Birmingham Development Plan

Transport Modelling Assessment: Hybrid Model Output

May 2014

Birmingham City Council

Mott MacDonald

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A	21 May 2014	Mike Oliver	Paul Parkhouse	Paresh Shingadia	First issue	
B	3 June 2014	Mike Oliver	Paul Parkhouse	Paresh Shingadia	First revision - two image titles amended	

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1 Introduction

1.1 Study Context

Birmingham City Council (BCC) is in the process of developing the Birmingham Development Plan; a central part of its Local Development Framework. As with any land use policy, the way the Plan is supported by transport services and associated infrastructure will be one of the elements fundamental to its successful delivery. Similarly, the way in which the transport system develops to respond to the implementation of the Plan will also be fundamental to the system's on-going effectiveness. For these reasons, and in accordance with relevant policy, BCC has commissioned Mott MacDonald to develop a Transport Evidence Base to support the emerging Birmingham Development Plan.

The Transport Evidence Base is being developed over five stages, as shown in the following table.

Table 1.1: Proposed study stages

Study Stage	Label	Description
Stage 1	Scoping	Establishing and agreeing key study parameters from the outset.
Stage 2	Establishing Context	Building up the full picture of relevant policy, plans and programmes which set the context for being able to assess the Birmingham Development Plan's future impacts
Stage 3a	Strategic Modelling	Assessing area-wide future impacts through strategic modelling
Stage 3b	Junction Modelling	Local area modelling of specific junctions and development of mitigation measures
Stage 4	Infrastructure Delivery	Considerations of design, cost, funding and delivery of required new infrastructure
Stage 5	EIP Assistance	Expert witness support to the Council at the Planning Inquiry

Stages 1 and 2 are now completed and available as separate reports. Stages 3b and 4 are being undertaken by other consultants.

A key stage of the methodology is Stage 3a (Strategic Modelling) because this is the stage where the Birmingham Development Plan's transport impacts – both positive and negative – are strategically quantified. As part of the **Initial Output Report (January 2014)**, the West Midlands Policy Responsive Integrated Strategy Model (PRISM) was employed to quantify these impacts. The following three scenarios were considered:

1. **Base year scenario (2011) –** which represents a present-day transport and land-use scenario
2. **Reference Case scenario (2021 and 2031) –** which represents the future transport and land-use scenario in the hypothetical case where there is no Development Plan implemented
3. **Development Case scenario (2021 and 2031) –** which represents the future transport and land-use scenario in which the Development Plan is implemented

These scenarios were the first applications of the new PRISM model and hence include a degree of uncertainty around the outputs. PRISM has developed significantly since then, both in terms of refining the code, calculating the output and understanding how to interpret results from the newer model features. Complementary work by other consultants has also progressed since the first applications.

The purpose of this report is therefore to describe how the initial model application has been updated to take advantage of the latest PRISM developments and also to consolidate the PRISM forecasts with the Green Belt Development (GBD) demand modelling undertaken by Phil Jones Associates (PJA). This updated model has been termed the **Hybrid Model** and the analysis that follows is focussed on assessing the impact of the GBD on the surrounding strategic road network.

The results presented in the **Initial Output Report** are also updated in order to quantify the headline strategic level highway impact of the Development Plan proposals in 2031

1.2 Report Contents and Structure

In light of the purpose of this stage of the study, this report is structured as follows:

Table 1.2: Report structure

Section	Title	Description
2	Hybrid Model Overview	Overview of how the Hybrid Model has been developed
3	Forecasting Results	Presentation of forecasting scenario results
4	Summary	Report summary

2 Hybrid Model Overview

2.1 Introduction

The purpose of this section is to provide an introduction to and overview of the Hybrid Model.

2.2 PRISM Forecast

PRISM (Policy Responsive Integrated Strategy Model) is a transport model of the West Midlands and is described in some detail in the **Initial Output Report** where the results of three scenarios were presented and compared:

1. **Base year scenario** (2011) – which represents a present-day transport and land-use scenario.
2. **Reference Case scenario** (2021 and 2031) – which represents the future transport and land-use scenario in the hypothetical case where there is no Development Plan implemented
3. **Development Case scenario** (2021 and 2031) – which represents the future transport and land-use scenario in which the Development Plan is implemented

As explained in the Introduction of this report, the PRISM models used for the above forecasts have now been superseded and there is a new 'standard' PRISM Reference Case scenario. The new scenario is presented in the PRISM Forecasting Report (expected June 2014) which will be available on request from Birmingham City Council once issued.

2.3 PJA Forecast

Since the **Initial Output Report** was issued, PJA has also developed a separate 'micro' travel demand model (**PJA TDM**) designed to provide for more detailed and local network appraisal concerning the GBD. The PJA TDM is in contrast to PRISM which presents the strategic impact of the BDP in the context of other regionally important development and infrastructures.

Although developed from similar information sources, the results from the two demand models will vary for a variety of reasons, such as the focus on local detail of the PJA model and the representation of the wider network in PRISM. It is appropriate to reconcile the two models where relevant.

2.4 PRISM-PJA Comparison

Table 2.1 provides an initial assessment of the pros and cons of the PRISM and PJA forecasts. The assessment can be summarised as follows:

- PRISM has a complex demand model which is based on a West Midlands travel survey, but the model is still strategic in nature and requires careful consideration when looking at local impacts
- The PJA TDM is based on more local data and the Development Case forecasts are up-to-date, unlike the initial PRISM forecast. There is, however, no highway assignment mechanism and the assumptions are in some places necessarily simplistic

Table 2.1: Strengths and limitations of PRISM and the PJA TDM

PRISM		PJA TDM	
Strengths	**Limitations**	**Strengths**	**Limitations**
Forecast takes into account complex interactions seen in the household travel survey	Calibrated on the West Midlands as a whole	Transparent methodology	Assumptions are more simplistic
Allows for changes in future socio-demography	Model has moved on since original BDP forecasts	Calibrated based on very local data	Empirical highway assignment method
Contains a highway assignment model	Large zones and lack of network detail around the GBD	Current Development Case forecast is up to date	No consideration for changes in socio-demography in the future
		Disaggregation within the GBD	No interaction with the road network

This initial assessment shows that there are different strengths and limitations with each forecast model. A more detailed assessment has therefore been undertaken in Table 2.2 which looks at each demand model component in detail. The assessment can be summarised as follows:

- The total person trips will be taken as forecast with the PJA TDM
- Mode, purpose and destination distributions will be taken as forecast using PRISM
- Routing will be calculated using the PRISM highway assignment model

The approach to developing the Hybrid Model is explained in the following Section.

Table 2.2: Detailed Comparison of PRISM and the PJA TDM

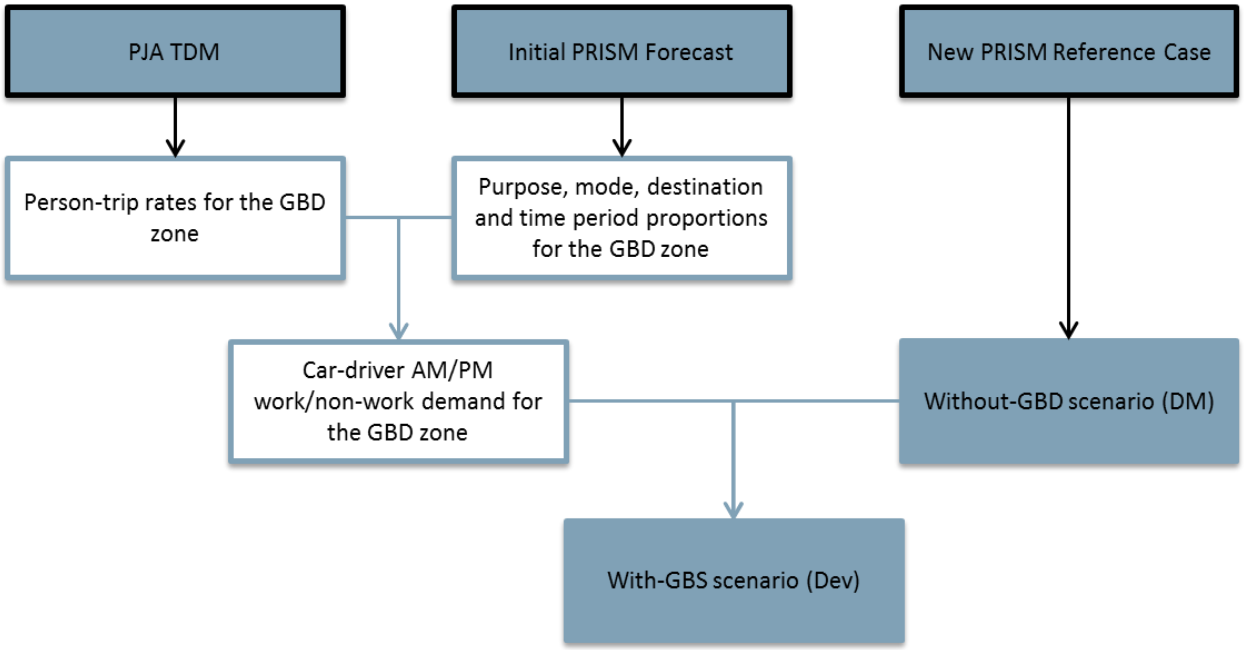
Model Aspect	PRISM	PJA TDM	Assessment
Demand Unit	Average weekday average hour	Average weekday peak hour	Needs to be taken into consideration during consolidation.
Trip Generation / Frequency	Output from a model calibrated to the West Midlands Household Travel Survey (WMHTS) and dependent on accessibility and socio-demography. Models are tour-based and hence non-residential and residential trip rates are intrinsically linked.	TRICS trip rates applied to population (residential) or floor area (non-residential). Includes all trip purposes at this stage.	PRISM is more complex, although it has been calibrated on the WM Metropolitan Area (WMMA) as a whole. The PJA model has less detail but has been calibrated more locally. **Conclusion:** Use the **PJA TDM** to constrain the total trip rates
Purpose Splits	Separate trip generation / frequency models developed for each travel purpose – see above.	Birmingham district-level purpose splits applied to total trips output from the trip generation model	PJA purpose splits calculations relatively simplistic compared to the detail used in PRISM. **Conclusion**: Use **PRISM** purpose splits from the initial PRISM forecast
Trip Distribution	Output from models calibrated to the WMHTS and uses detailed data sources including socio-demographics and the output from detailed assignment models.	Census journey to work data from 2001 used to calibrate gravity models based on demographics and direct-distance.	**Conclusion**: Use **PRISM** distribution from the initial PRISM forecast due to the detailed future year socio-demography and the more accurate representation of travel costs.
Mode Choice	See 'Trip Distribution'	For commute trips leaving Peddimore the 2001 Census JTW mode split has been taken for a similar nearby site. For education and retail the mode split has been taken directly from NTEM.	**Conclusion**: Use **PRISM** mode split from the initial PRISM forecast because the Green Belt Development (GBD) is likely to have very different characteristics to the existing travel patterns of the nearby site (many nearby jobs and provision of cycle routes etc.). PRISM also takes into consideration the changes in generalised cost between different modes between 2001 and the future years along with socio-economic changes such as household income, fuel and fare increases.
Routing	Detailed assignment models	None	**Conclusion**: Use **PRISM** to assess the impact on the strategic network
Forecast Scenario	Future year demographics developed in conjunction with local authorities and accessibility measured using detailed future year assignment models. The initial PRISM development forecasts are out-of-date and so only those aspects of the model that are believed to be sufficiently accurate should be used.	No consideration for a fundamental change in the future year demographics (used in the gravity model) or change in accessibility.	**Conclusion**: Use **PRISM**, but constrain the trip totals as much as is reasonable to the PJA model for consistency and transparency.
Validity	Long-standing model structure that has stood up to scrutiny for 10 years. Recently developed which means new data has been used. Expensive to fully re-run the latest model although there might be potential to do so if a run is required including the full public transport options.	Transparent but simplistic approach. Easy to explain the results but potentially at risk of challenge.	**Conclusion**: Develop a **Hybrid Model** that takes some of the detail from PRISM and adjusts it to be broadly in line with the PJA model. In terms of total magnitude of impact it is therefore easy to explain but still has the robustness of the full PRISM model to support the outputs.

2.5 Hybrid Model Development

The process diagram in Figure 2.1 shows how the Hybrid Model has been developed:

1. AM and PM peak hour person-trip rates have been taken from the PJA TDM Report
2. Synthetic demand[1] has been extracted for the GBD zone from the PRISM forecasts used for the Initial Output Report. The proportion of total person trips that are car-driver trips for work and non-work purposes has then been calculated
3. Extract the origin/destination distributions for the GBD zone from the PRISM forecasts used for the Initial Output Report
4. Apply the proportions from Step 2 to the trip totals in Step 1 to estimate the total number of car-driver trips to and from the GBD zone for work and non-work purposes in the AM and PM average hour
5. Factor the origin/destination distribution from Step 3 to the car-driver trip totals as calculated in Step 4 – the result is an estimation of the GBD demand
6. Extract demand from the latest PRISM Reference Case – this is the without-GBD scenario
7. Add the GBD demand from Step 5 to the without-GBD demand from Step 6 to create the with-GBS scenario

Figure 2.1: Process Diagram for the Development of the Hybrid Model



Source: Mott MacDonald

[1] The synthetic demand is a mathematical estimation of the travel movement in the area, based on observations of the travel behaviour of the West Midlands population, spatial information and generalised travel costs for each origin-destination (OD) pair in each modelled year. Taking the synthetic demand rather than the 'pivoted' demand removes some of the issues around using the initial forecasts. See the **Initial Output Report** for further information.

