DRAFT

Internal TfL Technical Note

Initial Strategic Scenario Modelling to Inform the Work of the Roads Task Force

August 2013

TfL Planning

Initial Strategic Scenario Modelling to Inform the Work of the Roads Task Force

Draft version 8
12th August 2013

Contents

1. Introduction

The establishment of the Roads Task Force (RTF) was a Mayoral manifesto commitment. It was set up in 2012 by the Mayor to consider the challenges facing London's roads now and in the future. It is an independent group with a wide range of different interests and expertise. The RTF has worked closely with, and been supported by, a Transport for London (TfL) team. The TfL team has undertaken research, analysis and high level assessment of potential scenarios, as well as offering its perspective and experience.

This paper documents the strategic scenario modelling support provided to the RTF by the TfL team. Work undertaken at this stage is, necessarily, strategic and high level as it is aimed at further understanding the indicative scale of impact associated with different approaches to managing and developing London's roads. In response to the recommendations of the RTF a number of further strategic studies are proposed, which will examine some of the scenarios in more detail. See page 63 of TfL's response to the Roads Task Force[1] for details.

In section 2 we set out the approach applied to the modelling exercise, in section 3 we describe some of the high level outcomes and section 4 identifies how some key elements of the RTF vision relate to the modelling exercise. Section 5 provides a summary of this note and Annex 1 contains flow change plots for each of the strategic tests that were undertaken.

2. Approach

2.1. Joint TfL Planning and Surface Oversight

TfL's strategic modelling capability, including public transport and highway demand forecasting, mode choice and strategic highway and public transport assignment sits within the TfL Planning department. TfL's operational highway modelling capability, including corridor and junction specific models sits within TfL Surface Transport. The impact of the RTF tests was assessed primarily at the strategic level. However, the strategic modelling must be carried out in a manner that enables more detailed operational modelling to be carried out in the future. A joint TfL Planning and TfL Surface Transport strategic modelling working group (known from here on as the Working Group) led the strategic modelling to inform the RTF.

The Working Group provided regular briefings at RTF meetings on progress with, and outcomes of, the strategic modelling.

[1] www.tfl.gov.uk/roadstaskforce

2.2. RTF Road Typologies

The RTF meeting of November 21 2012 (meeting number 4) agreed upon a framework of road typologies as defined in Figure 1.

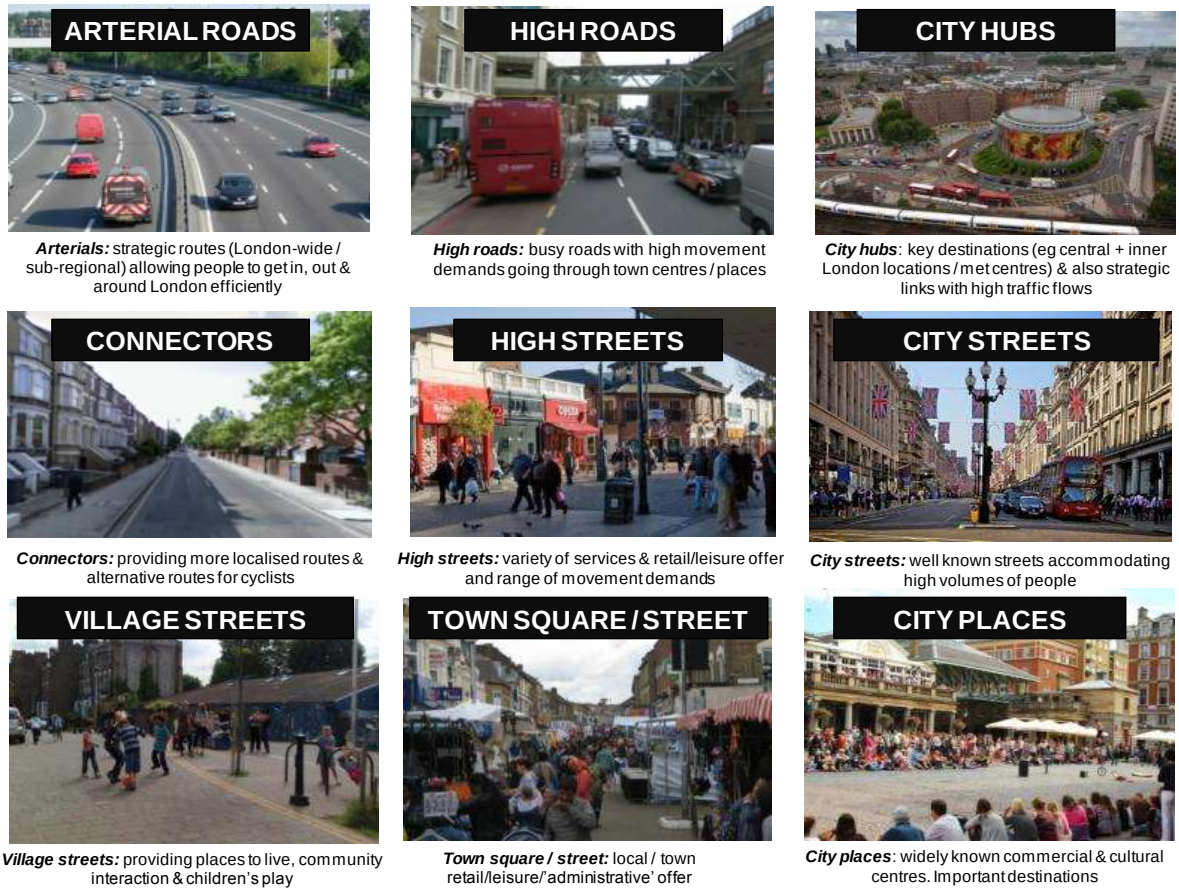


Figure 1: London road typologies

Each road network link in TfL's strategic transport demand model (LTS – London Transportation Study) was assigned a typology to enable the application of typology based policy scenarios. Criteria detailed in Figure 2 were applied to produce an initial representation of typologies in the LTS road network.

Locations as defined by the London Plan	London-Wide Corridors (inc. TLRN)	Strategic Road Network	Other Borough Priority Road Network (BPRN) and busy bus routes (>20 buses per hour)	All other roads in LTS
Central Activities Zone / World Heritage Sites	City Hub	City Street	City Street	Town Square / Street
Major / Metropolitan town centres	High Road	High Street	High Street	Town Square / Street
District town centres	High Road	High Street	High Street	Town Square / Street
Inner London	High Road	High Street	Connector	Connector
Outer London	Arterial	Arterial	Connector	Connector

Figure 2: Model typology definition criteria

The resulting typologies were reviewed by the working group and some alterations were made to address issues such as consistency along corridors, etc. In particular a number of City Hub locations were identified around the Inner Ring Road (IRR) and in Central London:

- Euston Road (IRR)
- Old Street Roundabout (IRR)
- Aldgate and Tower Bridge (IRR)
- Elephant and Castle (IRR)
- Vauxhall Cross (IRR)
- Victoria (IRR)
- Hyde Park Corner (IRR)
- London Bridge and Bishopsgate
- Waterloo, Waterloo Bridge and Westminster Bridge
- Parliament Square
- Victoria Embankment from Blackfriars Bridge to Vauxhall Bridge

Figure 3 and Figure 4 on the following pages illustrate the application of the typologies to the LTS road network that was used for the strategic modelling to inform the RTF. This is one example of how the typologies could be applied. TfL and the boroughs will work together to agree the classification of road typologies by the end of 2014, consistent with recommendation 6 of the RTF report.

