

Colchester Local Plan Review: Further Transport Evidence

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Further Transport Evidence

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Abbreviations and acronyms

Term	Description
BaU	Business as usual
BRT	Bus rapid transit
BSIP	Bus Service Improvement Plan
CCC	Colchester City Council
CTM	Colchester Transport Model
DfT	Department for Transport
DPD	Development Plan Document
DRT	Demand responsive transport
ECC	Essex County Council
FTS	Future Transport Strategy
HGV	Heavy goods vehicle
IADP	Infrastructure Audit and Delivery Plan
LCWIP	Local Cycling and Walking Infrastructure Plan
LGV	Light goods vehicle
LTP4	Local Transport Plan
NEMo	North Essex Model
NH	National Highways
NPPF	National Planning Policy Framework
NTEM	National Trip End Model
NTS	National Travel Survey
P&C	Park and choose
P&R	Park and ride
RTI	Real time information
RTS	Rapid transit system
SRN	Strategic Road Network
ST	Sustainable transport
TAG	Transport Analysis Guidance
TCBGC	Tendring Colchester Borders Garden Community

Term	Description
TEMPro	Trip End Model Programme
TfGM	Transport for Greater Manchester
TfL	Transport for London
VDM	Variable demand model
WYCA	West Yorkshire Combined Authority

Executive summary

This report sets out evidence on the transport impact of preferred site allocations for homes and employment in the Colchester council area being considered for the Regulation 18 Preferred Options Local Plan and a vision-based approach to mitigation. The report expands on an initial transport evidence study published in February 2025 by:

- exploring the implication of not delivering major road infrastructure including A12 widening and the A1331 Link Road and whether the transport impact can be acceptably managed
- researching the likelihood and the extent to which sustainable travel measures can indirectly contribute to the mitigation of the highway impacts of growth through reducing car mode share
- detailing the package of highway and sustainable travel measures that will be required to manage the transport impact of growth

The assessment and identification of mitigation measures has been grounded in the vision-based approach recommended in the National Planning Policy Framework (NPPF). The vision reflects Colchester City Council (CCC) and Essex County Council (ECC) policies which aims to widen viable sustainable transport (ST) choices whilst keeping all people and goods moving safely on the county and National Highways (NH) road networks. In the report it has been assumed that the A12 widening scheme between Junctions 19-25 (J19-25) has been cancelled and will not come forward before 2041. Nevertheless, transport model runs including A12 widening have been carried out to establish how the cancellation impacts the management of traffic growth.

Growth that has been assessed is in addition to reference case growth, which includes Tendring Colchester Borders Garden Community (TCBGC). The formulation of the reference case has adhered to Department for Transport (DfT) guidance [18, p48] to identify those developments in the Colchester council area that are near certain or more than likely to come forward; and assumes substantial growth in adjacent districts. Overall, the growth required up to 2041 in the Colchester council area is for approximately 21,000 new homes and 21,000 new jobs, of which preferred site allocations provide for approximately 11,000 more homes and 11,000 more jobs. The transport assessment process involved the following steps to expand the evidence base.

1. Transport modelling commenced by establishing an acceptable 2041 baseline scenario. Since the level of reference case demand led to significant traffic problems on the highway network at Greenstead and A12 Junction 29 (J29), it was necessary to identify and test possible solutions at these locations.
2. Then traffic growth from preferred site allocations was added to the acceptable baseline scenario. This scenario, represents a 2041 future in which the amount of car trips at preferred allocations are at business as usual (BaU) levels and in which there is no additional mitigation. This scenario informed how the transport impact of growth could be managed.
3. Next a package of sustainable transport measures was identified and evidence collated on its impact – measures include park and choose (P&C) West, rapid transit system (RTS) extensions, Bus Service Improvement Plan (BSIP) bus improvements and Local Cycling and Walking Infrastructure Plan (LCWIP) expansion. Only those car trips in the transport model considered viable to switch

to sustainable travel were allowed to do so. This was achieved by constraining switching of trips in the model by geography and distance. Transport model tests reflecting a modal shift to ST found movement improved in futures with and without the link road, but there were still areas of caution requiring additional highways mitigation.