2.6 Trip Rates

The PJA TDM uses survey data collected from the TRICS database to calculate average trip rates for the land uses intended at the GBD[2]. These trip rates are then applied to each land use to estimate the following total person trips in the peak hours:

Table 2.3: Total peak hour person-trips to/from the GBD from the PJA TDM

Person Trips	08:00-09:00	17:00-18:00
Peddimore Arrivals	2018	297
Peddimore Departures	458	1739
Langley Arrivals	1280	3397
Langley Departures	4373	2244
Total Arrivals	**3298**	**3694**
Total Departures	**4831**	**3983**

Using NTS[3] 2012 table NTS0501, we can estimate the following factors to convert from peak hour to average hour within the peaks as required for PRISM:

- AM peak hour to average hour: 0.7017
- PM peak hour to average hour: 0.9317

The factors suggest that the AM period has a more pronounced 'peak' than the PM and therefore the impacts estimated by the Hybrid Model are likely to seem more severe in the PM (the Hybrid Model will represent an average hour in the period). The average hour trip totals are shown in Table 2.4.

Table 2.4: Total average hour person-trips to/from the GBD, converted from the PJA TDM

Person Trips	08:00-09:00	17:00-18:00
Total Arrivals	2314	3442
Total Departures	3390	3711

2.7 Purpose, Mode, and Time Period Proportions

The PRISM travel demand model has been chosen as the appropriate source to distribute the trip totals in Table 2.4. The model runs used to support the **Initial Output Report** have been selected because many of the improvements since then have been to the network models rather than to the demand model. The following table presents the percentage of total person arrivals or departures in each time period to the GBD zone that are made by car drivers for the purposes of business and other-purposes (including commuting):

[2] Birmingham Development Plan Travel Demand Model Report - Green Belt, PJA.

[3] https://www.gov.uk/government/organisations/department-for-transport/series/national-travel-survey-statistics

Table 2.5: Proportion of Total Person Trips by Arrival/Departure and Time Period that are Car Driver by Purpose

Mode / Purpose	AM Departures	AM Arrivals	PM Departures	PM Arrivals
Car Driver / Business	5.0%	5.1%	3.4%	5.6%
Car Driver / Other	53.0%	69.8%	54.8%	56.2%
Car Driver Total	**58.0%**	**74.9%**	**58.2%**	**61.8%**

The proportions in Table 2.5 can then be applied to the trip totals given in Table 2.4 to provide estimates of the car driver trip-ends for the AM and PM average hours:

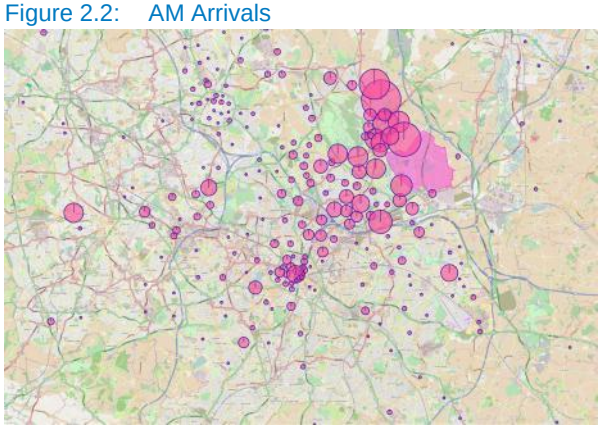
Table 2.6: Car Driver Trip Ends for the GBD Zone

Mode / Purpose	AM Departures	AM Arrivals	PM Departures	PM Arrivals
Car Driver / Business	170	118	127	192
Car Driver / Other	1797	1616	2032	1934
Car Driver Total	**1967**	**1734**	**2159**	**2126**

2.8 With-GBD Scenario

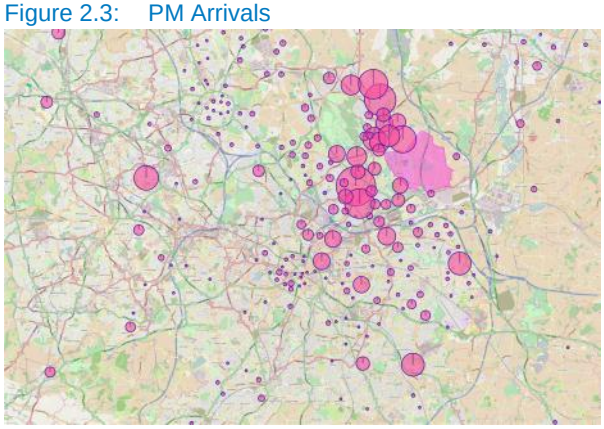
The With-GBD scenario (termed 'Development Case') is then created by taking the GBD origin/destination distribution from the initial PRISM forecasts and constraining the trip ends to the values in Table 2.6. The resulting distribution of external trips is visualised in the figures below[4].

Figure 2.2: AM Arrivals



Source: Mott MacDonald

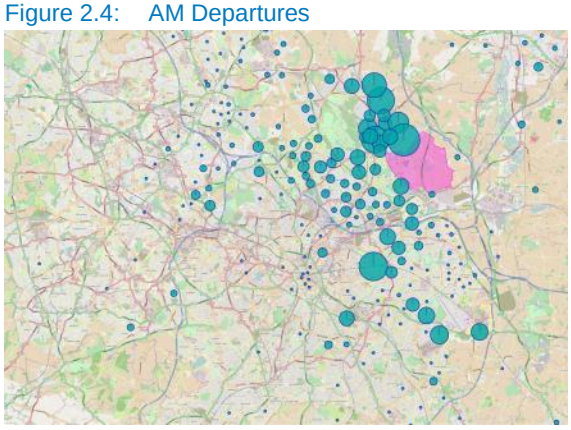
Figure 2.3: PM Arrivals



Source: Mott MacDonald

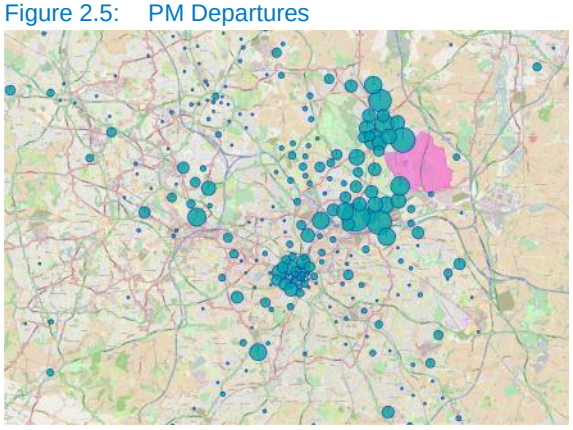
[4] Note that the figures include the change in trip ends forecast for light and heavy goods-vehicles which has been assumed to be the same as in the initial PRISM forecasts used to support the **Initial Output Report**.

Figure 2.4: AM Departures



Source: Mott MacDonald

Figure 2.5: PM Departures



Source: Mott MacDonald

The figures above provide some insight into the external travel patterns forecast for the GBD:

- The majority of external arrivals from the GBD in the AM are at zones in the Sutton Coldfield / Four Oaks area with some concentration also in Birmingham City Centre. The pattern of PM departures is fairly similar to AM arrivals.
- The majority of external departures to the GBD in the AM also come from the Sutton Coldfield / Four Oaks area but also from East Birmingham. The similarity of the PM arrivals to the AM departures reflects the tour-based nature of the PRISM demand model.

3 Forecasting Results

3.1 Introduction

The purpose of this section is to use the Hybrid Model to present an update of the outputs given in the **Initial Output Report**.

3.2 2031 Do Minimum Reference Case Results

Figure 3.1 and Figure 3.2 below show the predicted distribution of link flows in the 2031 Reference Case AM and PM average hour scenarios. The thicker the blue line, the higher the flow. These figures show the greatest flows on:

- The motorway network
- The A38 corridor between the M6 Toll and Selly Oak, especially on the Aston Expressway and through the city centre
- The A456 Hagley Road corridor
- The A45 Coventry Road corridor
- The A4540 city centre Ring Road

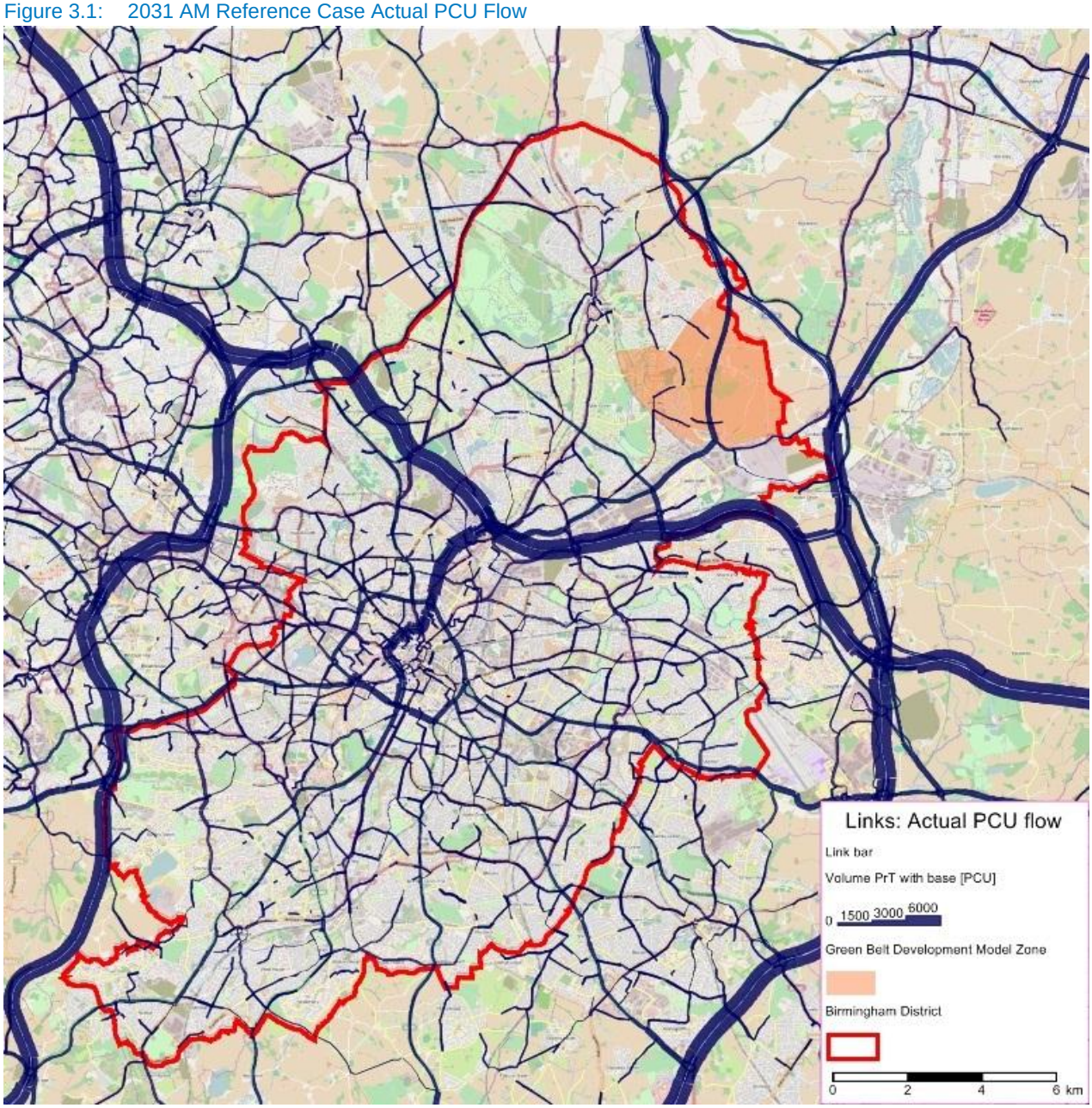
Figure 3.3 and Figure 3.4 below show the predicted impact of these AM and PM flow levels on link flow speed. Impact is shown in terms of the ratio of modelled scenario speeds compared to the equivalent 'free-flow' speed. The lower the ratio, the greater the impact on speed. These figures show the greatest impact on:

- Sutton Coldfield town centre
- The city centre, particularly the A4540, A38 and A34 corridors
- Sections on key radial routes, particularly the A38 north and south, the A5127 (Sutton Road), the A34 (north) and the A441 (Pershore Road)

Figure 3.5 and Figure 3.6 below show the predicted impact of the AM and PM flow levels on junction capacity. Impact is shown in terms of the ratio of flow to capacity (RFC). Only those junctions are shown where one or more movements within the junction are predicted to operate at a RFC of 85% or more, as this is the threshold above which junctions are considered to be operating at or over capacity. It is at levels above this value that increased delays and cumulative queuing can occur. These figures show greatest junction impacts on:

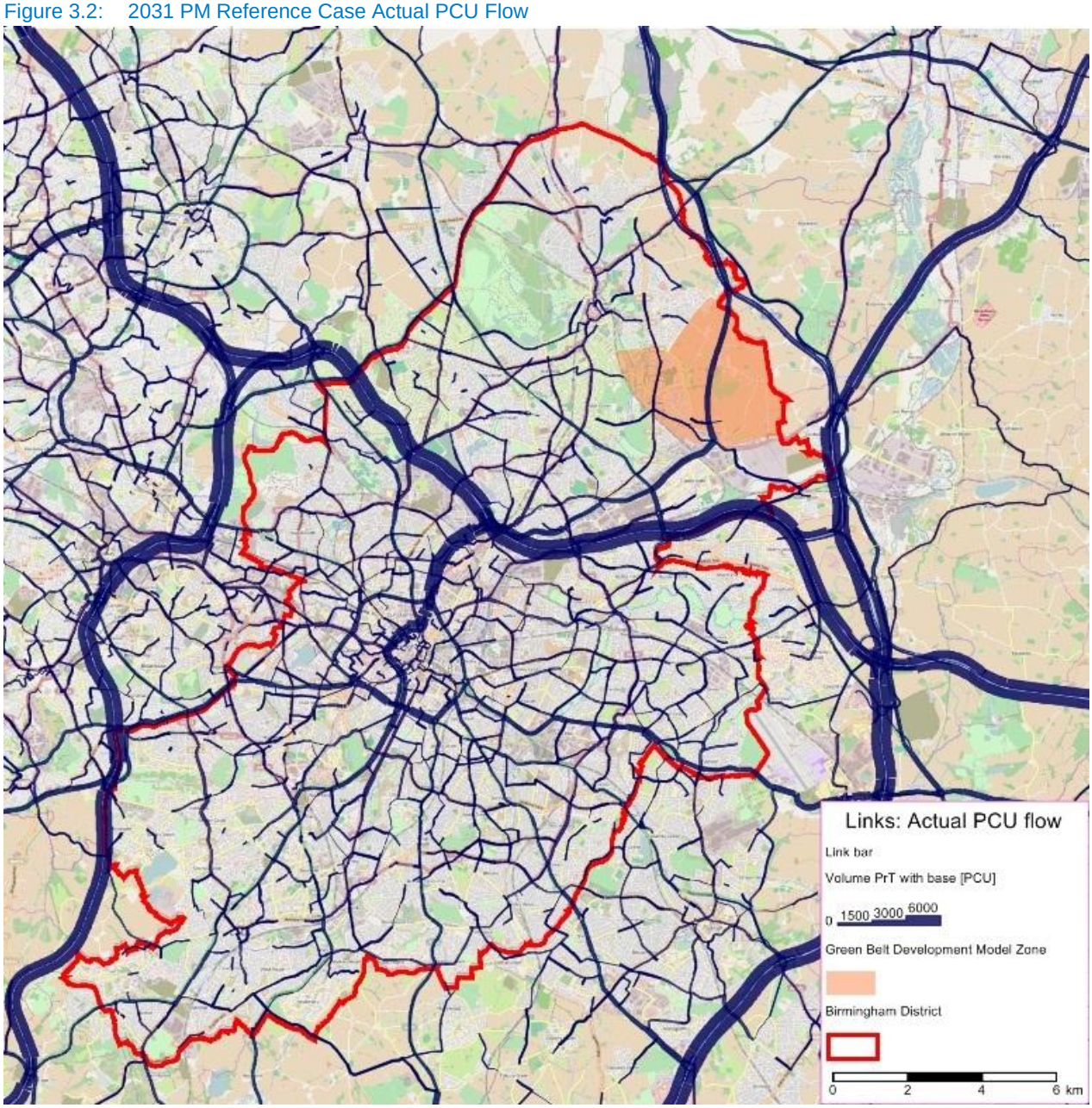
- A4040 Outer Ring Road, between the A5127 Sutton Road and Bordesley Green East
- A4540 Ring Road
- A34 Walsall Road corridor
- A38 Tyburn Road corridor, especially at the Norton Crossroads and Salford Circus
- A4097 Kingsbury Road, at M42 J9 and Water Orton Lane
- A38 city centre corridor
- A38 Bristol Road corridor
- A456 Hagley Road corridor
- A457 Dudley Road corridor
- A45 Coventry Road corridor

