarios; however there are some areas where noticeable differences can be observed. This is particularly true in the South Oxford area where link flows are higher in the high growth scenario; likely to be caused by the development of the Southern Development Area.
- 4.7 As with the 2016 scenarios, delay difference plots have been produced for the morning peak for each of the three growth scenarios; these compare the change in delay from the 2007 base with the 2026 future year scenarios. Figure 15 illustrates the change in delay in the worst case scenario, that of high growth.
- 4.8 The key areas which experience increases in delay between 2007 and 2026 are set out below:
- Wolvercote Roundabout
 - Botley Junction (particularly joining the A34 NB)
 - Hinksey Hill Junction
 - Kennington Roundabout
 - Heyford Hill Roundabout
 - Sandford Junction
 - Marston Road
 - Donnington Bridge
 - Central Oxford

Figure 11: Do-nothing Scenario – Difference in AM Flows Vs 2007

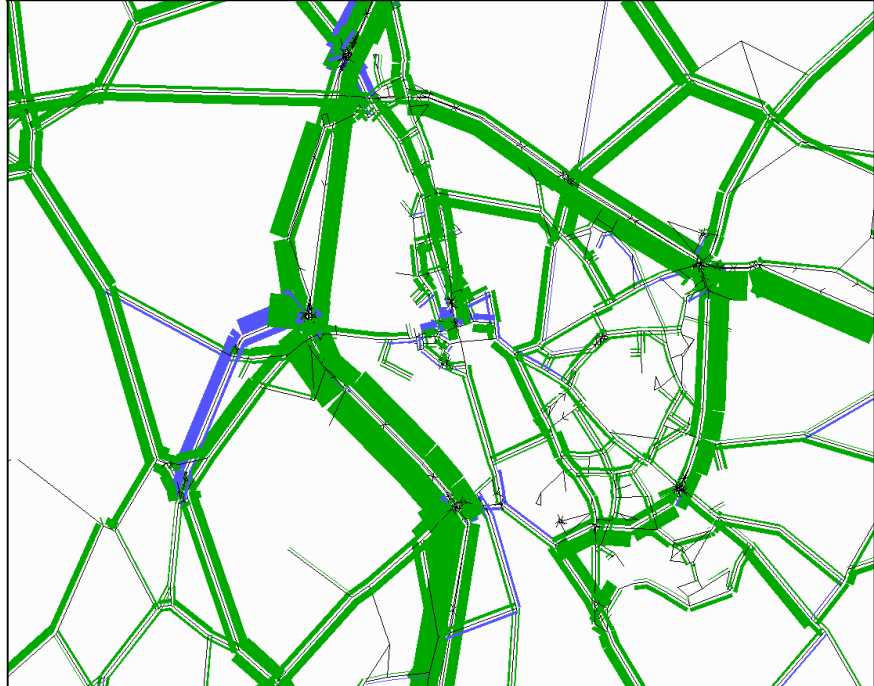


Figure 12: Low Growth – Difference in AM Flows Vs 2007

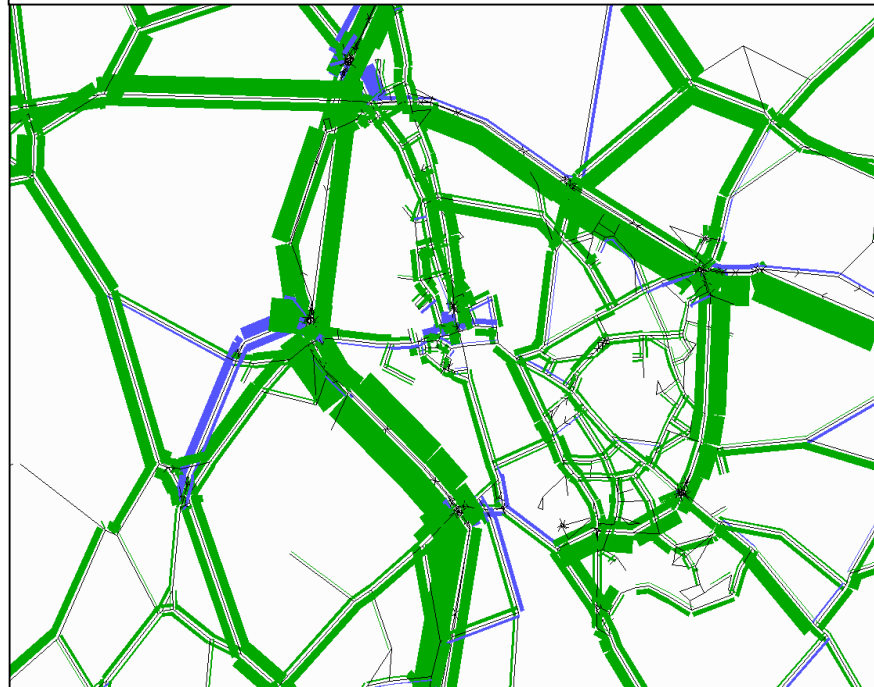


Figure 13: High Growth – Difference in AM Flows Vs 2007

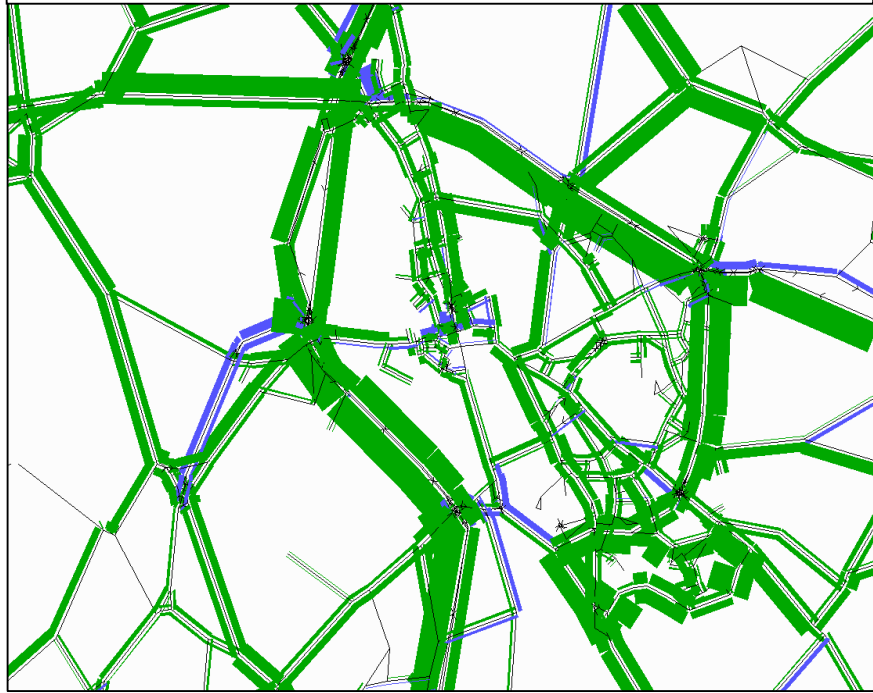
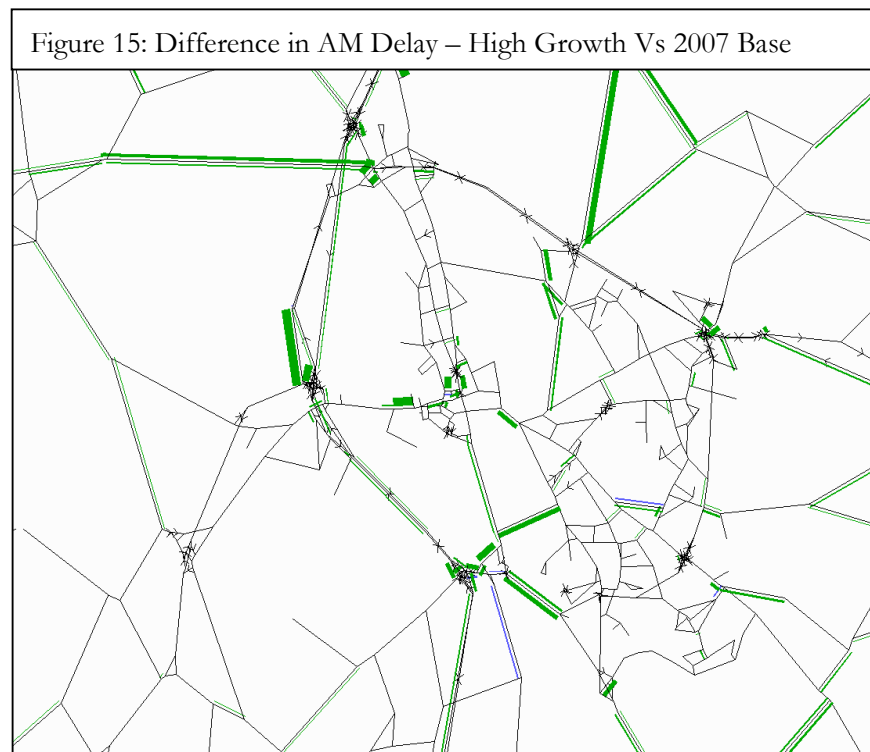