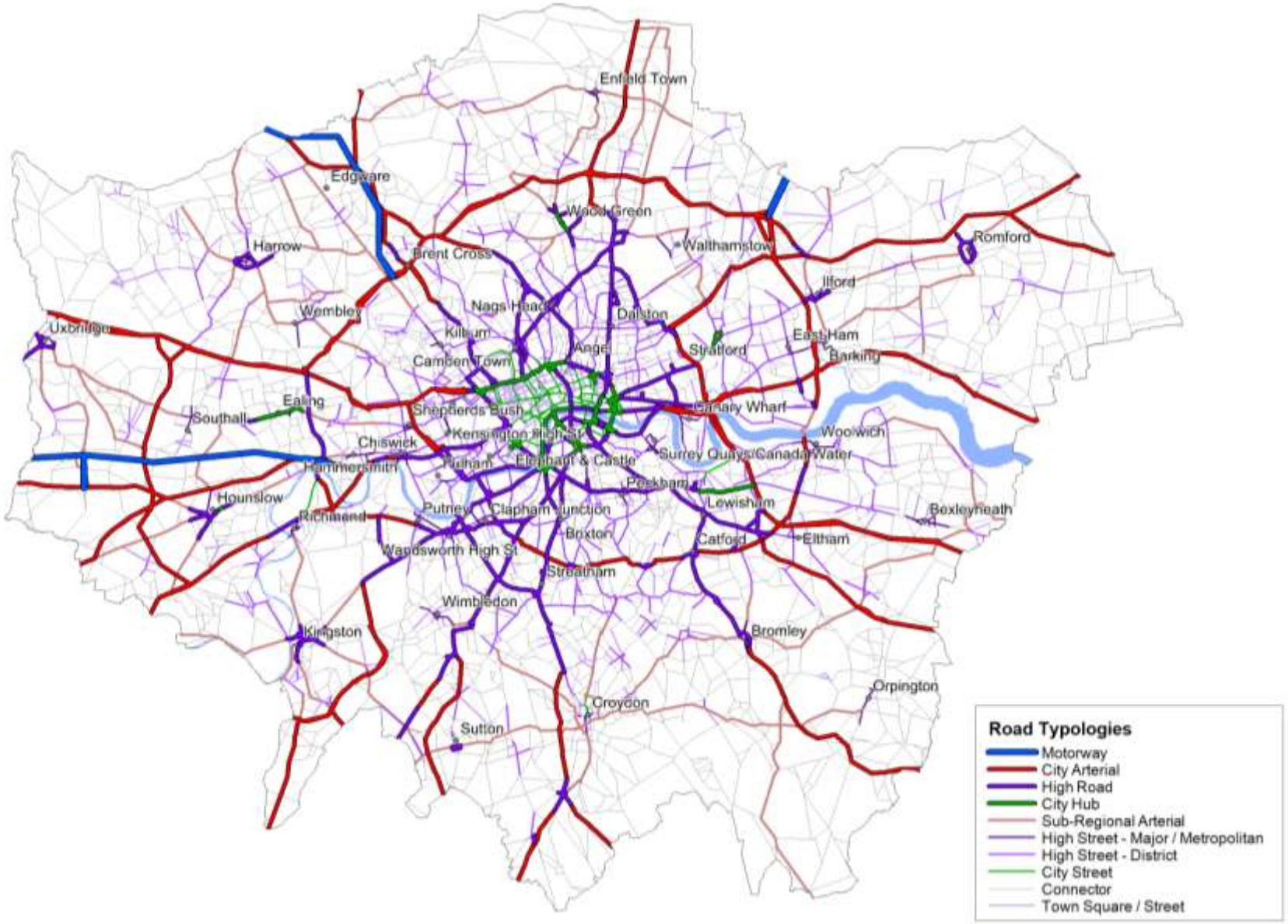


Figure 3: Illustrative London-Wide road typologies for modelling assessments

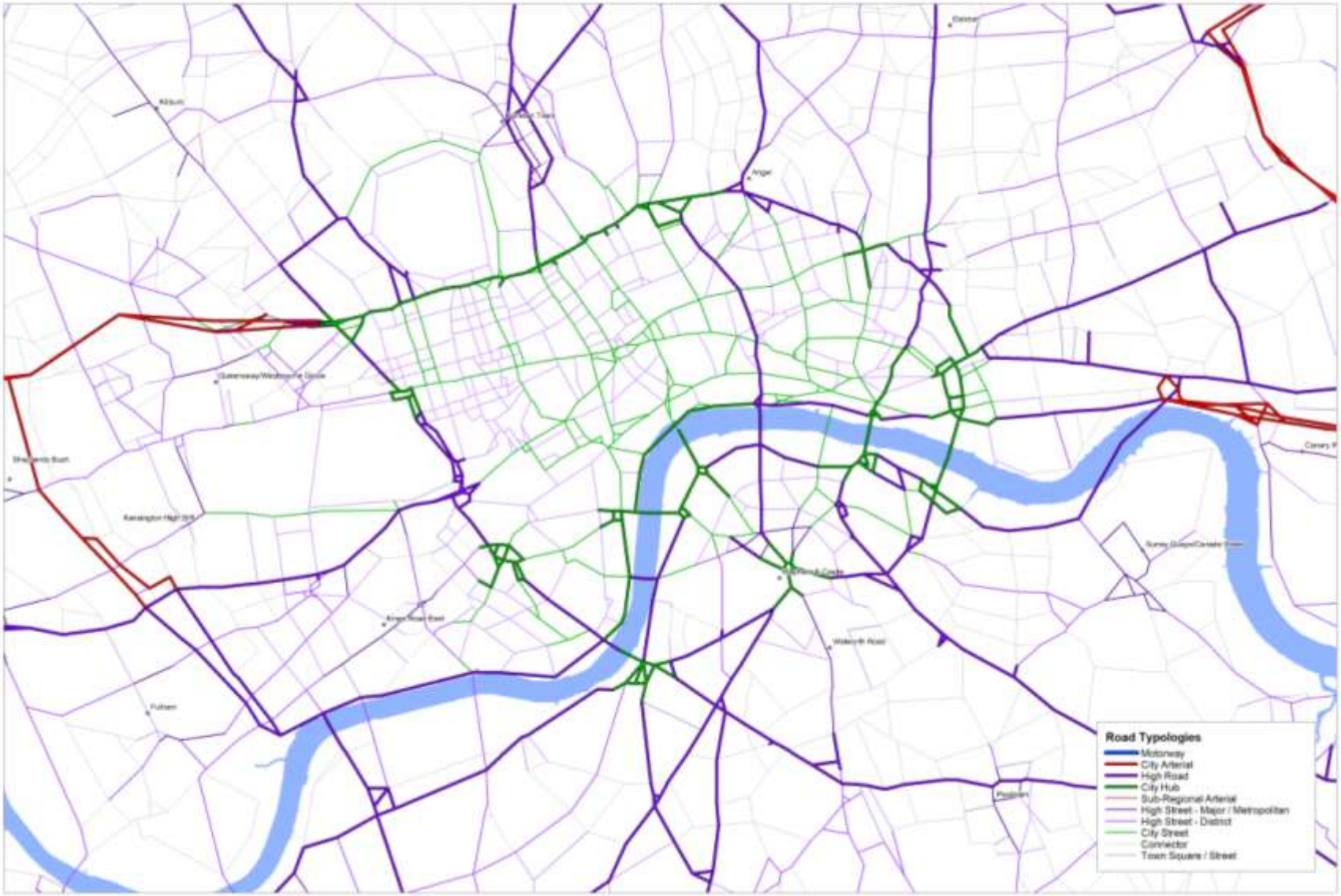


Figure 4: Illustrative central London road typologies for modelling assessments

2.3. Policy Scenarios

The RTF Meeting of 24 January 2013 (meeting number 5) confirmed seven policy scenarios to be assessed by the Working Group. The RTF identified six functions that the road network fulfils: Moving, Living, Functioning, Protecting, Unlocking and Sustaining. The policy scenarios are intended to primarily assess the balance that must be struck between the Moving and Living functions. Figure 5 provides an overview of the scenarios.