Figure 3.1: 2031 AM Reference Case Actual PCU Flow



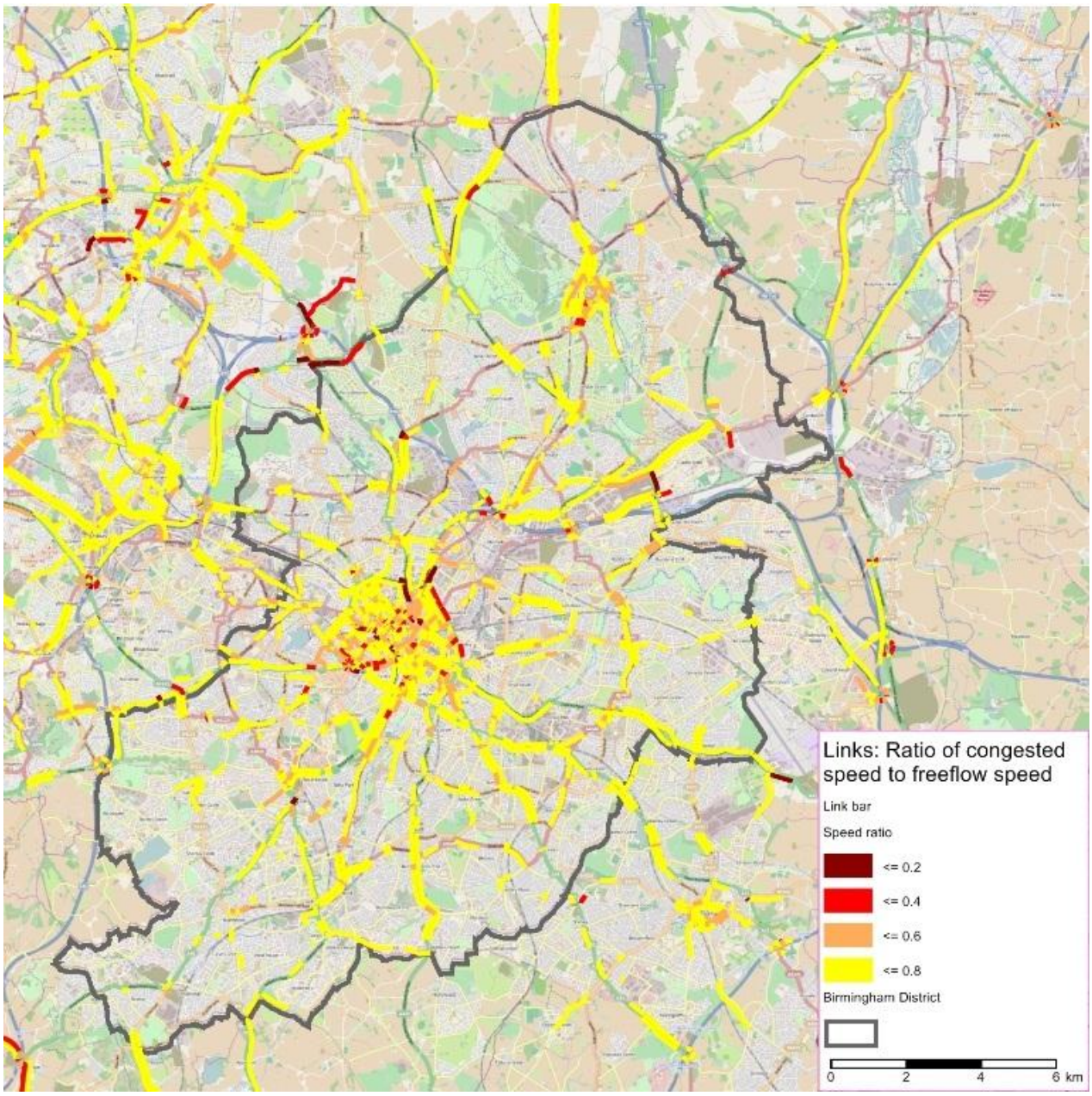
Source: Mott MacDonald

Figure 3.2: 2031 PM Reference Case Actual PCU Flow



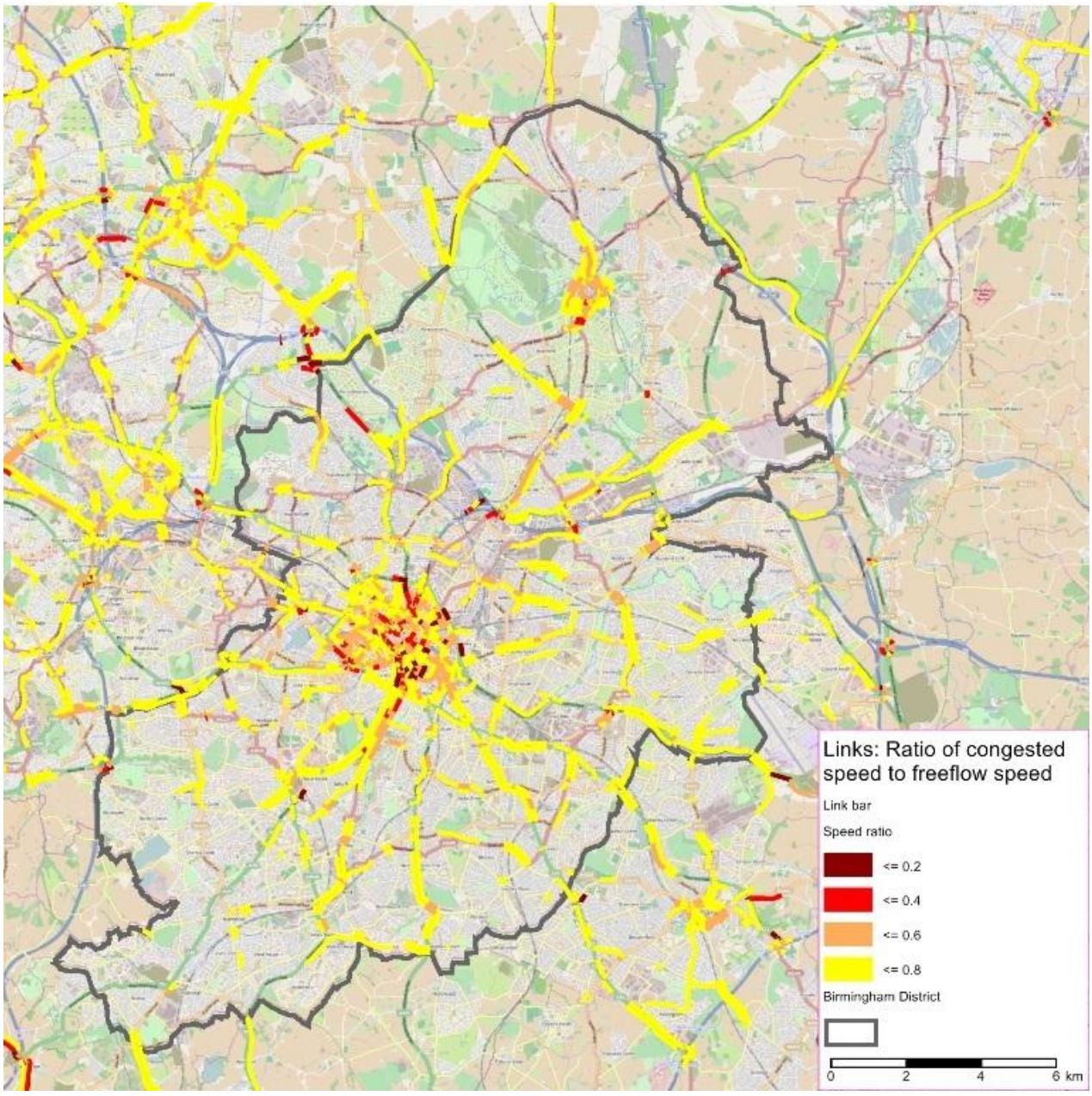
Source: Mott MacDonald

Figure 3.3: 2031 AM Reference Case Ratio of Congested Speed to Free-Flow Speed



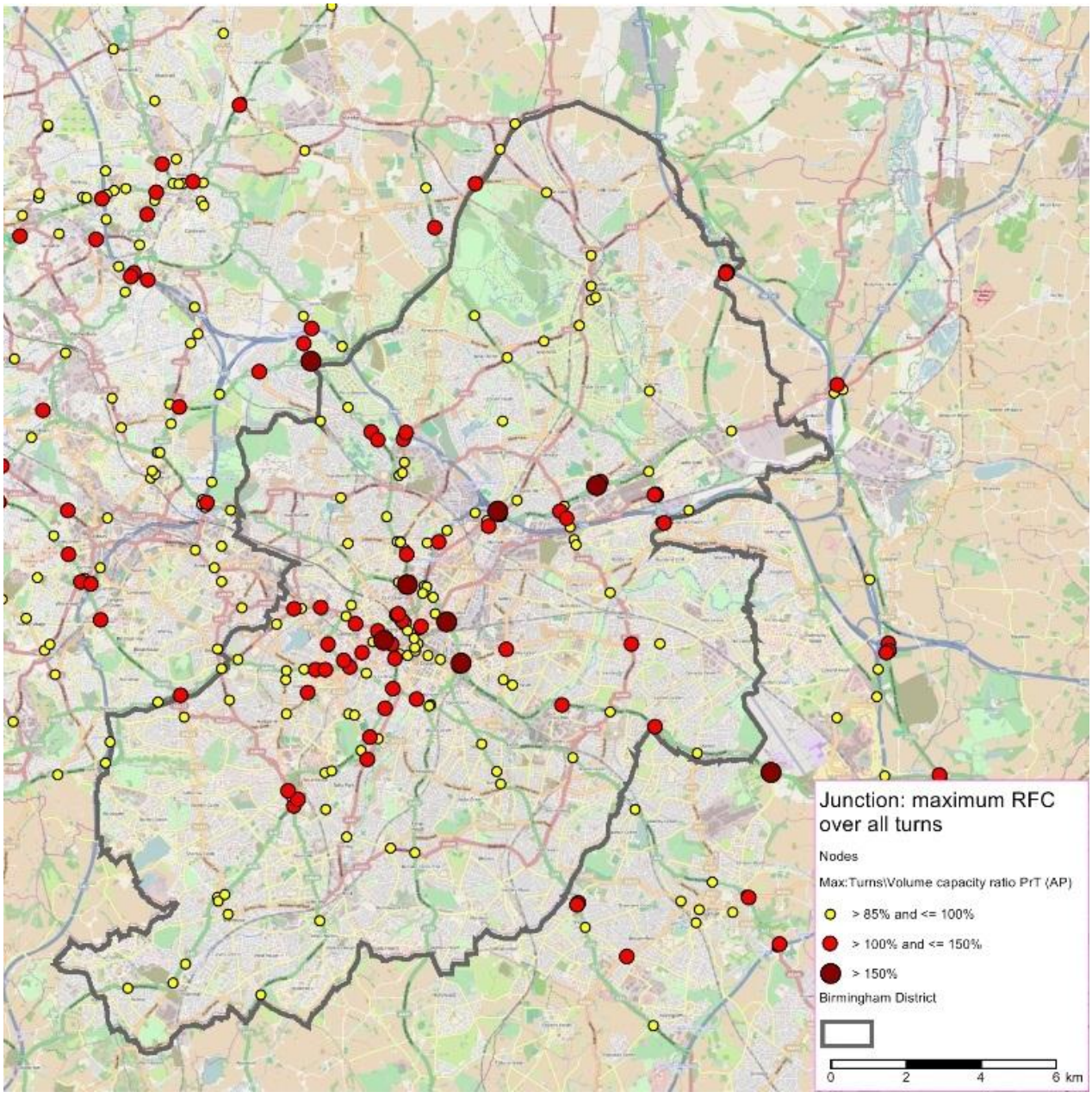
Source: Mott MacDonald

Figure 3.4: 2031 PM Reference Case Ratio of Congested Speed to Free-Flow Speed



Source: Mott MacDonald

Figure 3.5: 2031 AM Reference Case RFC (of most saturated turn)



Source: Mott MacDonald

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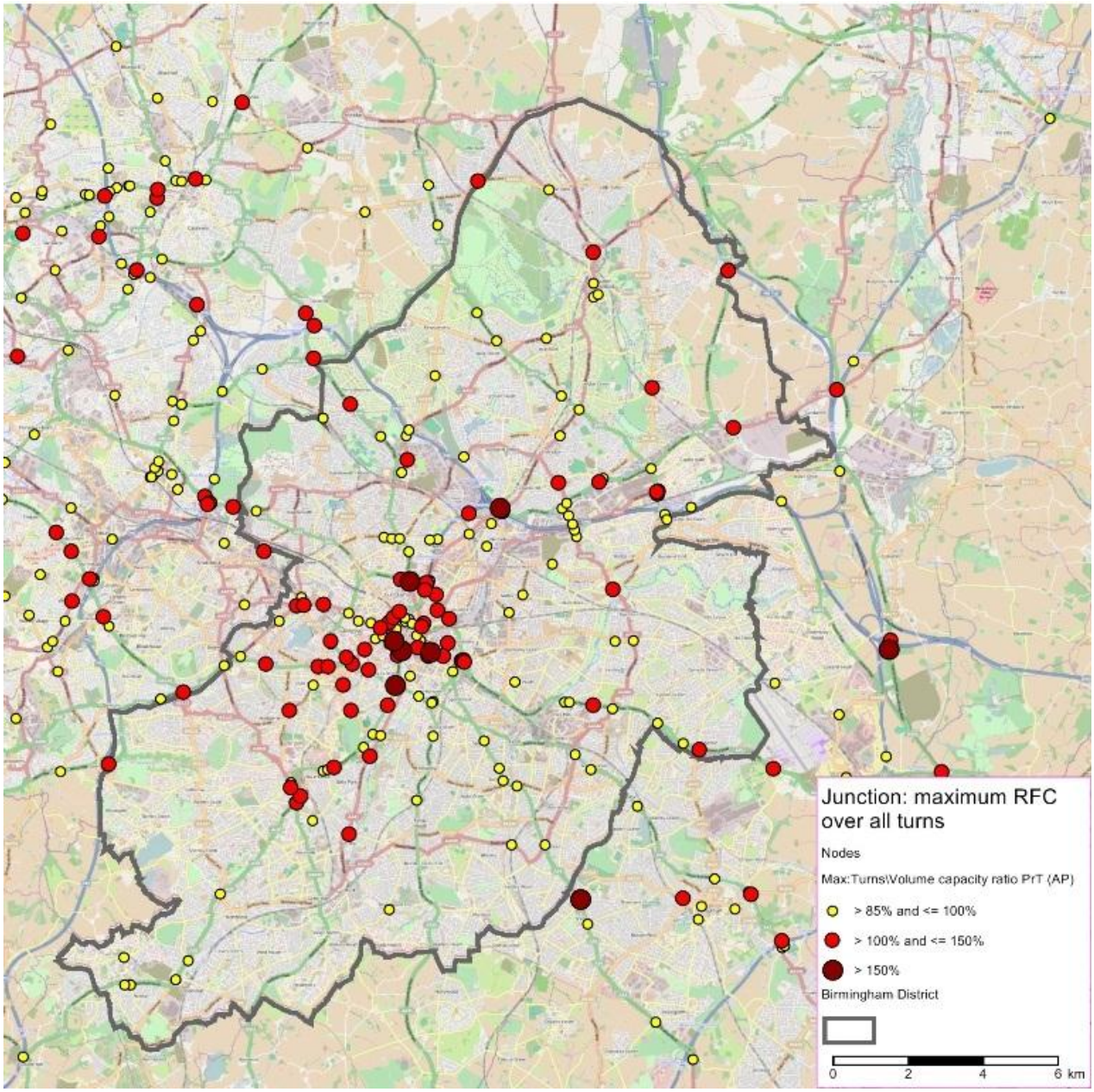
http://localhost:3579/UCdoc~EUNAPiMS/1559853876/Transport Modelling Assessment - Hybrid Model Output - RevB.docx

Figure 3.6: 2031 PM Reference Case RFC (of most saturated turn)



Source: Mott MacDonald

3.3 2031 Development Case Results and Impacts

The above model outputs are reproduced below for the Development Case scenario, which represents the Reference Case scenario but with the additional Green Belt Development added. The below outputs therefore include the impact of the GBD.

In order to isolate the impacts of the GBD, after each set of outputs below, the difference between the Development Case and Reference Case outputs are shown.

Figure 3.7 and Figure 3.8 below show the predicted distribution of link flows in the 2031 Development Case AM and PM average hour scenarios. Figure 3.9 and Figure 3.10 show how these plots differ from the equivalent Reference Case plots, and therefore isolate the flow changes predicted to occur as a result of the GBD. These figures show:

- The most significant flow increases being on the main local links between the GBD and surrounding urban area, namely:
  - A38 Kingsbury Road
  - Walmley Ash Road
  - Fox Hollies Road / Wylde Green Road
  - B4148 Walmley Road
  - Ox Leys Road
- And some less significant increases on the:
  - A38 Tyburn Road and Aston Expressway
  - M6 between M5 and M42
  - M42 between M6 and A5

Figure 3.11 and Figure 3.12 below show the predicted impact of the Development Case AM and PM flow levels on link flow speed. Figure 3.13 and Figure 3.14 show how these plots differ from the equivalent Reference Case plots, and therefore isolate the speed changes predicted to occur as a result of the GBD. These figures show that the main impact is predicted to be a small speed deterioration on the main local links between the GBD and surrounding urban area.

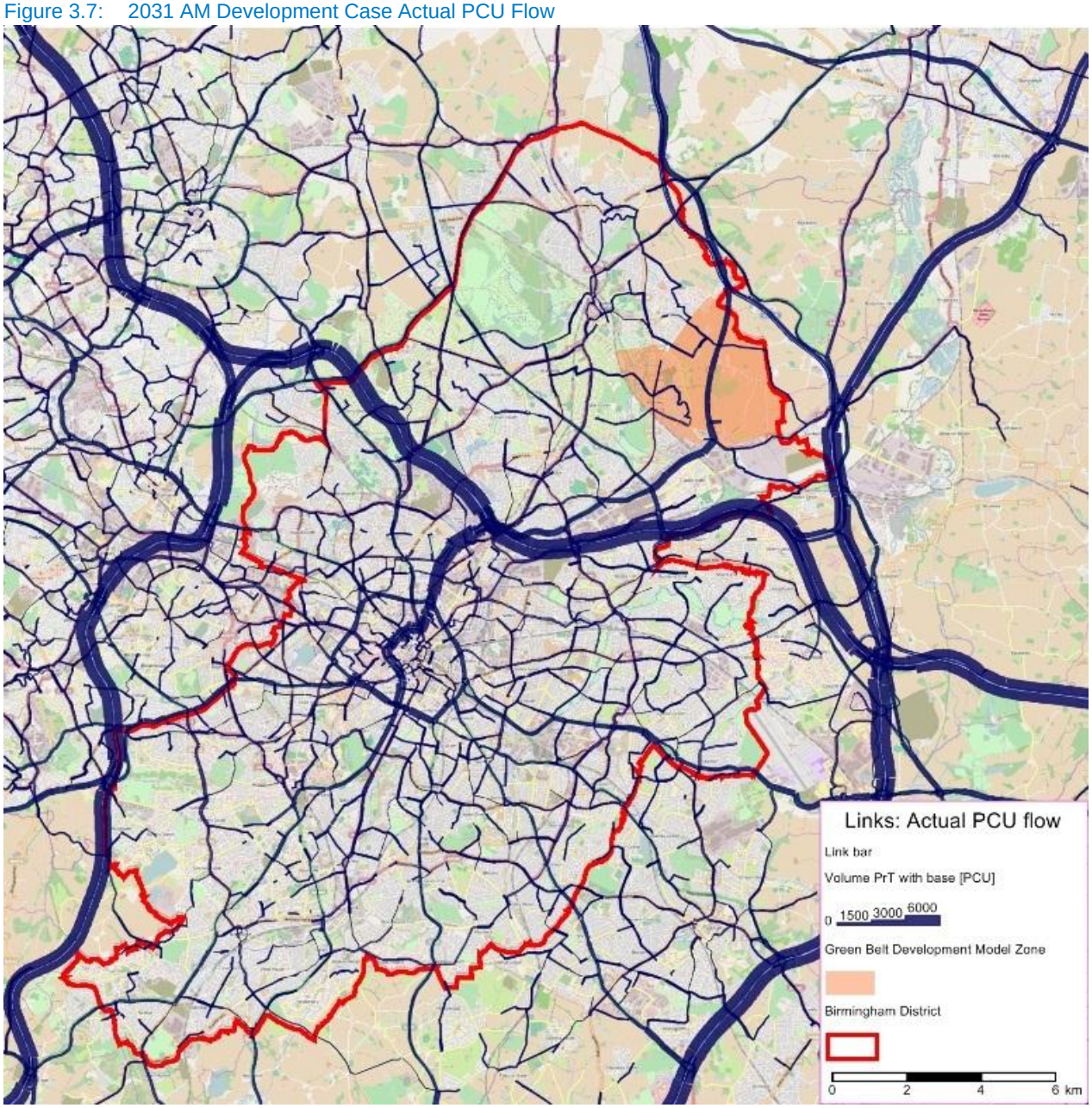
Figure 3.15 and Figure 3.16 below show the predicted impact of the Development Case AM and PM flow levels on junction capacity. Impact is shown in terms of the ratio of flow to capacity (RFC). Figure 3.17 and Figure 3.18 show how these plots differ from the equivalent Reference Case plots, and therefore isolate the RFC changes predicted to occur as a result of the GBD. These show:

- AM average peak hour:
  - The RFC at the following junctions is predicted to **increase** from over 85% to over 100%
    - One of the nodes at M42 J9
    - A4097 junction with Water Orton Lane
    - Chester Road / Fort Parkway junction

  - A34 Walsall Road / A453 Aldridge Road junction
- The RFC at the following junctions is predicted to **increase** from under 85% to over 85%
  - A38 Minworth Island
  - A453 Tamworth Road / Whitehouse Common Road junction
  - B4148 Walmley Road / Wylde Green Road junction
  - A452 Chester Road / A5127 Sutton Road junction
  - A4040 Bromford Lane / Bromford Road
- The RFC at the following junction is predicted to **decrease** from above 85% to under 85%
  - A38 Tyburn House Island