Figure 14: Difference in AM Flows –High Growth Vs Low Growth



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4.9 Figures 16, 17 and 18 show the change in actual flows between the 2007 base and the 2026 future year scenarios in the PM peak for the do nothing, low growth and high growth scenarios respectively. As before, green and blue lines indicate increases and decreases in actual flows with thicker lines indicating larger changes.

4.10 Figures 16, 17 and 18 all show a large increase in actual flows on the network in and around Oxford. Increases are observed throughout the Oxford area; however these increases are particularly high on the A34, A40 and A4142. These figures clearly illustrate a large growth in flows between the 2007 base and the 2026 future year scenarios.

4.11 Many of the links in these figures appear to experience very similar impacts in all three growth scenarios. There are however some areas where noticeable differences can be observed, Figure 19 shows the difference in link flows between the low and high growth scenario in the 2026 PM peak. This figure highlights both the South Oxford area and the area just north of Oxford as being particularly affected in terms of having higher link flows in the high growth scenario. This is likely to be caused by the development of the Southern Development Area and higher employment levels at the Northern Gateway and Oxford Business Park in the high growth scenario.

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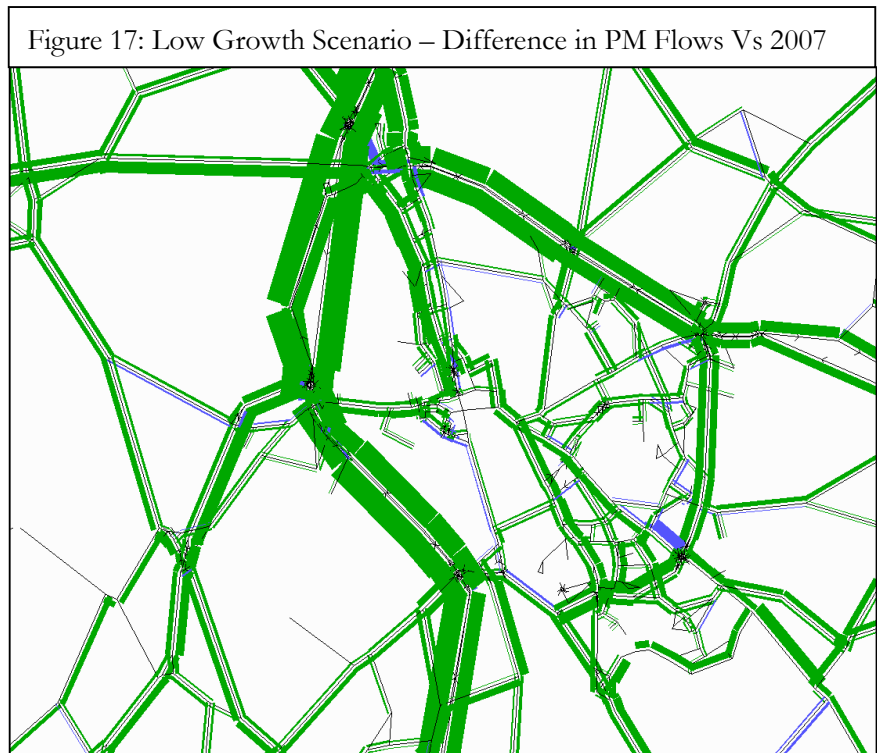
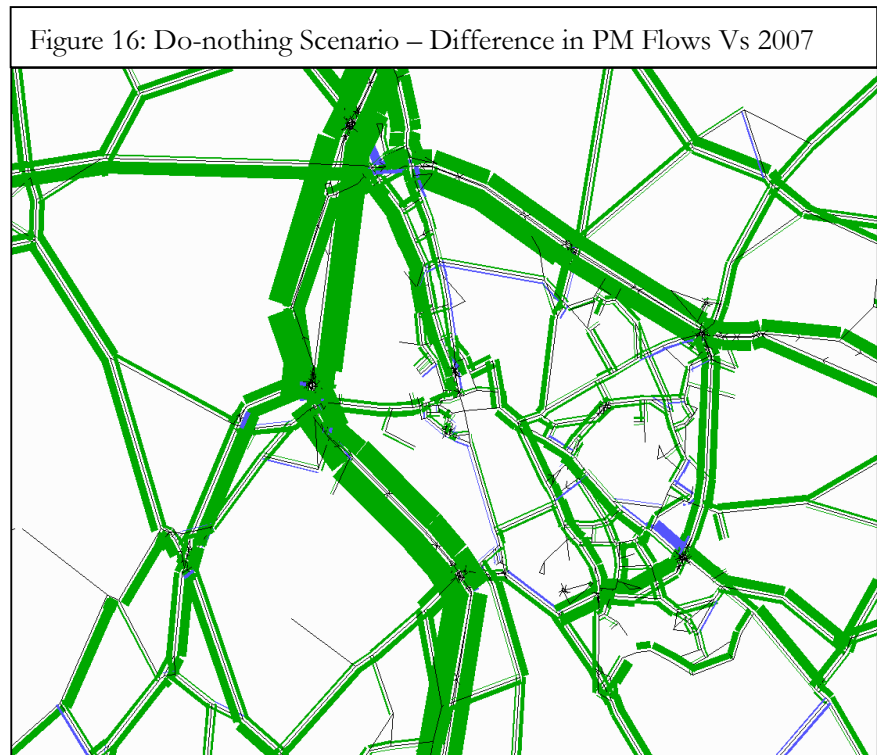