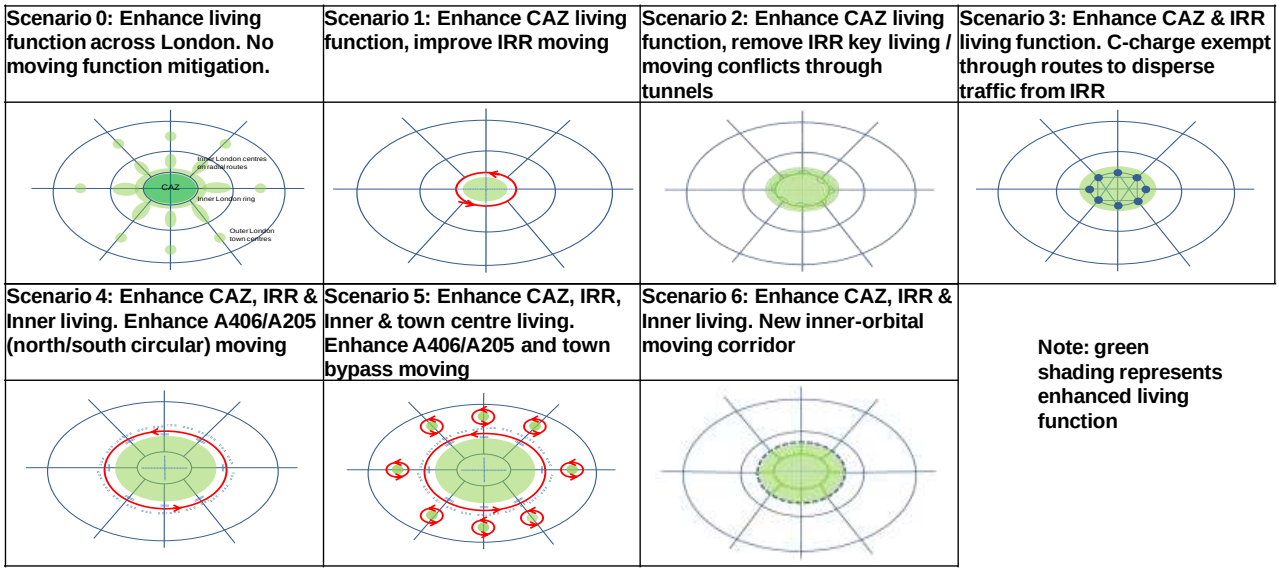


Figure 5: Overview of strategic policy scenarios

The Working Group agreed the specification of strategic modelling tests to reflect the scenarios outlined in Figure 5.

2.4. Test Specifications

The tests were carried out as changes from the LTS B6.2 2031 reference case (6231sen5). The tests assume the scale and distribution of population and employment growth as per the London Plan (published in 2011). The scale and distribution of employment and population is currently under review. Following publication of 2011 census results, revised GLA population and employment projections indicate that the scale of growth, and therefore overall travel demand, will be revised upwards.

The concept of 'enhanced living function' involves the reallocation of road space from private motorised vehicles to improve conditions for pedestrians, cyclists, public transport and enhance the public realm. Figure 6 identifies generic typology based changes to the road network that were agreed by the Working Group to represent the impact of road space reallocation. The changes are an estimate of the scale of intervention required to achieve the improved conditions for pedestrians, cyclists,

buses and the urban realm aspired to by the RTF. The changes were applied to the modelled road network on a typology basis in those areas of London identified in Figure 5 with an enhanced living function (the green shaded areas).

The typology based changes to the modelled road network comprised of two elements:

- Reductions in junction throughput capacity for private motorised vehicles
- 20 miles per hour speed limit

Figure 6: Generic changes in junction capacity and speed limits applied to areas of the road network with 'enhanced living' function

The generic model assumptions are subject to review and change as and when new evidence comes to light to better inform the scale of change required to meet the aspirations of the RTF.

Due to the strategic nature of the tests it was not possible to code specific bus priority measures that could be expected at individual locations. However, an integral element of the road space reallocation concept is allowance for additional bus priority. The working group agreed that bus operating speeds should be maintained as in 2031 with London Plan population and employment growth and committed transport investment (the 2031 reference case, i.e. 2031 without RTF related interventions) in all policy scenario tests. This assumption reflects that although buses may get delayed by additional congestion in some areas, in other locations they will be quicker due to improved bus priority. Therefore, the assumption of a net neutral impact on bus operating speeds appeared reasonable.

The modelling specification of indicative measures to mitigate the reallocation of road space was agreed by the working group. Figure 7 provides an overview of the scenario test specifications.

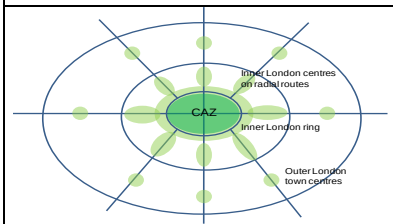
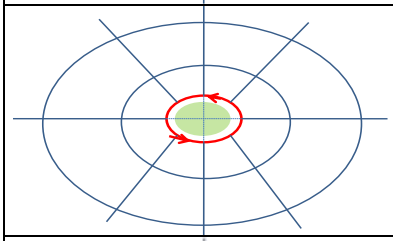
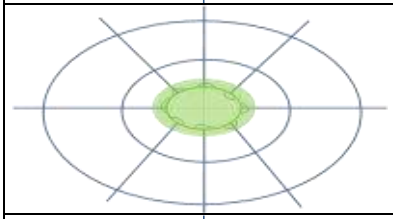
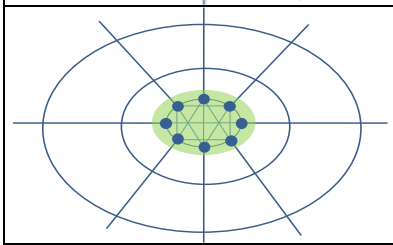
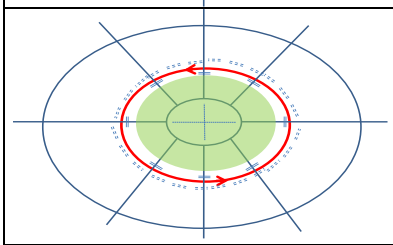
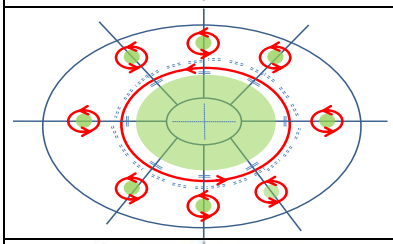
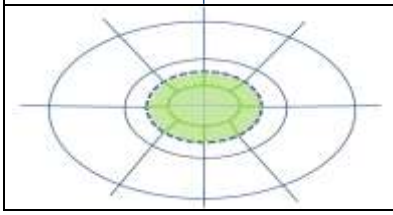
Scenario	Description	Mitigation Measures
	0) Road space reallocation across London. No moving mitigation	None
	1) Road space reallocation in CAZ, with exception of IRR	10% increase in throughput capacity for motorised vehicles at all junctions on the IRR
	2) Road space reallocation in CAZ, remove IRR key living / moving conflicts through tunnels	Tunnels under City Hub locations on the IRR. Other (non-tunnelled) sections of the IRR do not have road space reallocation. Instead, junction capacity is increased by 10%
	3) CAZ & IRR road space reallocation. C-Charge exempt through routes to disperse traffic from IRR	One north-south and one east-west route identified across the Congestion Charge area. These routes made exempt from C-Charge and 5% junction capacity increase applied.
	4) Enhance CAZ, IRR & Inner living. Enhance A406/A205 (north/south circular) moving	Test A) +10% traffic capacity at all not grade separated A205/A406 junctions Test B) Grade separate most of A205/A406 route (inc. new river crossings). 10% capacity increase at remaining not grade separated junctions
	5) CAZ, IRR, Inner & town centre road space reallocation. Enhance A406/ A205 and town bypass moving	As Scenario 4, with addition: Test A) +10 junction capacity on Met town centre bypass routes Test B) tunnels under Met town centres on key routes and +10% junction capacity on others
	6) New inner-orbital moving corridor. Road space reallocation within new orbital corridor	New strategic tunnelled orbital route between IRR and A205/A406 corridors with 10 junctions.

Figure 7: Overview of scenario specifications

2.5. Modelling Tools

The policy scenarios identified in Figure 5 are expected to result in changes in travel demand through mode shift and changes in choice of trip destination. This is in addition to re-routing and other highway assignment impacts. Generally, for strategic modelling, TfL Planning employs a hierarchical modelling approach using LTS to produce changes in travel demand and the Sub-Regional Highway Assignment Models and Railplan Public Transport assignment model for more accurate assignment impacts.

It was decided that where possible TfL would analyse the impacts of the scenarios in the hierarchical manner described above, using the Central London Highway Assignment Model (CLoHAM) alongside LTS to examine indicative traffic impacts. This approach was decided upon because it was clear from the test specifications that the largest impacts would be experienced in central London, due to the numerous locations of City Hub road typology in central London that experience a 30% reduction in capacity for general traffic.