4. Then highway and traffic management measures that would be required in addition to ST measures were identified. These measures include capacity changes at A12 J25, introduction of signals and co-ordination of those signals to balance better traffic through A12 J25, J26, J27, and J28, Urbis Romanae, Mill Road and Colne Bank, and Ipswich and Harwich Road roundabouts with St Andrews Avenue. The combination of highway and ST improvements were tested in futures with and without link road completion and found to comprise an effective strategy to manage the transport impacts of growth.

A comparison of models with and without the J19-25 A12 widening scheme has identified the need for a highway and traffic management scheme at J25. This scheme is intended to mitigate the impact of preferred site allocations without requiring main-line widening of the A12 between Junctions 19 and 25. The concept for J25 focuses on increasing capacity on the A120 approaches and introducing traffic signals to better balance movements between the A12 and A120, particularly on the station-side (north-bound off-slip roundabout). Early assessments suggest that this may also involve re-configuring the existing roundabout to enhance capacity and performance. Options under consideration include converting the roundabout into a large, signalised cross-roads junction or retaining the roundabout with a revised layout. This would be delivered alongside a package of sustainable transport mitigation measures, including improved pedestrian and cycle crossings over the A12, a proposed new park and ride (P&R) facility, mobility hubs, and integration with an extension of the RTS.

It should be noted that including J25 improvements does not replace need for wider investment in the strategic road network:

- A12 widening is still advocated to contribute to regional growth and economic development, and would likely be essential for growth in the Colchester council area beyond 2041
- investment in the Strategic Road Network (SRN) will be expected to be required to support growth between Chelmsford and the A120 required by other districts for their local plan revisions and achieving growth targets
- SRN infrastructure investment, which is considered essential to support ongoing growth and productivity across Essex

The report also identifies the importance of completing the A1331 link road and why it is considered a committed scheme required to accompany TCBGC in line with the Development Plan Document (DPD) which states that "before any planning approval is granted for development forming part of the Garden Community the full delivery of the A120-A133 link road must have secured planning consent and a commitment to full funding must be demonstrated." [9, p.106]

In reaching a conclusion on the acceptability of proceeding with preferred site allocation from the perspective of transport, the assessment has balanced the potential contribution to sustainable transport, the need to keep people and goods moving by

all modes, and safety considerations. In addition, the proportionality and deliverability of the mitigation strategy has been taken into consideration – with an assessment of costs and affordability reported in parallel local plan evidence base Infrastructure Audit and Delivery Plan (IADP) and viability reports.

The transport evidence study concludes that there is reasonable evidence that the scale of transport impacts arising from preferred site allocations can be managed through the vision-based strategy of sustainable and integrated transport mitigations. The transport impacts of growth up to 2041 can also be managed in the Colchester council area without the A12 widening scheme as long a mitigation scheme at A12 J25 is included.

As the plan proceeds it will be expected that further details are developed on vision-led mitigation measures needed to manage the transport impacts arising from both reference case growth and preferred site allocations, which would include:

- solutions at Greenstead and J29 A12, which could be based on the concepts introduced in this report
- integrated land use and transport planning of new developments to reduce car dependency
- significant expansion of the LCWIP network across the urban area
- extension of RTS from the city centre to Marks Tey
- general bus quality improvements, including a new bus station, aligned with BSIP
- mobility hubs
- travel planning at developments to incentivise and manage and monitor progress towards mode share targets
- A12 J25 improvements to partially offset the cancellation of the A12 J19-25 widening scheme
- wider highway and dynamic traffic management investment

1 Introduction and approach

1.1 Problems and challenges

In order to align with government targets, the growth required up to 2041 in the Colchester council area is for approximately 21,000 new homes alongside proportionate employment growth, estimated at one job per new home. To meet this target Colchester City Council (CCC) has identified preferred sites to accommodate approximately 11,000 new homes and 11,000 new jobs in its Regulation 18 Preferred Options Local Plan. The difference between the requisite target and preferred site allocations is to be met from existing commitments for housing and employment developments and an assumption of a dispersed windfall of small sites whose locations are not yet known.