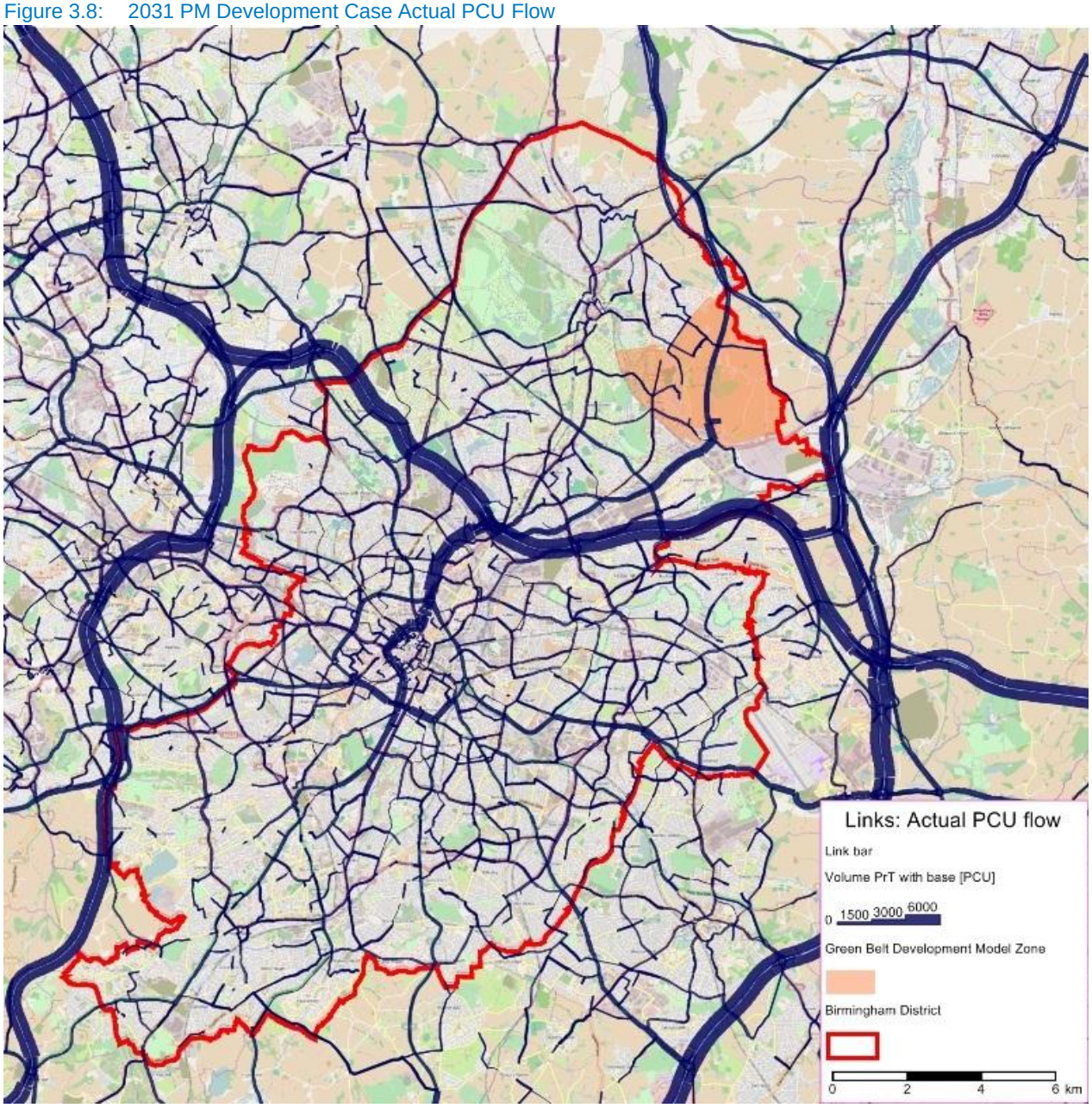
- PM average peak hour:
  - The RFC at the following junctions is predicted to **increase** from over 85% to over 100%
    - A38 Tyburn House Island
    - A38 Norton Crossroads
    - A38 Birches Green junction
    - A5127 Gravelly Hill / Kingsbury Road junction
  - The RFC at the following junctions is predicted to **increase** from under 85% to over 85%
    - A38 Minworth Island
    - A453 Tamworth Road / Whitehouse Common Road junction
    - B4148 Walmley Road / Wylde Green Road junction
    - A453 Jockey Road / A5127 Birmingham Road junction
    - A453 Jockey Road / A452 Chester Road junction
    - B4142 Summer Road / B4531 Station Road junction
    - Perry Common Road / Streetly Road junction
  - The RFC at the following junctions is predicted to **decrease** from above 85% to under 85%
    - A4040 Brookvale Road / George Road junction
    - A34 Walsall Road / A453 Aldridge Road junction

Figure 3.7: 2031 AM Development Case Actual PCU Flow



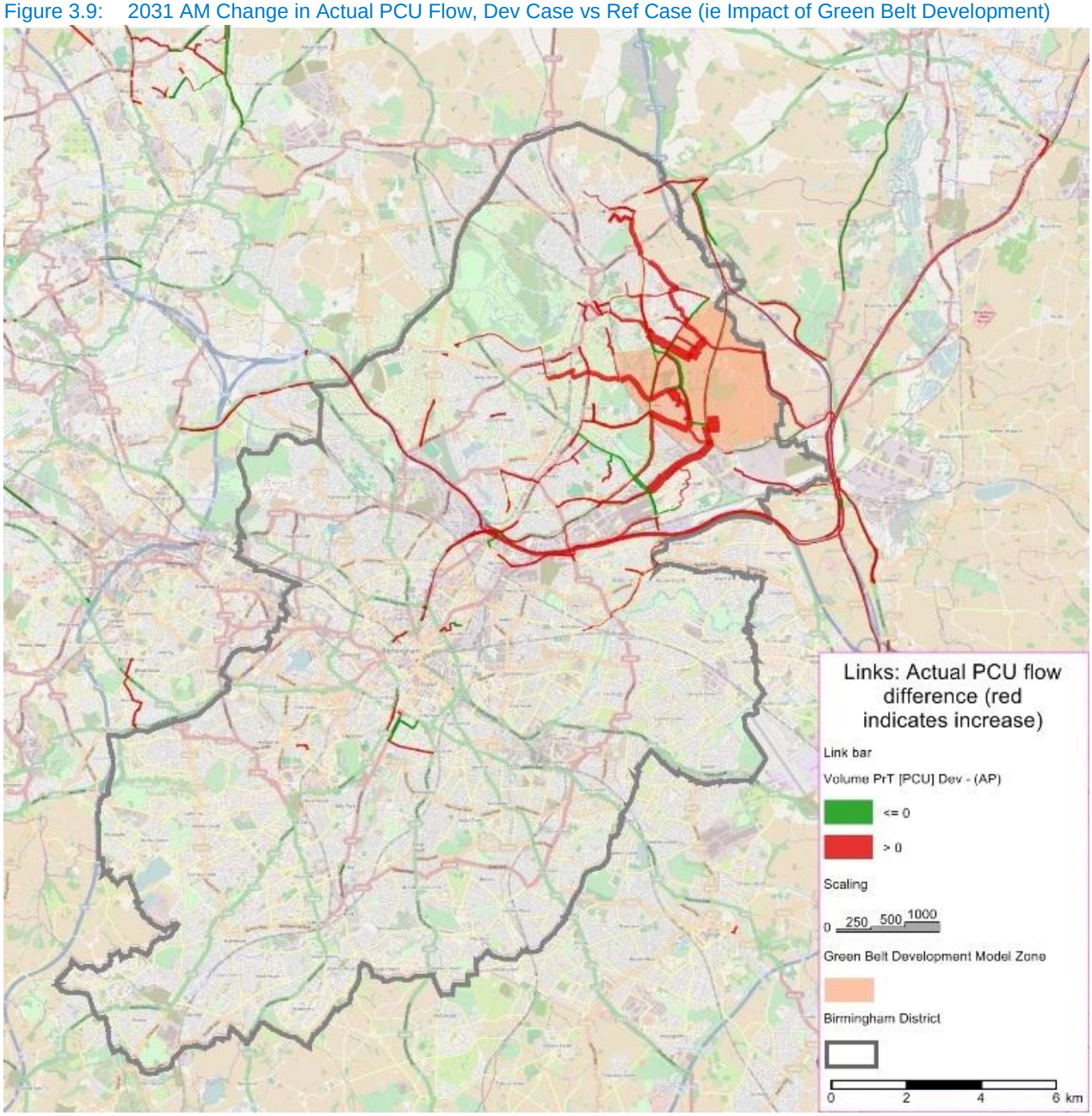
Source: Mott MacDonald

Figure 3.8: 2031 PM Development Case Actual PCU Flow



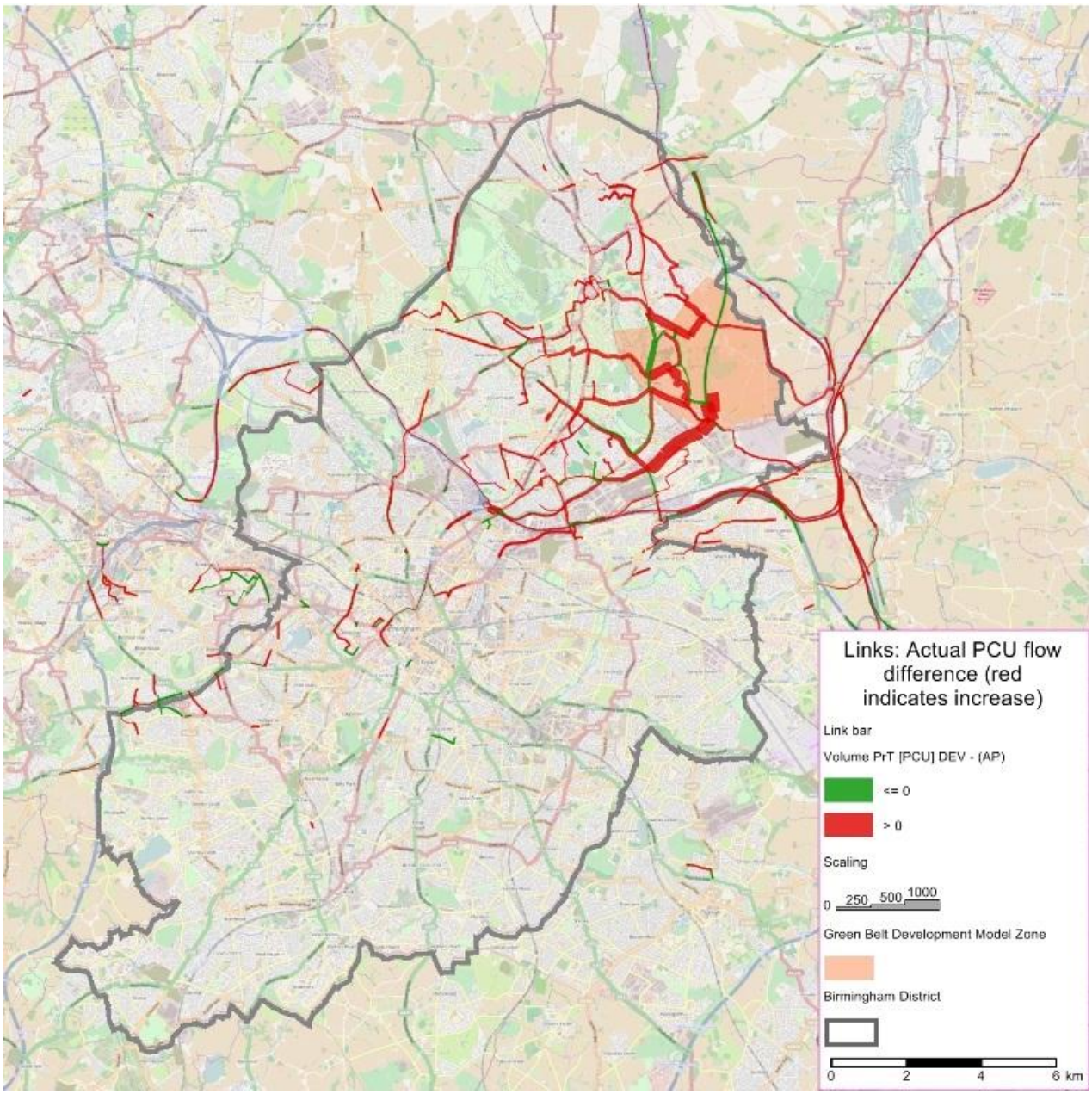
Source: Mott MacDonald

Figure 3.9: 2031 AM Change in Actual PCU Flow, Dev Case vs Ref Case (ie Impact of Green Belt Development)