As a result, LTS was supplemented by CLoHAM in the assessment of scenarios 1, 2 and 3. Scenarios that had impacts beyond the area modelled by CLoHAM were assessed using LTS alone.

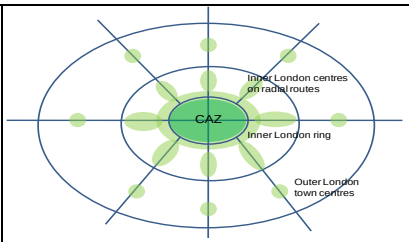
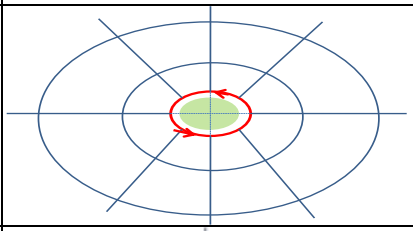
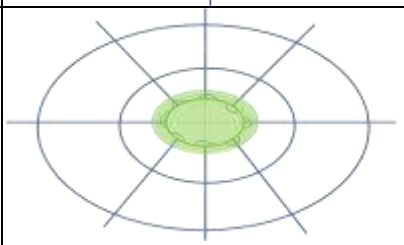
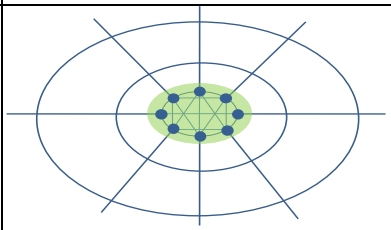
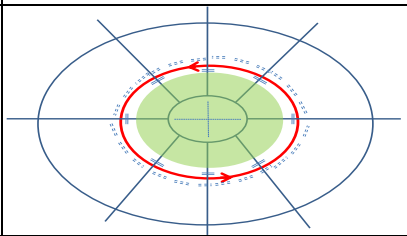
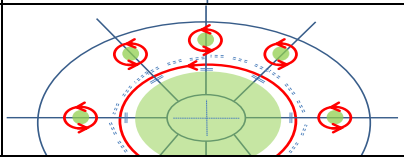
The RTF typologies were assigned to the entire model road network within the GLA in LTS and within the Central Activities Zone (CAZ) network in CLoHAM. In central London, therefore, LTS was used to determine road travel demand and CLoHAM was used to determine the assignment to the road network and consequent outcomes such as speed and congestion. In tests affecting a wider area, reported results are based on LTS only.

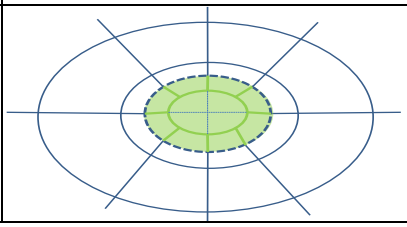
The central London outcomes of the LTS and CLoHAM assignments from the same scenario test were compared. This revealed some discrepancies that were investigated further. As a result, the manner in which 20mph speed limits are represented in LTS was altered to ensure a more accurate assignment impact. As a result of the changes the LTS and CLoHAM central London assignments were comparable.

3. Scenario Testing Outcomes

3.1. Traffic Speed and Vehicle Kilometres

Figure 8 provides an overview of the modelled change in average motorised traffic speeds and vehicle kilometres for each of the scenarios considered.

Scenario Test			Measure	Change by area of London – scenario tests compared to 2031 'reference case'		
				Central	Inner	Outer
0	Enhance living across London (as per specification in Figure 6). No moving mitigation.		Average traffic speed	-15%	-7%	-2%
			Vehicle Kilometres	-12%	-6%	-2%
1	Enhance living function (Figure 6 specification) in CAZ, with exception of IRR		Average traffic speed	-8%	0%	0%
			Vehicle Kilometres	-5%	0%	0%
2	Enhance CAZ living function, remove IRR key living / moving conflicts through tunnels		Average traffic speed	-6%	-1%	0%
			Vehicle Kilometres	-3%	0%	0%
3	Enhance CAZ & IRR living function. C-Charge exempt through routes to disperse traffic from IRR		Average traffic speed	-14%	-1%	0%
			Vehicle Kilometres	-9%	-1%	0%
4	Enhance CAZ, IRR & Inner living. Enhance A406/A205 (north/south circular) moving		Average traffic speed*	-14% to -13%	-7% to -5%	-1% to 0%
			Vehicle Kilometres *	-13% to -11%	-6% to -2%	-1% to +2%
5	Enhance CAZ, IRR, Inner & town centre living. Enhance		Average traffic speed*	-15% to -14%	-7% to -4%	-1% to +1%

Scenario Test			Measure	Change by area of London – scenario tests compared to 2031 'reference case'		
				Central	Inner	Outer
	A406/ A205 and town bypass moving		Vehicle Kilometres *	-13% to -12%	-5% to -2%	0% to +3%
6	Enhance CAZ, IRR & Inner living, new inner orbital moving corridor		Average traffic speed	-3%	+14%	+1%
			Vehicle Kilometres	-13%	+21%	+3%

* Note: Impact range determined by scale of additional capacity. See test specifications in Figure 7.

Figure 8: Modelled scenario impacts on average speed and vehicle kilometres

Plots of changes in AM 3 hour peak period traffic volumes associated with the scenarios detailed in Figure 8 are contained in Annex 1 of this document.

The outcomes from this programme of modelling are indicative and intended to provide the RTF with an overview of the comparative impact of alternative policy scenarios. Further work is required to determine the likely extent and location of road space reallocation, the specification of potential mitigation measures and assessment using more detailed road transport models.

Nonetheless, a number of conclusions can be drawn at this stage:

Central London

- The scale of impact in central London is far greater than other areas of London.
- The IRR has a significant impact on traffic in central London. If road space reallocation is only applied to the area within the IRR (the Congestion Charge area) the impact on average speed and vehicle kilometres is significantly less compared to also applying road space reallocation to the IRR. This demonstrates the need to explore options to mitigate the impacts of road space reallocation on IRR traffic conditions.
- The mitigation measures tested were not effective in maintaining central London traffic speeds at or above the reference case. Scenario 6, however, offered greater mitigation than other scenarios.

Inner Ring Road

- The Inner Ring Road is the corridor that experienced by far the greatest impact from proposed road space capacity reallocation in the tests. This is because around half of the IRR was assumed as City Hub typology (therefore experiencing the highest extent of road space reallocation) and because of

the extent of road space reallocation in central London, for which the IRR is the primary alternative route.

- The outcome of Scenario 2 suggests that the effectiveness of IRR tunnels would be constrained by the remaining non-tunnelled sections of the IRR. The specification of the IRR tunnels were two lanes in each direction - i.e. provided more capacity than that removed through application of the City Hub typology on the surface. Further analysis would be required to gain a better understanding of the complex issues associated with the IRR, including the balance to what extent capacity enhancements on the existing IRR corridor, or replacement capacity in other locations, is most effective in mitigating the impact of development proposals on or near the IRR corridor.
- Scenario 2 also highlighted the potential limited effectiveness of IRR tunnels due to the dispersed nature of origins and destinations of traffic at City Hubs on the IRR. For example a tunnel taking IRR traffic under Vauxhall gyratory may not remove a sufficient volume of traffic from the gyratory to enable road space reallocation to the extent envisaged by the RTF, due to the dispersed nature of traffic demand. Further work would be required to gain a better understanding of such issues.
- The outcome of Scenario 3 suggests that the concept of easing pressure on the IRR by introducing one north-south and one east-west congestion charge exempt route through central London is not effective. The congestion charge exempt routes are intended to provide alternative routes to the IRR. The lack of effectiveness is because it is not possible to identify a suitable through-route that is not severely constrained and because the locations where potential through routes meet or cross the IRR tend to be City Hubs, thus acting as a throttle on potential capacity.
- Analysis of Scenario 0 suggests that the time required to drive once around the entire IRR could increase by around 40% from today, without any mitigating measures.