This level of growth could severely impact the Strategic Road Network (SRN) managed by National Highways (NH); the county road network managed by Essex County Council (ECC); and the bus and rail networks. In a business as usual (BaU) scenario in which car trip rates are similar to now, it is estimated that the preferred allocations could add approximately 6,000 car trips to the network in the council area in each AM and PM peak hour.

Accordingly, this study explores how transport impacts of the preferred site allocations could be mitigated by packages of sustainable travel and highway measures alongside changes in travel behaviour. The mitigated impact is considered with and without A1331 link road completion to explore a situation in which completion, which is required to support Tendring Colchester Borders Garden Community (TCBGC) growth, is delayed.

It has been assumed that neither the J19-25 A12 (Chelmsford to A120) widening scheme nor the proposed A120 Braintree to A12 scheme come forward by 2041 over the life of the new plan, which is a factor influencing the size of housing allocations around Marks Tey. Nevertheless the report does consider the transport implications of the recent cancellation of the A12 widening scheme on growth.

In developing packages of mitigation measures, consideration has been given to deliverability and affordability, which informs CCC's parallel Local Plan Review workstreams on the Infrastructure Audit and Delivery Plan (IADP) and viability.

1.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) [37] mandates how transport issues arising from growth should be approached and assessed.

The NPPF has a presumption in favour of sustainable growth which is summarised as meeting the "needs of the present without compromising the ability of future generations to meet their own needs" (para.7). To guide sustainable development it also introduces three interdependent overarching economic, social and environmental objectives (para.8).

It states that strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses unless the "adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole" (para.11), which can be interpreted as working against the overarching objectives, assuming a consistency between policies and objectives.

The NPPF explains that "transport issues should be considered from the earliest stages of plan-making and development proposals, using a vision-led approach to identify transport solutions that deliver well-designed, sustainable and popular places" (para. 109). Furthermore, it states that "development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network, following mitigation, would be severe, taking into account all reasonable future scenarios" (para.116).

Connecting NPPF paragraphs (8), (11) and (116), above, implies that severe impact should be defined with respect to demonstrable impact on the overarching objectives. It would be expected that growth leads to increases in delay on the highway network; but a mitigation approach should be guided by desired policy outcomes not the alleviation of delay *per se*.

In a growing city area such as Colchester, the intention of the NPPF is especially pertinent. Transport issues of growth cannot be mitigated through highway capacity improvements alone, which would work against environmental and social objectives; rather growth should be approached as an enabler of more sustainable modes of travel and better integration between land uses and the transport system, which balances progress across all the overarching objectives.

1.3 Approach to transport evidence

A report entitled Colchester Local Plan Review: Transport Evidence published in February 2025 [21] established the traffic impact of the preferred site allocations in a scenario with J19-25 A12 widening and with completion of the A1331 link road. The report identified a significant reduction in car trips or a significant increase in highway capacity would be required to alleviate transport issues arising from growth at preferred site allocations. This work also considered the quantum of housing able to be allocated around Marks Tey without the proposed A120 Braintree to A12 scheme.

In line with the NPPF approach and CCC and ECC's existing and emerging plans, including the adopted Colchester Local Plan 2017-2033 [8], the Colchester Future Transport Strategy [20] and the draft Essex Local Transport Plan (LTP4) – which has now been published as a consultation document A Better Connected Essex [19] – the report made a case that the transport impact could be mitigated through packages of sustainable travel measures with limited highway capacity increases. Through this approach a reduction in BaU car trips at preferred site allocations could be expected but it would also provide viable alternatives to car travel for existing trip makers.