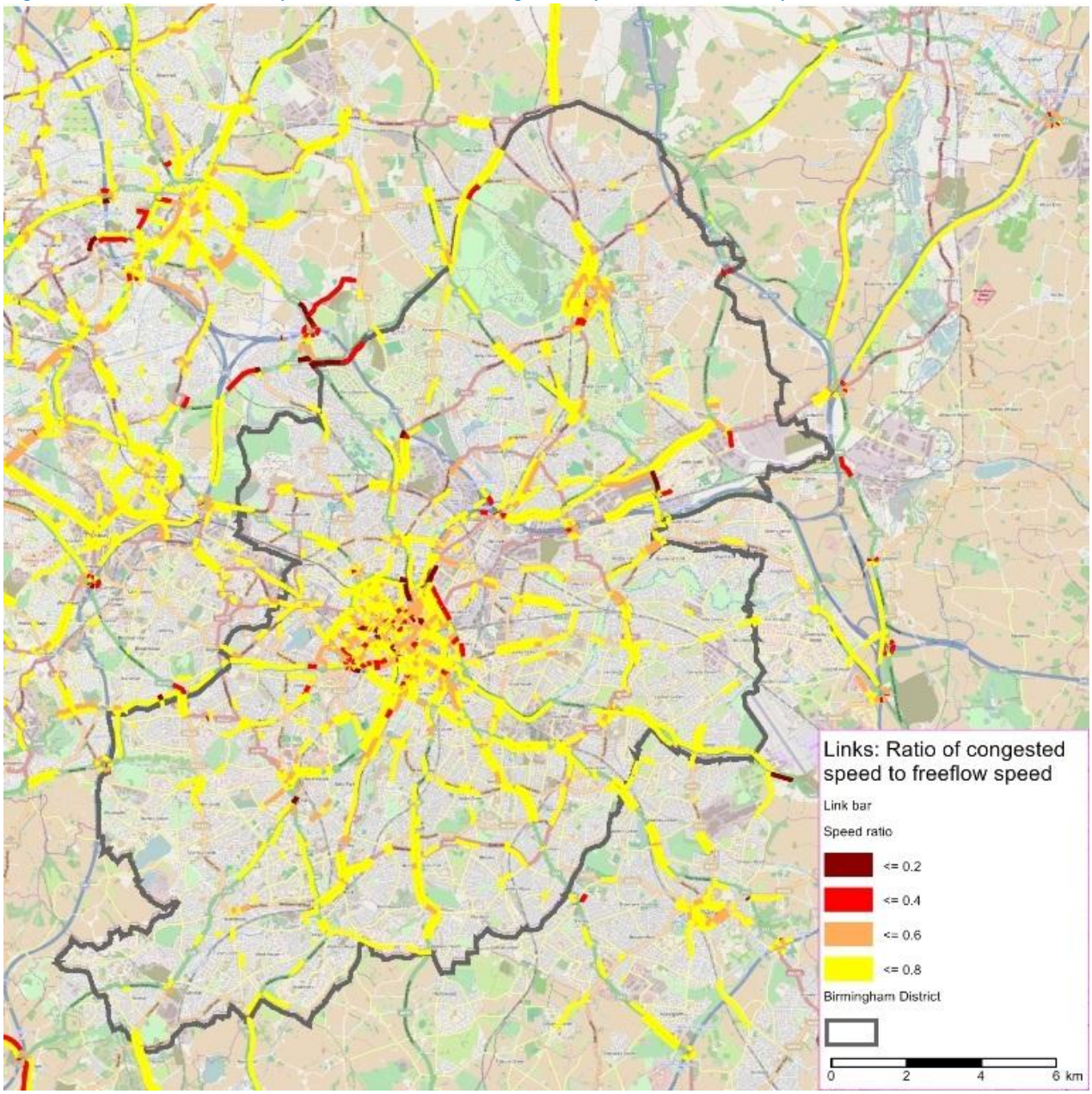
Source: Mott MacDonald

Figure 3.10: 2031 PM Change in Actual PCU Flow, Dev Case vs Ref Case (ie Impact of Green Belt Development)



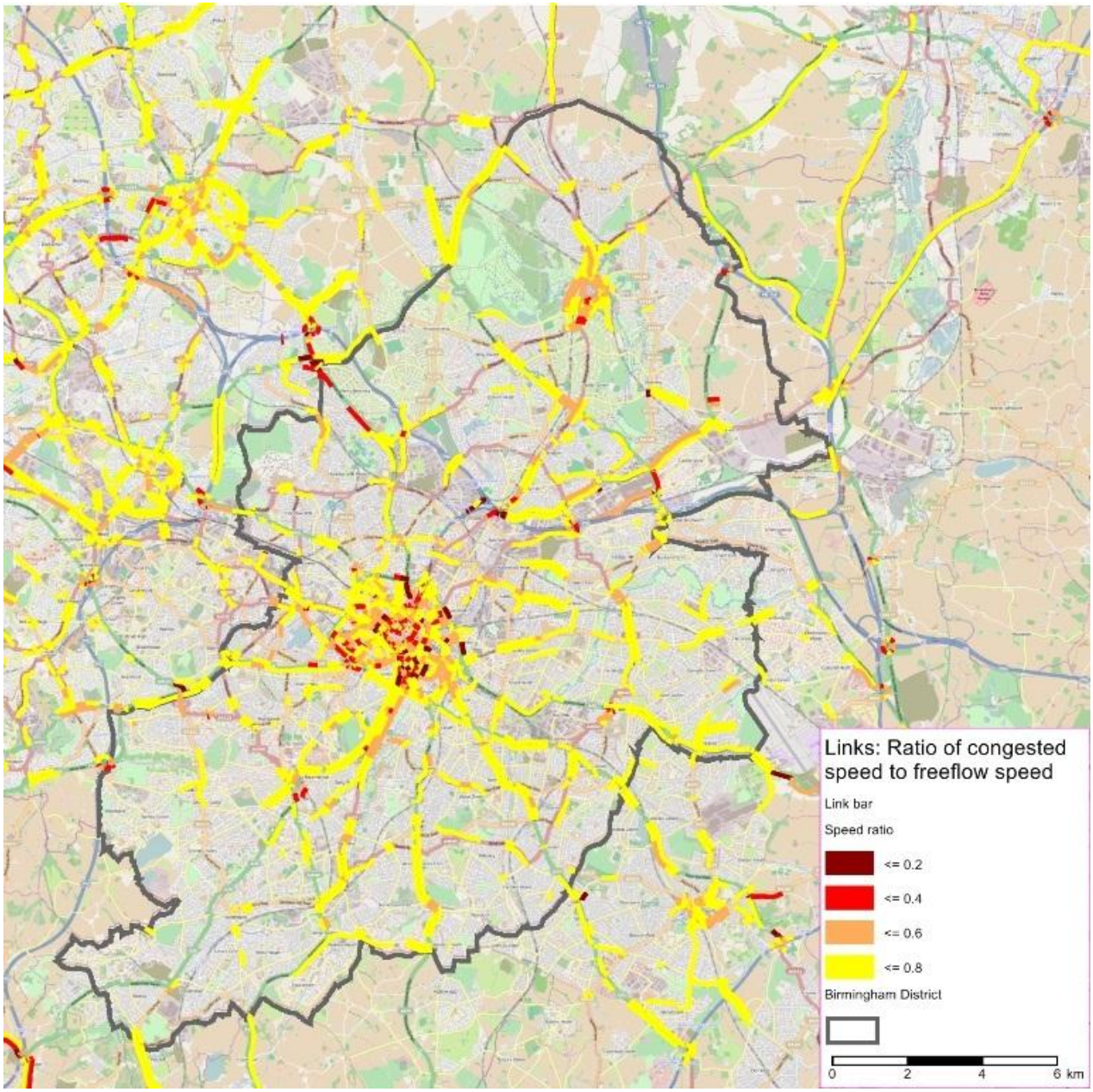
Source: Mott MacDonald

Figure 3.11: 2031 AM Development Case Ratio of Congested Speed to Free-Flow Speed



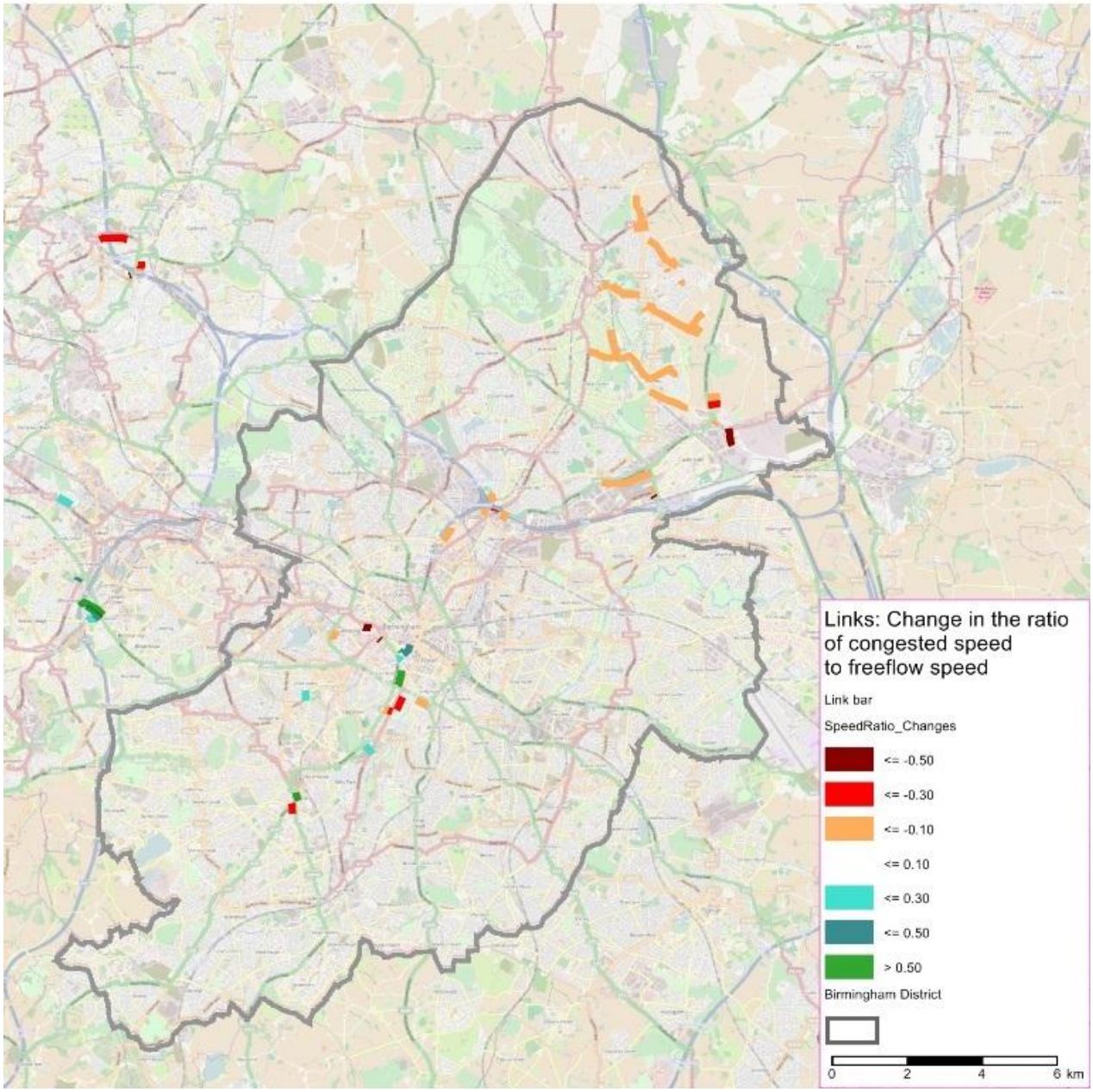
Source: Mott MacDonald

Figure 3.12: 2031 PM Development Case Ratio of Congested Speed to Free-Flow Speed