Inner London

- The impact of unmitigated road space reallocation in inner London on average speeds and vehicle kilometres is around half that in central London.
- Scenario 6 has a transformative impact on average speeds in inner London, increasing them above 2031 reference case levels and even above 2007 base year levels. However, this statistic includes speeds on the new orbital route, which would considerably raise the average compared to the rest of the inner London road network.

Effectiveness of Orbital Capacity Compared to Radial Capacity

- Analysis of scenarios 4, 5, 6 indicates that additional orbital capacity (i.e. upgrade of north / south circular or a new orbital route) is more effective at reducing delay rates than equivalent capacity upgrades to radial routes (i.e. tunnelling under town centres, etc.)

- Results of strategic modelling of Scenario 6, a conceptual new Inner London orbital tunnel with around 10 access / egress junctions, suggests that the concept could have the potential to make a significant improvement to Inner and Central London congestion. Further investigation of the case for such a scheme is therefore recommended.

Outer London

- The scale of impact in outer London, at an aggregate level, is modest in all scenarios. Changes due to population and employment growth in the period to 2031 have a larger impact in outer London at an aggregate level than RTF proposed road space reallocation.
- However, this may mask some more significant RTF induced impacts in some town centres, for example Ealing and Wood Green where the main through-route for traffic is also the main shopping street.

3.2. Other impacts

Buses

Bus services could potentially experience a far larger impact from potential road space reallocation than general traffic. This is because the bus network is focussed on those locations (City Hubs and High Streets) where the greatest road space reallocation could be expected and therefore also the greatest reductions in average speed. Furthermore, bus routes are fixed and therefore can not use alternative routes to avoid these locations.

However, an integral element of the proposed road space reallocation is improved bus priority, thus mitigating the impact on buses of the reduction in capacity for general traffic. Available time and resource did not allow the model coding of specific enhanced bus priority measures and therefore the assumption was made that bus operating speeds will remain as in the 2031reference case. The 2031 reference case includes London Plan employment and population growth and committed transport investment. If bus operating speeds were not protected and no additional bus priority provided, analysis of Scenario 0 shows that the reduction in average bus speeds in central London could be greater than experienced by other traffic.

Walking and Cycling

Assumptions were used to reflect the impact of meeting current mayoral targets for walking and cycling.

Substantial improvements should become evident for pedestrians and cyclists over the period of implementation of the RTF recommendations.

Road Safety

The proposals of the RTF are expected to improve road safety due to a number of factors, for example:

- Reduced average speeds
- Reduced motorised traffic volumes
- Improved junction and road design
- Improved facilities for vulnerable road users such as pedestrians and cyclists

Analysis was undertaken to estimate the impact on road safety solely due to the reduction in average speed and traffic volumes resulting from Scenario 0. This analysis predicted a reduction of around 6% in the number of annual collisions in London. The road safety impact of other identified factors requires further assessment.

4. The RTF Vision

The scenario testing described in earlier sections of this document was considered by the RTF alongside a number of other sources of information, such as the series of technical notes and street family case studies. In the latter stages of the programme of RTF work the RTF vision for London's began to crystallise, formed in part by the following decisions:

- The RTF determined that the spatial coverage of measures to improve conditions for pedestrians, cyclists, buses and the public realm (or area of London in which road space reallocation will take place) will correspond to scenario 0, i.e. the largest spatial extent of road space reallocation considered in the strategic scenarios.
- The RTF determined that a significant increase in congestion from current levels is not acceptable. Therefore, effective mitigation measures will need to be implemented alongside the road space reallocation measures.

5. Summary

TfL provided support to the RTF in developing a number of areas of their work, one of which was strategic scenario testing. A TfL internal working group was established to oversee the strategic scenario testing and inform the RTF on progress and findings.

The RTF identified a number of indicative road classifications for the purposes of high level modelling, referred to as typologies. The road typologies were applied to the road network as represented in TfL's strategic transport models.

The RTF described the outcomes sought in terms of reallocating road space to improve conditions for pedestrians, cyclists, buses and the urban realm. The RTF also determined a number of different spatial scenarios, determining the extent of coverage of road space reallocation across London. The scenarios also included a variety of mitigation measures to reduce the potential impact of road space reallocation on congestion.

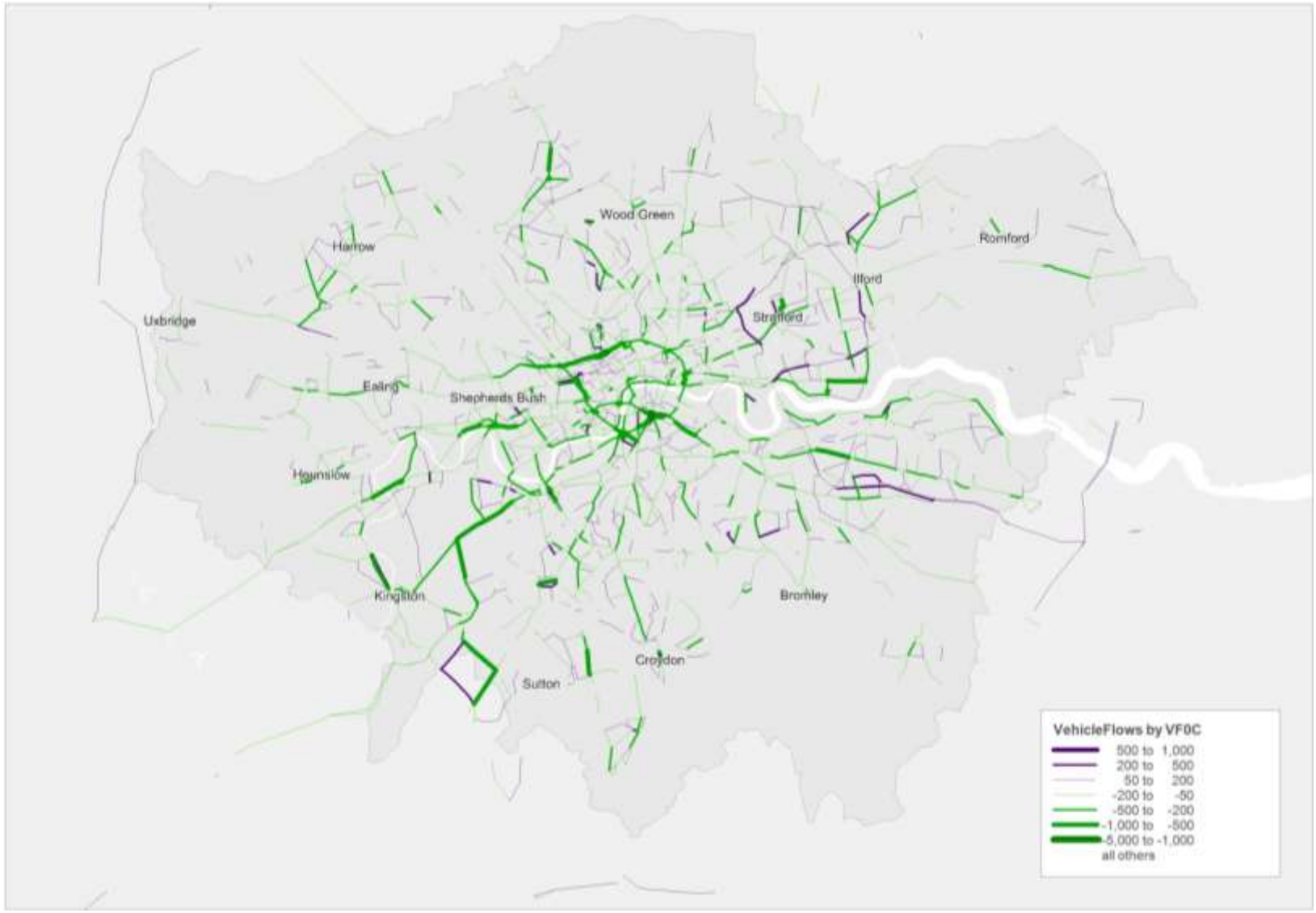
The working group agreed the specification of tests to represent the scenarios put forward by the RTF. Generic road typology based changes were identified to represent road space reallocation measures. These were applied to the appropriate spatial area of modelled road network, based on the scenario specification.