This report, subtitled Further Transport Evidence, expands the transport evidence base by:

- removing J19-25 A12 widening since the scheme was cancelled in July 2025
- providing more details on the vision-based mitigation approach and the reasons and evidence to justify it is apposite and credible
- demonstrating that the highway network can operate acceptably with a vision-based approach to mitigation
- exploring the consequences delayed completion of the A1331 link road and cancellation of J19-25 A12 widening

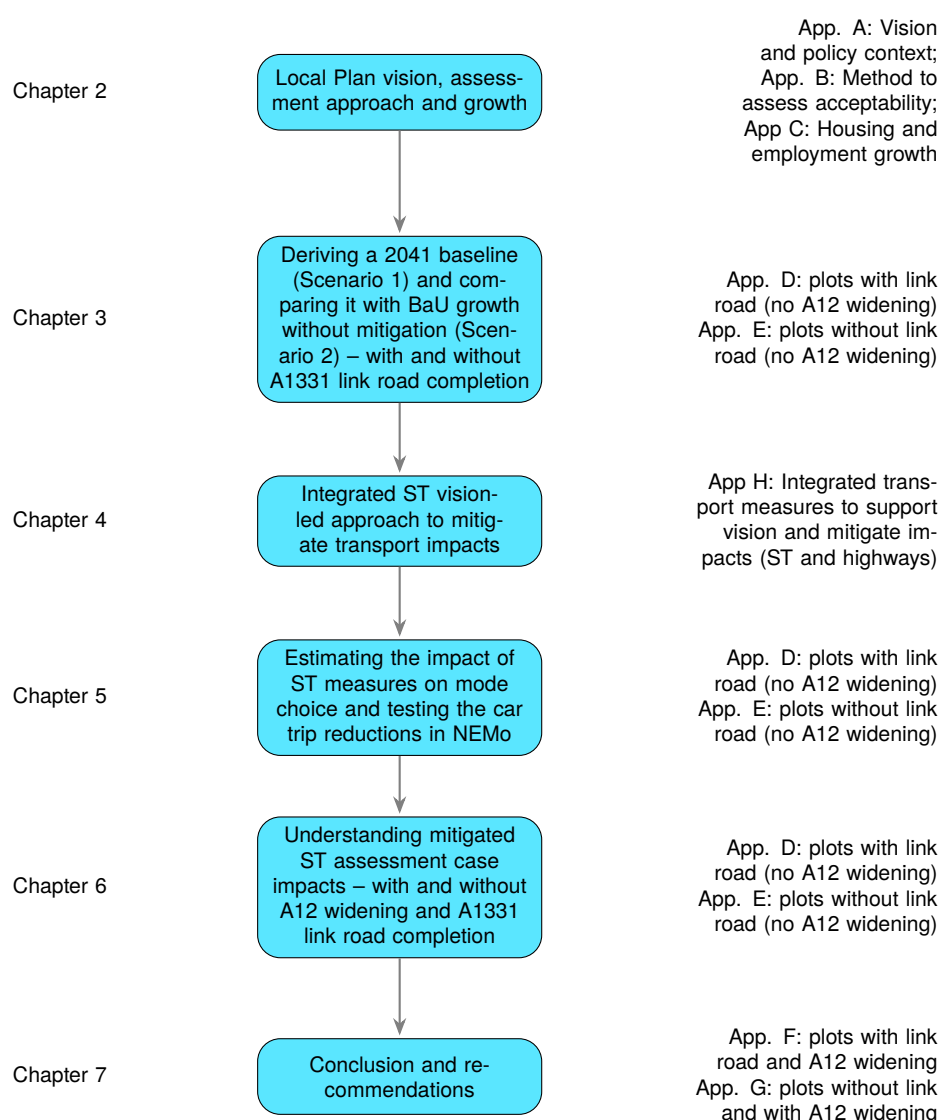


Figure 1.1: Overview of approach to further transport evidence

Figure 1.1 sets out the process that has been followed to develop the further transport evidence. To the sides of the diagram are chapter and appendix references to help the reader navigate to relevant sections of interest in the report. As far as possible, technical explanations and analysis have been placed in appendices rather than the main body of the report.