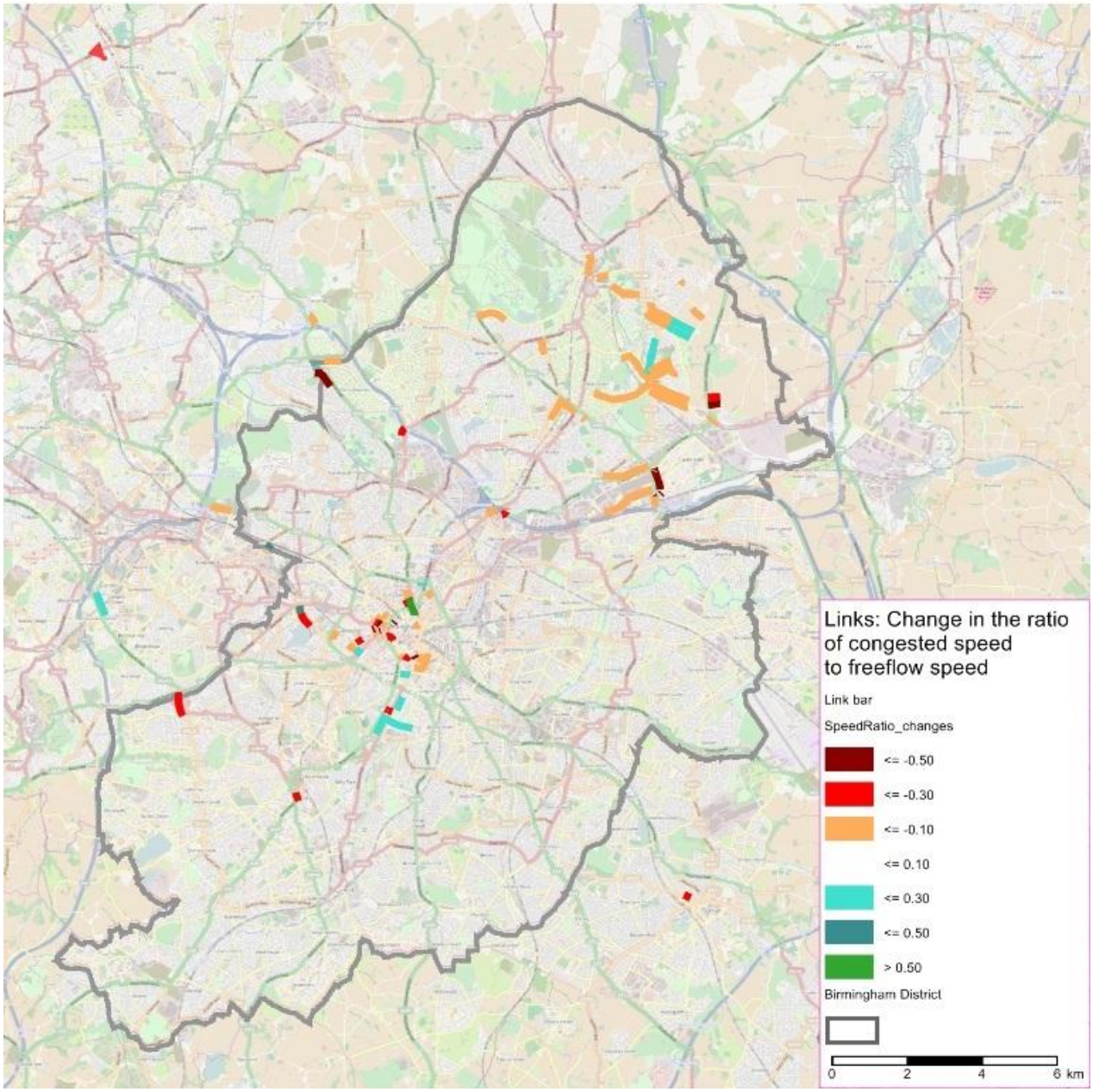
Source: Mott MacDonald

Figure 3.13: 2031 AM Change in Speed Ratio, Dev Case vs Ref Case (ie Impact of Green Belt Development)



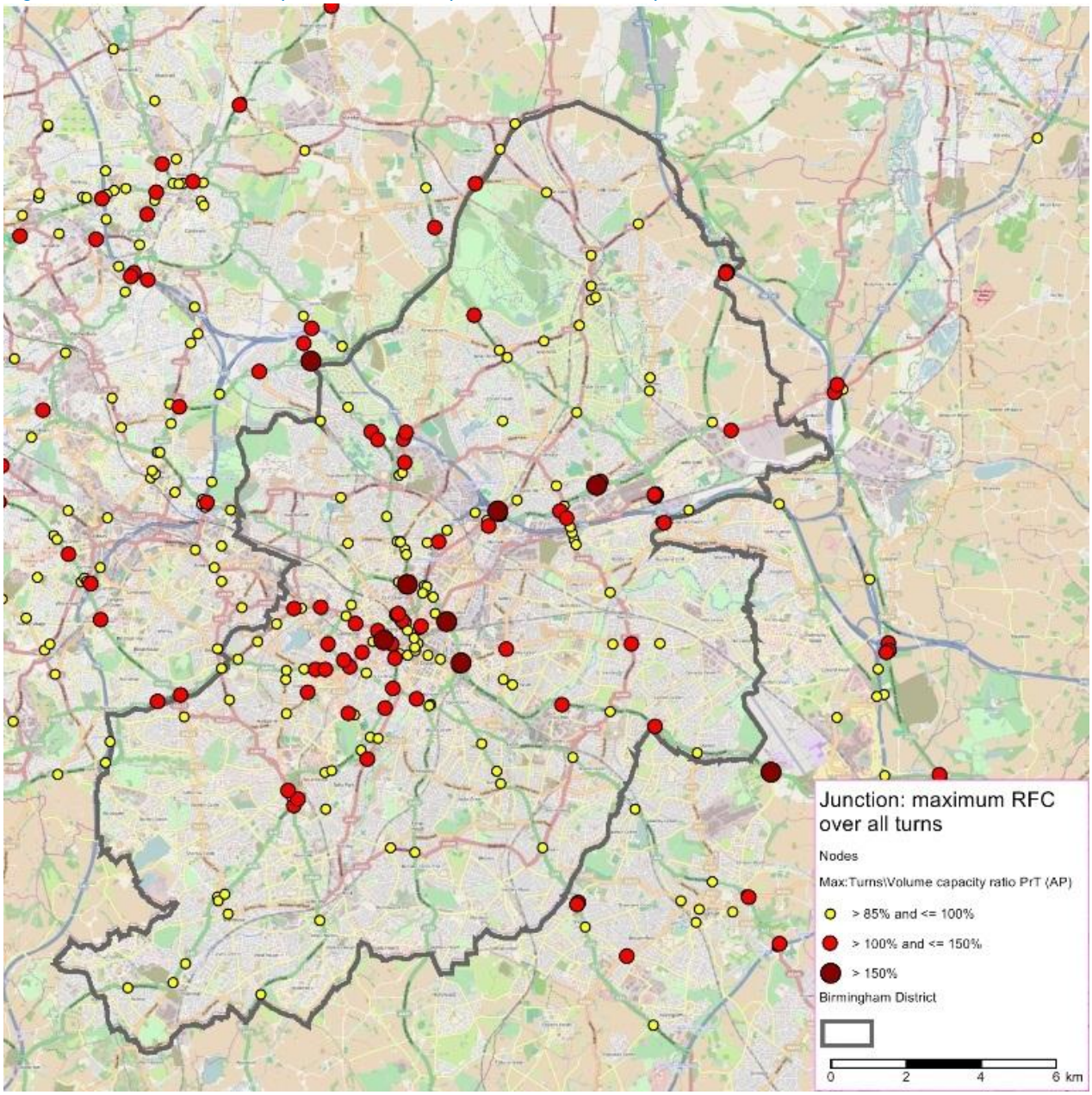
Source: Mott MacDonald

Figure 3.14: 2031 PM Change in Speed Ratio, Dev Case vs Ref Case (ie Impact of Green Belt Development)



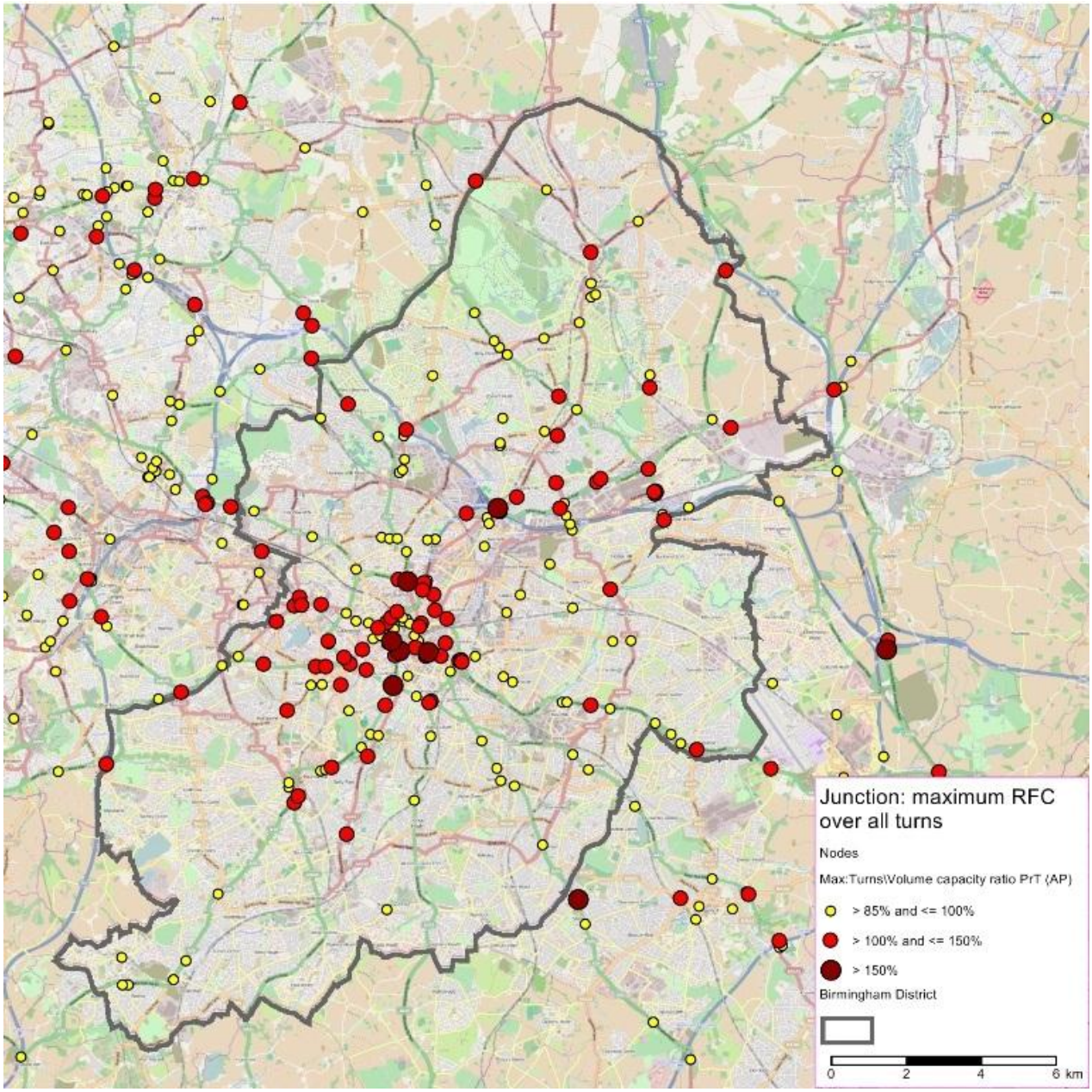
Source: Mott MacDonald

Figure 3.15: 2031 AM Development Case RFC (of most saturated turn)



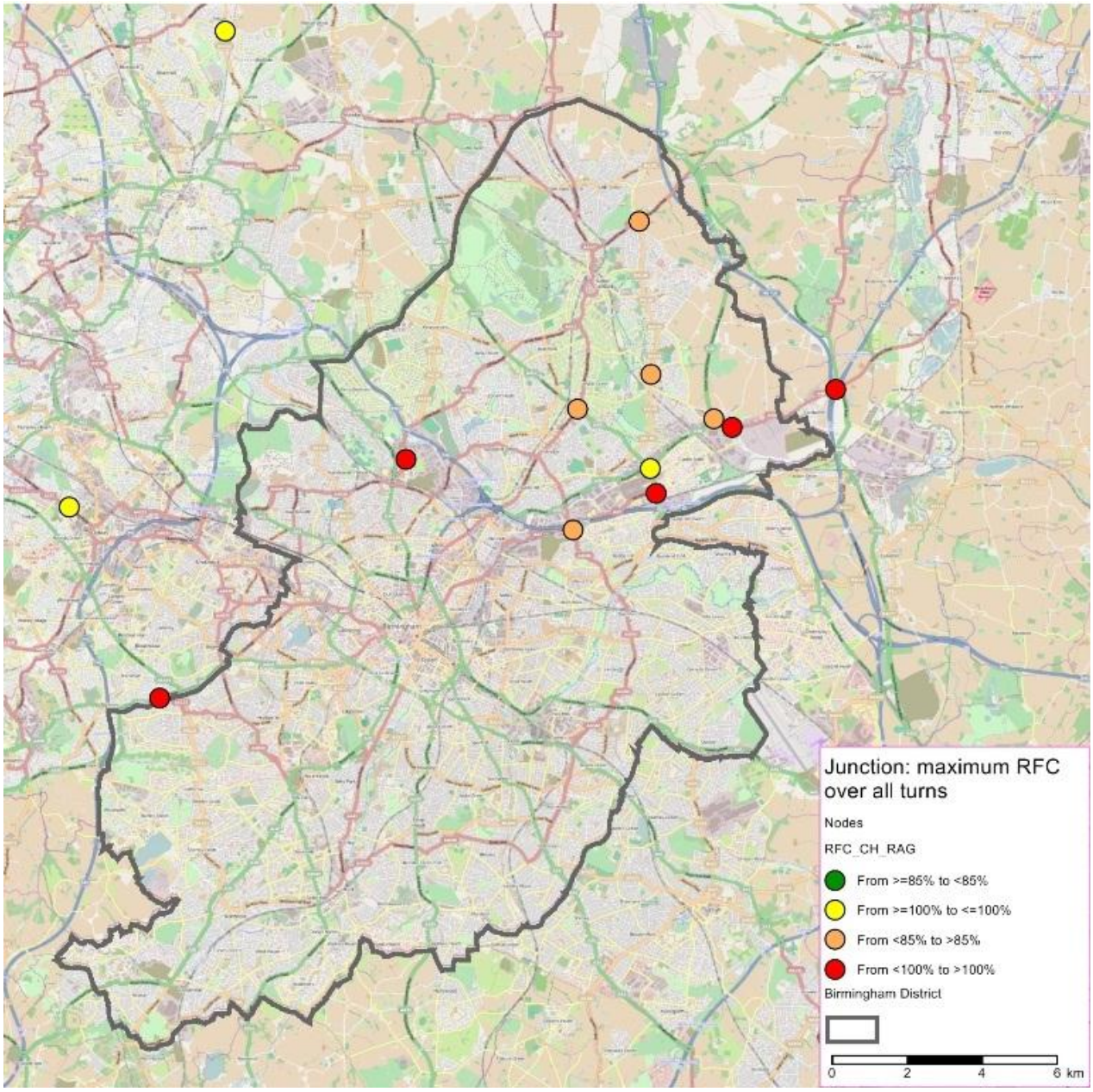
Source: Mott MacDonald

Figure 3.16: 2031 PM Development Case RFC (of most saturated turn)