The outcomes of the indicative strategic modelling identified that central London, and the Inner Ring Road in particular, are expected to experience the largest change as a result of the RTF vision and recommendations. Congestion would increase significantly in these areas without mitigation measures. The indicative impact of the RTF vision at an aggregate level in Outer London is relatively small. Population and employment growth in the period to 2031 is anticipated to have a larger impact on traffic conditions in outer London than implementation of the RTF vision.

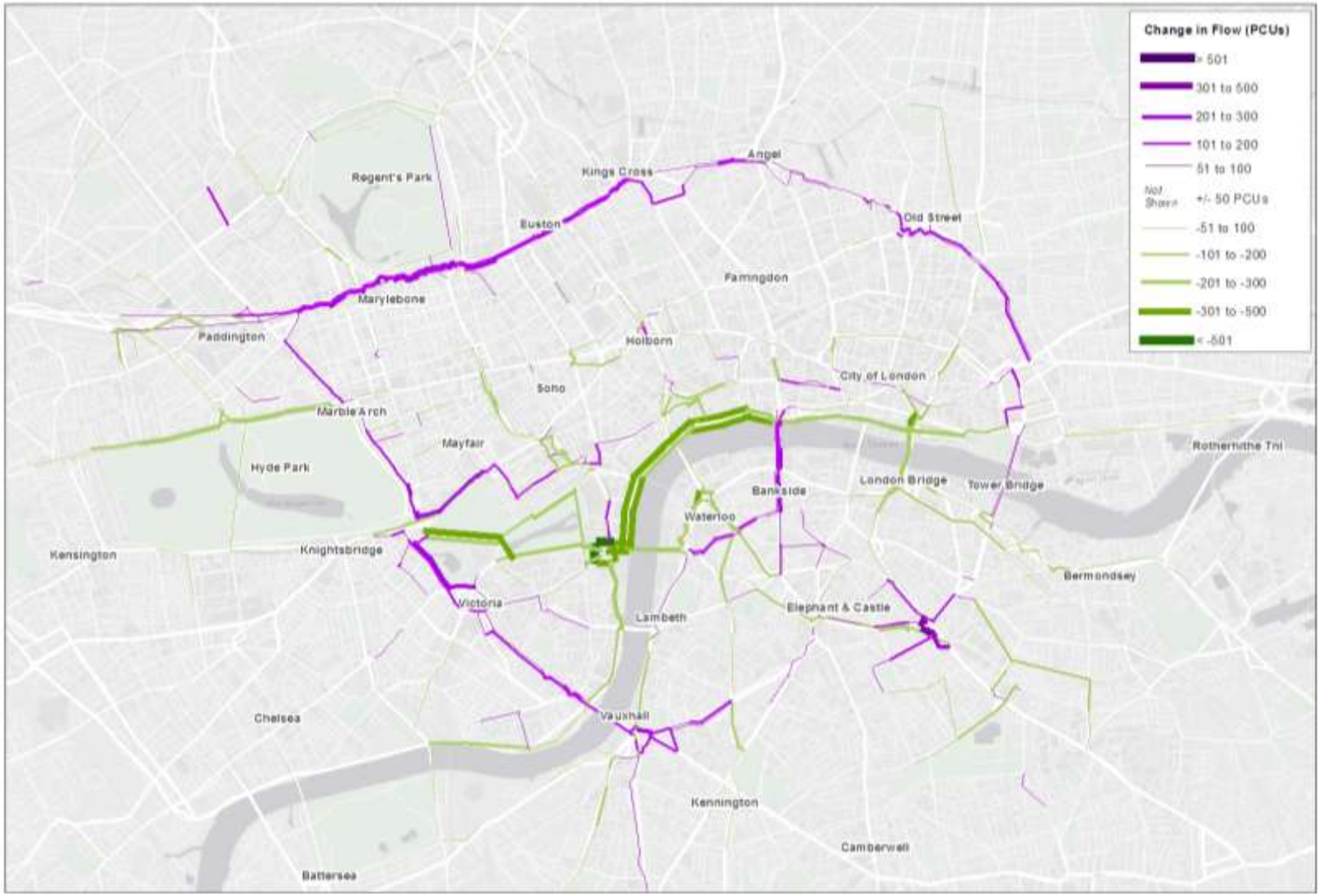
Further work is required to gain a better understanding of both the traffic impacts associated with the implementation of the RTF's proposed road space reallocation, as well as the effectiveness of potential congestion mitigation measures. As a result of the RTF recommendations, TfL have committed to undertaking a number of studies in order to inform future decision making on the implementation of the RTF vision.

Annex 1: Traffic volume change plots

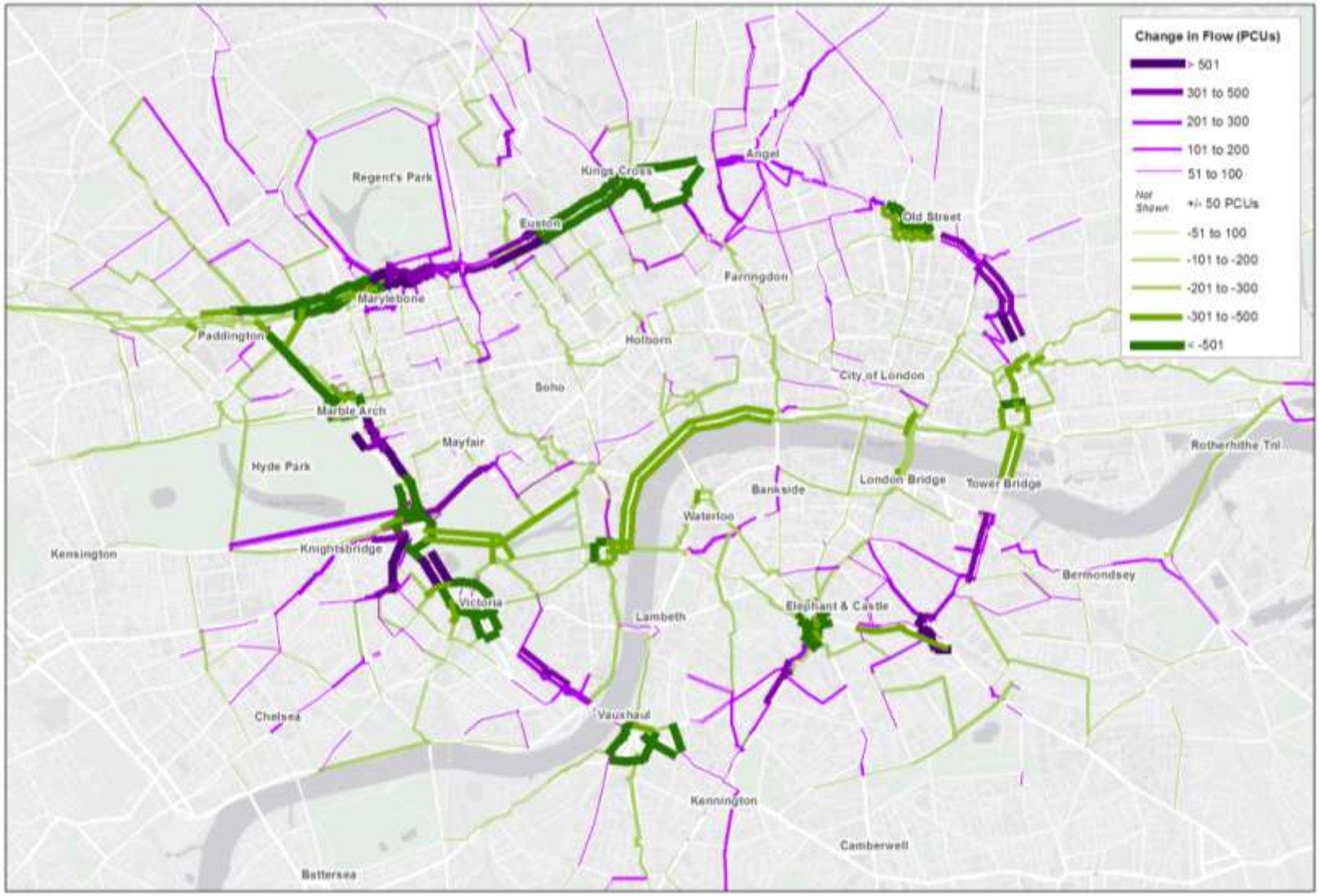
Scenario 0: Indicative AM 3-hour peak period change in traffic volumes (Passenger Car Unit – PCU)