Figure 18: High Growth Scenario – Difference in PM Flows Vs 2007

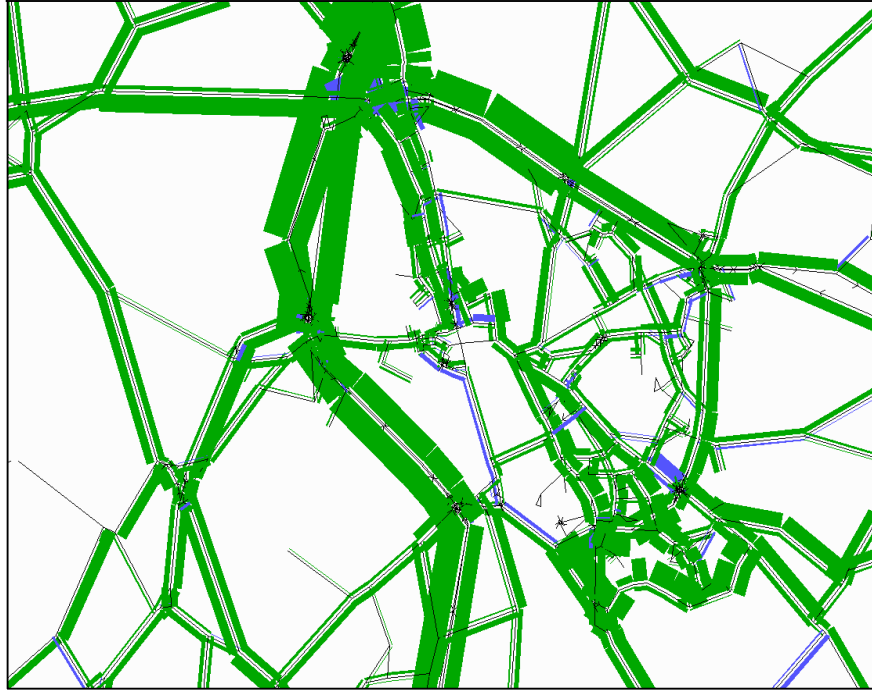
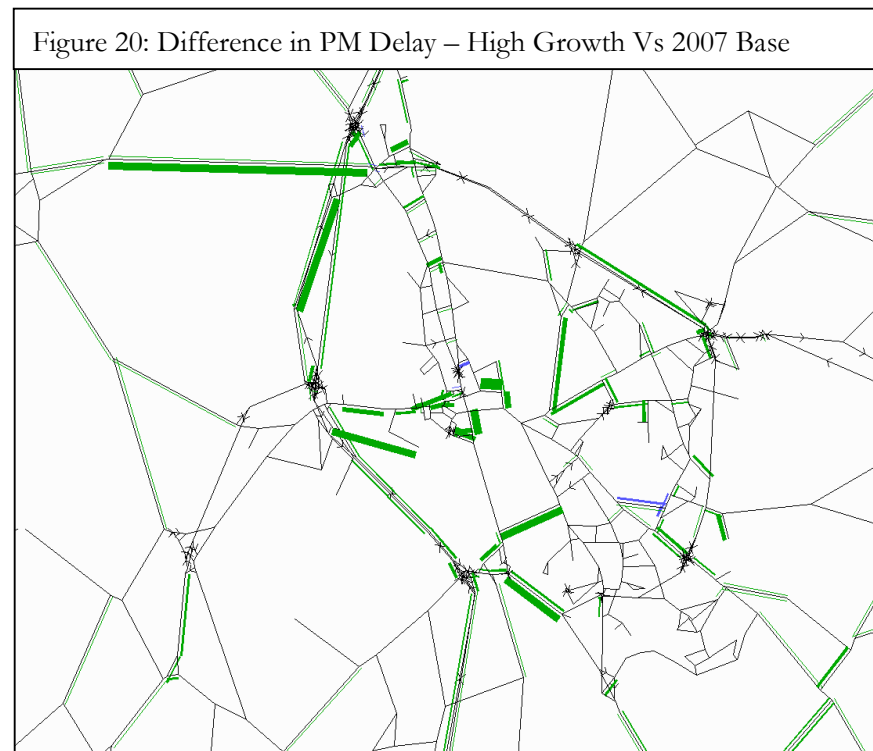


Figure 19: Difference in PM Flows –High Growth Vs Low Growth



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4.12 As with the 2016 scenarios, delay difference plots have been produced for the evening peak for each of the three growth scenarios; these compare the change in delay from the 2007 base with the 2026 future year scenarios. Figure 20 illustrates the change in delay in the worst case scenario, that of high growth.

4.13 The key areas which experience increases in delay between 2007 and 2026 are set out below:

- Wolvercote Roundabout
- A40/Headington Roundabout
- Hinksey Hill Junction
- Kennington Roundabout
- Heyford Hill Roundabout
- Sandford Junction
- Cowley Interchange
- London Road
- Marston Road
- Donnington Bridge
- Central Oxford

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5***Summary***

5.1

Model testing has been undertaken for the Oxford City LDF. Three levels of development growth scenarios have been developed; do nothing, low growth and high growth. These scenarios include housing and employment growth but do not include any mitigation measures. Results have been compiled for both AM and PM time periods for both 2016 and 2026. The key findings are set out below.

5.2

By 2016, the three increasing levels of growth yield corresponding increases in trips on the network. In turn this leads to increases in travel time and distance travelled on the network. The A34 and A40 see large increases in actual flows in all three scenarios whilst the Wolvercote Roundabout, Botley Interchange and Hinksey Hill Interchange all experience increased delay.

5.3

By 2026, more development and thus more trips leads to even larger increases in travel time and distance travelled on the network. In addition, further increases in actual flows are observed right across the Oxford network. However by 2026 the three levels of growth do have noticeably differing impacts on the road network. In particular the high growth scenario causes increased actual flows on the network in South Oxford as well as on the Northern approaches into Oxford.