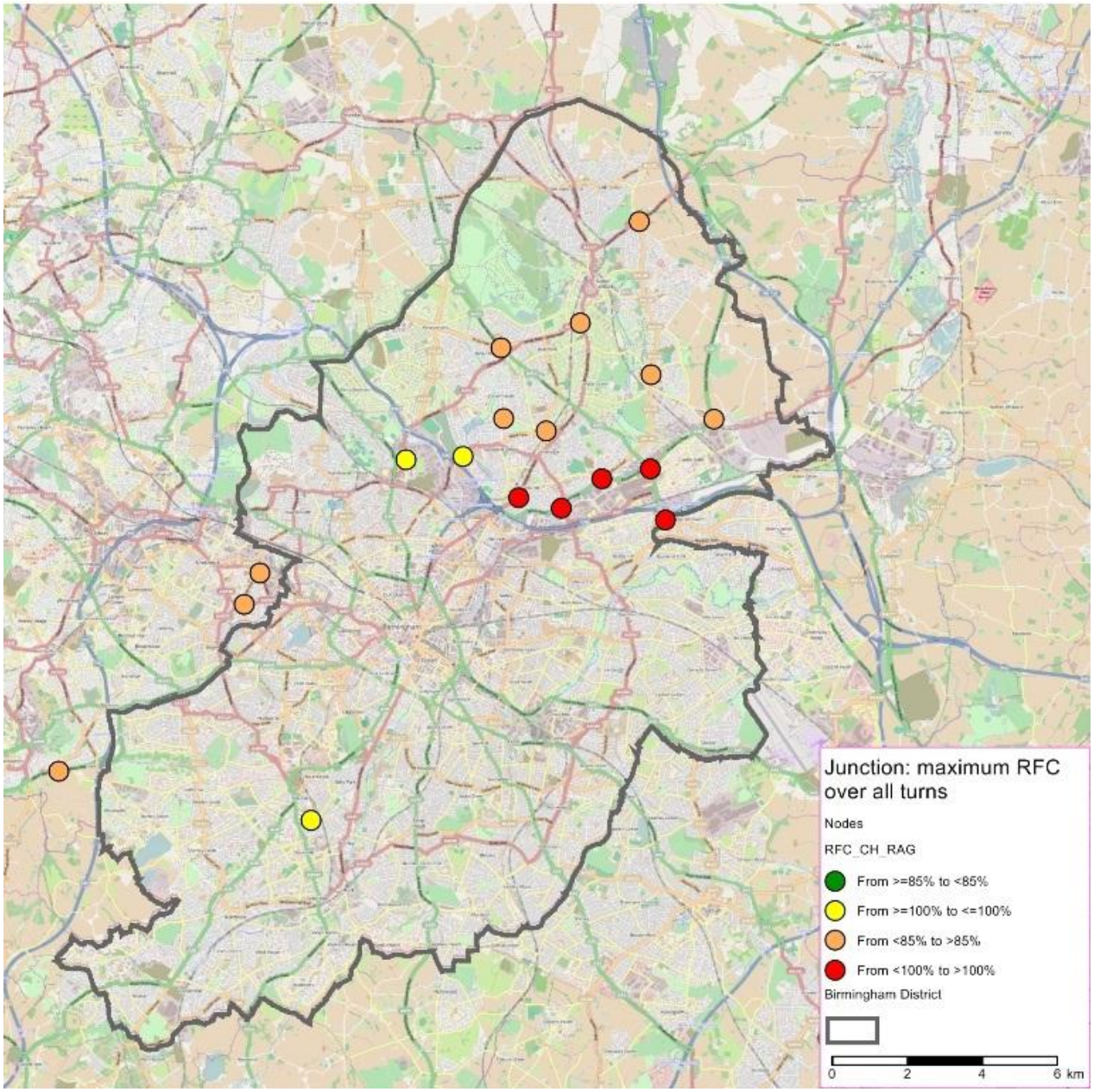
Source: Mott MacDonald

Figure 3.17: 2031 AM Change in RFC Classification, Dev Case vs Ref Case (ie Impact of Green Belt Development)



Source: Mott MacDonald

Figure 3.18: 2031 PM Change in RFC Classification, Dev Case vs Ref Case (ie Impact of Green Belt Development)



Source: Mott MacDonald

4 Summary

4.1 Background

Birmingham City Council (BCC) is in the process of developing the Birmingham Development Plan and has commissioned Mott MacDonald to help develop a Transport Evidence Base to support the emerging Plan.

The Transport Evidence Base is being developed over five stages, the third of which involves testing the transport impact of the Plan using the West Midlands Policy Responsive Integrated Strategy Model (PRISM). Initial results were issued in the **Initial Output Report (January 2014)**, but PRISM has developed significantly since then, both in terms of refining the code, calculating the output and understanding how to interpret results from the newer model features. Complementary work by other consultants has also progressed since the first applications.

The purpose of this report is therefore to describe how the initial model application has been updated to take advantage of the latest PRISM developments and also to consolidate the PRISM forecasts with the Green Belt Development (GBD) demand modelling undertaken by Phil Jones Associates (PJA). This updated model has been termed the **Hybrid Model** and the resulting analysis presented above is focussed on assessing the impact of the GBD on the surrounding strategic road network.

4.2 Summary of Forecasting Results

The 2031 Reference Case results for the Birmingham highway network in the weekday AM and PM peak average hours predict that a number of junctions will be operating at or over-capacity during these periods in the following areas:

- A4040 Outer Ring Road, between between the A5127 Sutton Road and Bordesley Green East
- A4540 Ring Road
- A34 Walsall Road corridor
- A38 Tyburn Road corridor, especially at the Norton Crossroads and Salford Circus
- A4097 Kingsbury Road, at M42 J9 and Water Orton Lane
- A38 city centre corridor
- A38 Bristol Road corridor
- A456 Hagley Road corridor
- A457 Dudley Road corridor
- A45 Coventry Road corridor

The Green Belt Development (GBD) in the 2031 Development Case will increase traffic levels on local roads linking the GBD to the surrounding urban area to the west. It will also result in less significant increases on the M6 and M42. As a result, the model predicts a performance deterioration in the area surrounding the GBD for 9 junctions in the AM period and 12 junctions in the PM period. Performance for 1 and 2 junctions is predicted to improve in each period respectively.

Appendices

Appendix A. Junction Data Tables

A.1 2031 AM Comparison

Table A.1: Junction Data from the AM Reference Case and Hybrid Model

Junction	Reference Case			Hybrid Model			
	In Flow	RFC	Delay	In Flow	%chge	RFC	Delay
A4097 Minworth to M42 J9	1479	56%	0.2	1582	7%	61%	0.2
A446 M6 J4 to M42 J9	2077	25%	0.9	2167	4%	26%	0.9
Ox Leys Road	576	22%	1.5	848	47%	33%	1.6
Church Lane	-	-	-	-	-	-	-
Dunton Lane	-	-	-	-	-	-	-
Wishaw Lane	576	22%	1.5	848	47%	33%	1.6
Blindpit Lane	-	-	-	-	-	-	-
Water Orton Lane	932	36%	1.5	1053	13%	41%	1.5
Thru Settlement of Curdworth	-	-	-	-	-	-	-
Thru Settlement of Water Orton	449	18%	1.2	510	14%	20%	1.2
Thru Settlement of Wishaw	-	-	-	-	-	-	-
A38 junction with A5	4743	81%	0.6	4801	1%	83%	0.6
A4091 between Wishaw and Tamworth	1727	65%	5.1	1693	-2%	65%	5.1
A51 between Tamworth and Kingsbury	228	9%	8.7	228	0%	9%	8.7
A453 between Tamworth and Bassetts Pole	1904	72%	4.1	1811	-5%	70%	4.0
A5127 between Lichfield and Sutton Coldfield	1216	71%	3.7	1215	0%	71%	3.8
A5206 London Road and	2318	87%	1.7	2322	0%	88%	1.8
M42 J3	4743	104%	1.3	4801	1%	103%	1.3
A51 between Lichfield and Weeford Island	2475	96%	1.8	2531	2%	99%	1.9
M42 J4	4426	63%	0.5	4423	0%	62%	0.5
M42 J5	3673	102%	0.7	3683	0%	102%	0.7
M42 J6	4724	97%	1.2	4779	1%	97%	1.3
M42 J9	6915	102%	1.2	7004	1%	106%	1.3
M5 J4	5618	83%	0.5	5643	0%	84%	0.5
M5 J3	3639	99%	0.6	3662	1%	99%	0.6
M5 J2	5995	114%	1.4	5996	0%	115%	1.4
M5 J1	7104	107%	2.1	7119	0%	109%	2.2
M6 J4	3967	133%	1.6	3978	0%	138%	1.6
M6 J5	4523	103%	1.2	4587	1%	102%	1.3
M6 J6	-	-	-	-	-	-	-
M6 J7	4614	139%	0.1	4689	2%	140%	0.1
M6 J8	-	-	-	-	-	-	-
M6 J9	5394	103%	1.1	5444	1%	103%	1.1
M6 J10	5647	147%	1.5	5683	1%	144%	1.5
A4148 northern ring road (Walsall)	2020	29%	0.4	2024	0%	29%	0.4
A461 Lichfield Road (Walsall)	2100	48%	0.3	2127	1%	48%	0.3

A.2 2031 PM Comparison

Table A.2: Junction Data from the PM Reference Case and Hybrid Model

Junction	Reference Case			Development Case			
	In Flow	RFC	Delay	In Flow	%chge	RFC	Delay
A4097 Minworth to M42 J9	998	41%	0.2	1156	16%	49%	0.2
A446 M6 J4 to M42 J9	2228	28%	0.9	2283	2%	30%	0.9
Ox Leys Road	494	21%	1.5	726	47%	32%	1.6
Church Lane	-	-	-	-	-	-	-
Dunton Lane	-	-	-	-	-	-	-
Wishaw Lane	494	21%	1.5	726	47%	32%	1.6
Blindpit Lane	-	-	-	-	-	-	-
Water Orton Lane	1005	40%	1.5	1136	13%	45%	1.6
Thru Settlement of Curdworth	-	-	-	-	-	-	-
Thru Settlement of Water Orton	449	19%	1.2	499	11%	20%	1.2
Thru Settlement of Wishaw	-	-	-	-	-	-	-
A38 junction with A5	4981	54%	0.4	4996	0%	58%	0.4
A4091 between Wishaw and Tamworth	1303	54%	4.8	1298	0%	56%	4.9
A51 between Tamworth and Kingsbury	153	6%	8.7	152	0%	6%	8.7
A453 between Tamworth and Bassetts Pole	1833	73%	4.1	1819	-1%	71%	4.1
A5127 between Lichfield and Sutton Coldfield	1228	70%	3.7	1209	-2%	69%	3.7
A5206 London Road and	2188	84%	1.7	2200	1%	85%	1.7
M42 J3	4981	100%	1.0	4996	0%	101%	1.0
A51 between Lichfield and Weeford Island	2326	94%	1.3	2329	0%	95%	1.3
M42 J4	4508	57%	0.6	4559	1%	57%	0.6
M42 J5	4046	107%	0.4	4038	0%	107%	0.4
M42 J6	4515	74%	1.6	4530	0%	76%	1.6
M42 J9	6299	129%	1.6	6448	2%	134%	1.6
M5 J4	5705	93%	0.6	5712	0%	93%	0.6
M5 J3	4059	110%	0.4	4080	1%	112%	0.4
M5 J2	5900	100%	0.9	5967	1%	100%	0.9
M5 J1	6446	105%	2.0	6537	1%	106%	2.1
M6 J4	3603	168%	0.7	3620	0%	169%	0.7
M6 J5	4310	95%	2.1	4264	-1%	103%	2.2
M6 J6	-	-	-	-	-	-	-
M6 J7	4856	109%	0.1	4844	0%	111%	0.1
M6 J8	-	-	-	-	-	-	-
M6 J9	5661	102%	1.0	5664	0%	102%	1.0
M6 J10	5620	112%	1.6	5644	0%	111%	1.6
A4148 northern ring road (Walsall)	1915	27%	0.4	1930	1%	27%	0.4
A461 Lichfield Road (Walsall)	1926	49%	0.4	1924	0%	49%	0.4

Note: Flow is in PCU of average hour for both AM and PM. The ‘In Flow’ for junctions is the flow of all arms going toward the junction. Delay is in minutes. Some minor roads are not included in the PRISM model such as Church Lane, Blindpit Lane, Dunton Lane etc, so no results could be presented for these links.