Scenario 1: Indicative AM 3-hour peak period change in traffic volumes (PCU)

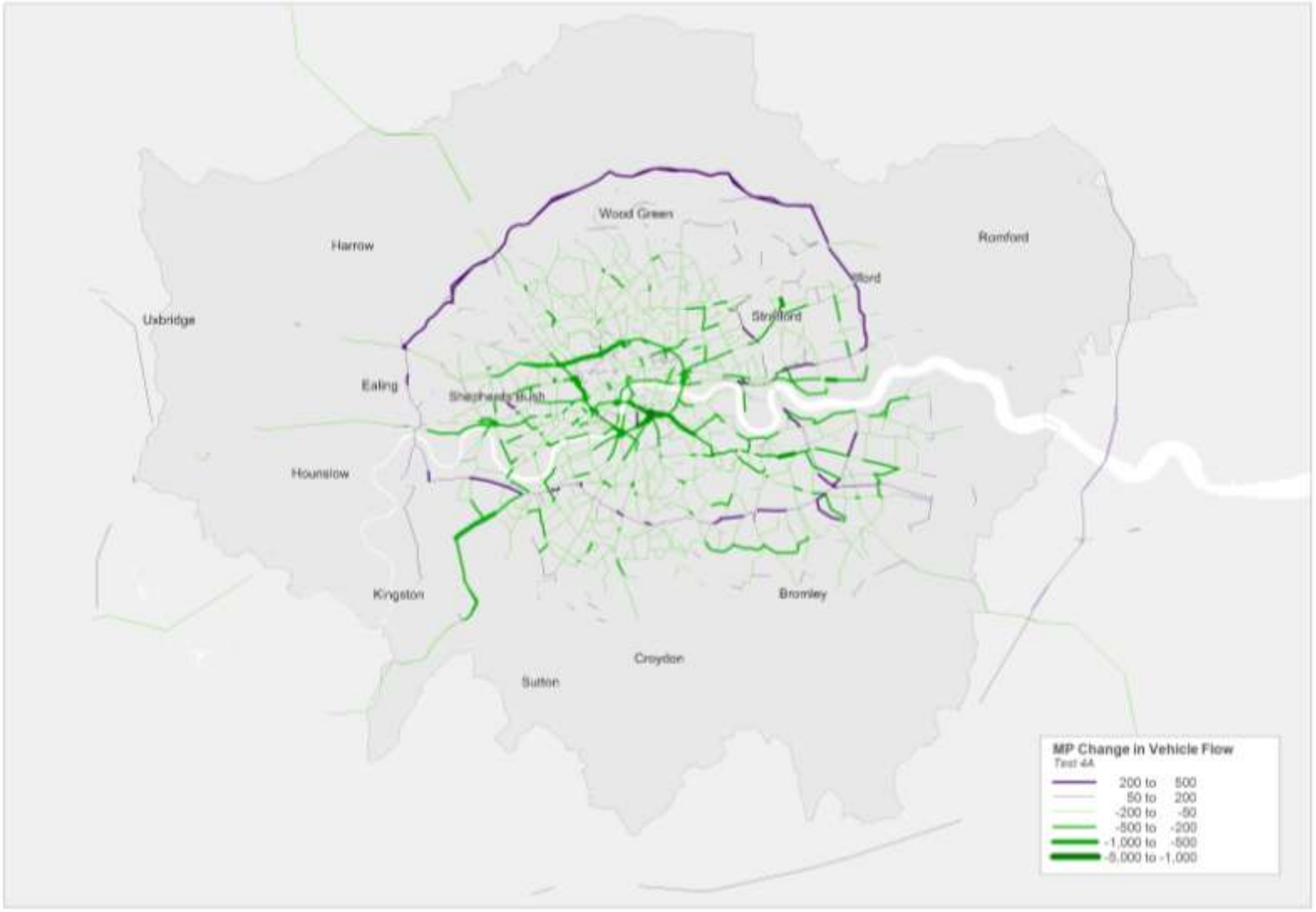


Scenario 2: Indicative AM 3-hour peak period change in traffic volumes (PCU – surface road network, i.e. not showing IRR tunnels)

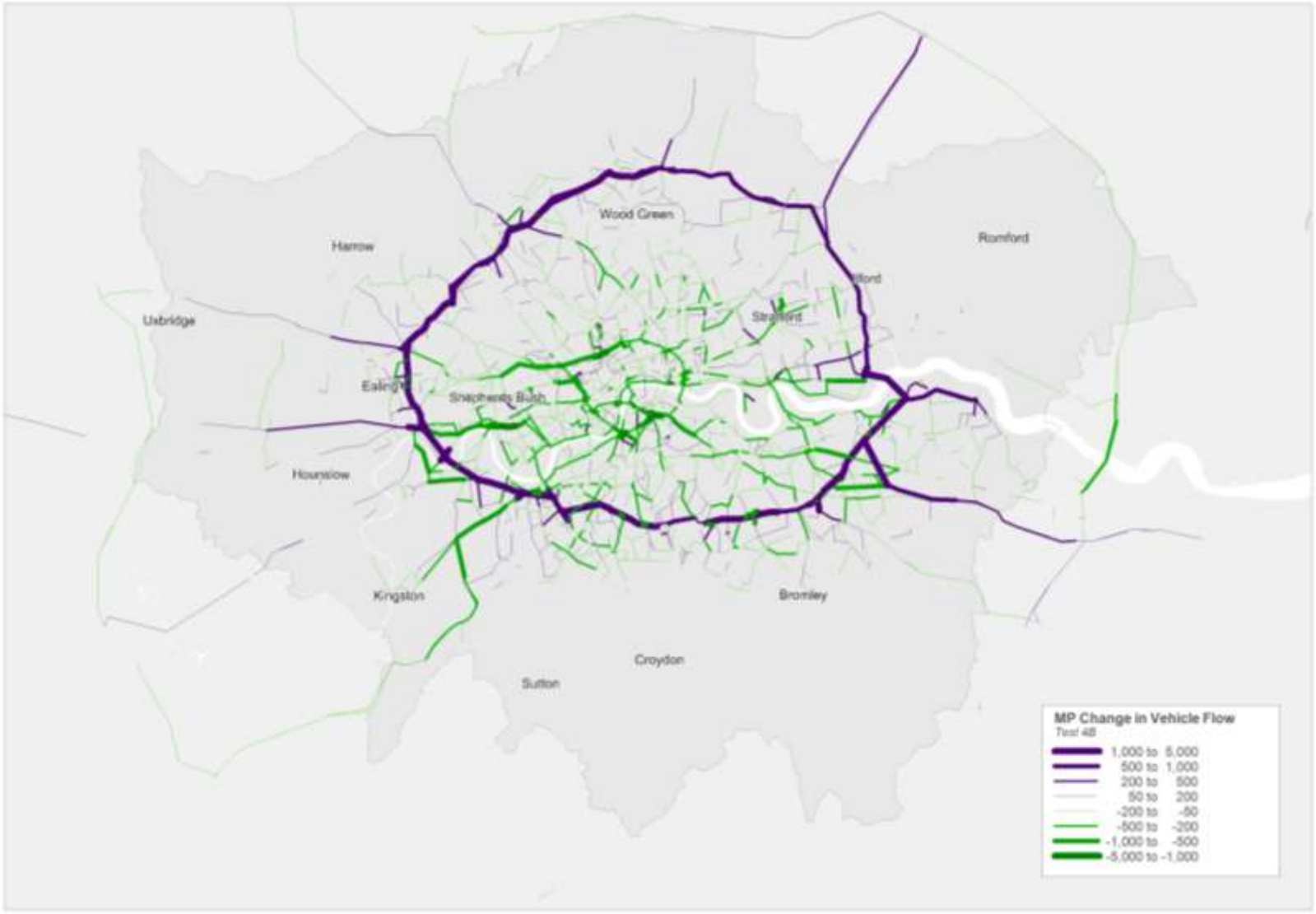


Scenario 3: Indicative AM 3-hour peak period change in traffic volumes (PCU)

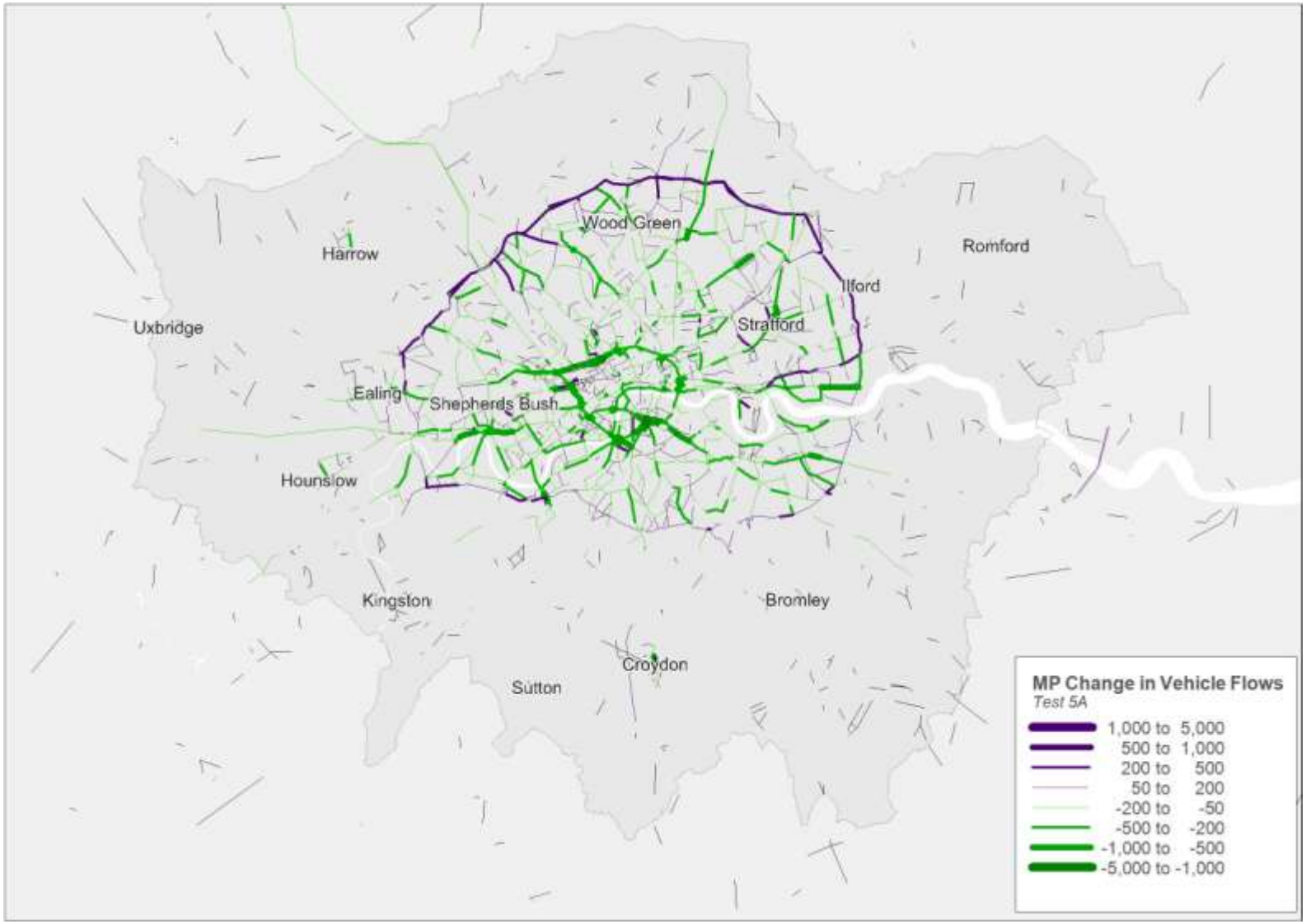
Scenario 4A: Indicative AM 3-hour peak period change in traffic volumes (PCU)



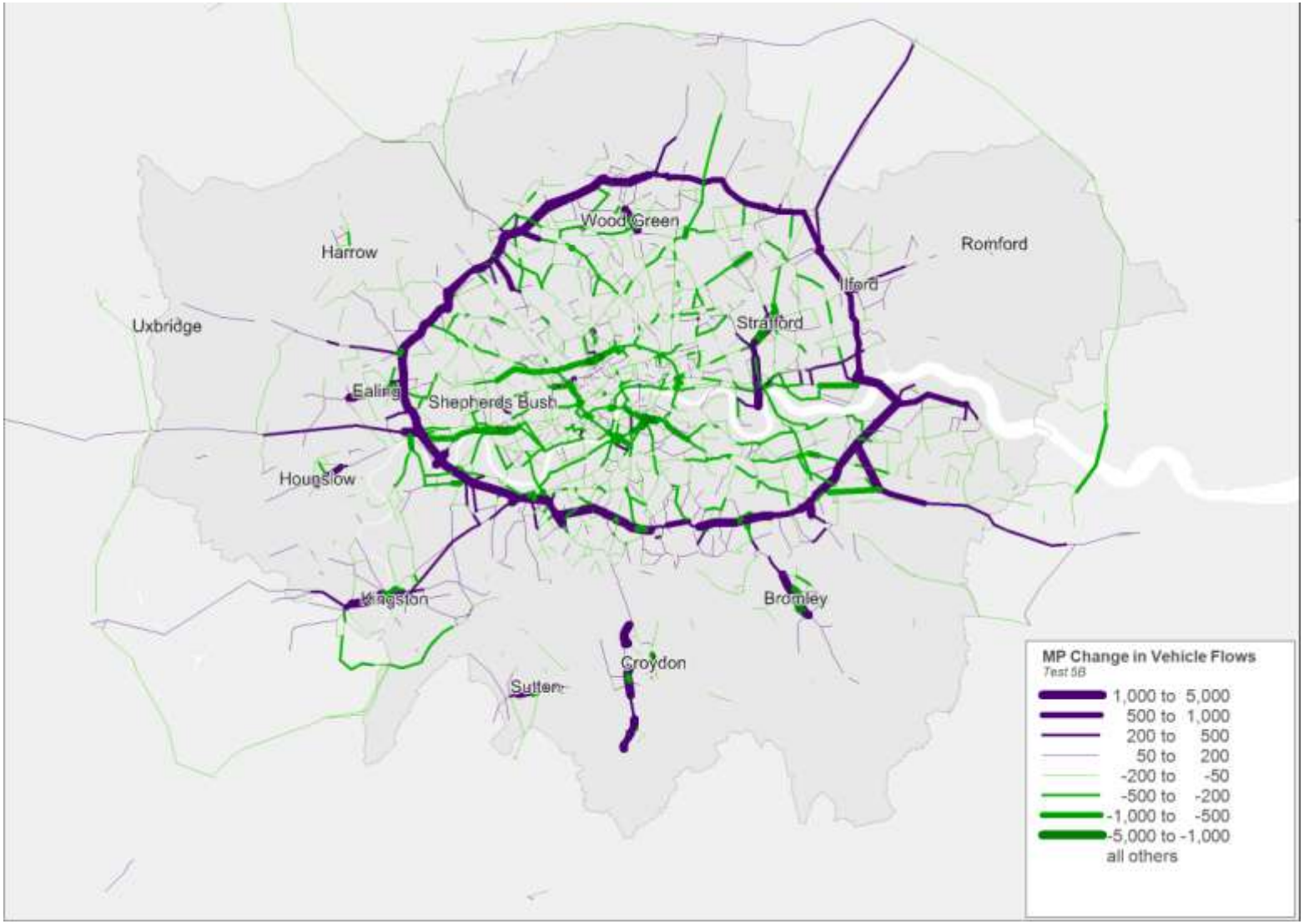
Scenario 4B: Indicative AM 3-hour peak period change in traffic volumes (PCU)



Scenario 5A: Indicative AM 3-hour peak period change in traffic volumes (PCU)



Scenario 5B: Indicative AM 3-hour peak period change in traffic volumes (PCU)



Scenario 6: Indicative AM 3-hour peak period change in traffic volumes (PCU)