2 Colchester Local Plan

2.1 Vision and approach

2.1.1 Purpose of a vision-led approach

It is generally accepted that transport is an enabler and a means to an end as opposed to being a goal itself; notwithstanding the desirability of journeys to be pleasurable and a subset of leisure trips. Accordingly, the vision for transport is grounded in enabling the prosperity and health of Colchester's communities, and protecting and enhancing the environment and social fabric for future generations.

"Colchester will be an active and welcoming town [sic] with its rich and prestigious heritage treasured and showcased for all to enjoy. Colchester will be acclaimed for the creative, innovative and sustainable ways in which it addresses the wide range of challenges facing the Borough [sic], including climate change; population growth and its changing composition; new life-style and technological innovations; creating and maintaining strong safe, healthy communities; and shifting market forces." [8, p.9]

This approach to setting the transport vision is consistent with the NPPF intent as introduced in Section 1.2, which describes the vision-led approach to transport planning as "based on setting outcomes for a development based on achieving well-designed, sustainable and popular places, and providing the transport solutions to deliver those outcomes as opposed to predicting future demand to provide capacity (often referred to as 'predict and provide')" [37, p.80]

2.1.2 Sustainable transport vision

Appendix A provides an overview of national, regional and local policies which coalesce around the vision and objectives for integrated sustainable transport opportunities. It is generally accepted that appropriate investment in sustainable transport is good for the environment and health; protects and enhances the attractiveness of business areas and communities; and provides inclusive and affordable connections between places. As well as helping the movement of people and goods, sustainable transport also facilitates growth and enhances productivity.

The sustainable transport vision runs through the choice of site allocations to the choices for mitigation measures – as illustrated by the LTP4 draft policies described in Appendix Section A.6 and the LTP4 consultation document A Better Connected Essex [19]:

- helping people move around developments sustainably
- linking new developments to existing public transport lines
- enhancing public transport options (rail, bus and bus rapid transit (BRT))
- enhancing networks of cycling and walking routes

The sustainable transport vision aims to provide viable sustainable transport alternatives that are fast, convenient and affordable in comparison to private car travel. Enhanced sustainable transport is not intended to replace car travel but co-ordinate and integrate with it. This can be supported by interventions such as:

- park and ride (P&R)
- dynamic traffic management utilising latest technologies to manage limited road

space amongst alternative modes

Implicit in the vision for widening integrated sustainable transport opportunities, therefore, is the aim to keep people and goods moving – ensuring that the movement needs of those for whom sustainable transport options are not available are also met.

Further chapters in the report explore how the vision for integrated sustainable transport can be achieved, with evidence that will support the desired outcomes for Colchester and help achieve sustainable growth.

2.2 Assessment framework for transport issues

While Section 2.1 identified the vision for the council area, this section introduces the broad, iterative approach to establishing the acceptability of local plan growth in a manner that reflects the vision-led approach mandated in the NPPF. The approach also reflects the draft LTP4 approach with its focus on outcomes, mode-agnostic mobility of people or goods, and expanding viable sustainable transport choices.

Figure 2.1 shows key criteria which bring together NPPF and LTP4 considerations: sustainable transport; keeping people and goods moving; and safety. It shows how these criteria are used to help transport authorities reach a view that Local Plan growth can be managed and is considered acceptable.

It is worth noting that the approach should consider viability and carbon management throughout and there are differences between the Regulation 18 and 19 stages of plan making. The Regulation 18 phase focuses on the viability of the sustainable transport vision and network-wide assessment of impacts. Meanwhile, the Regulation 19 Local Plan phase, by which time the preferred options and sustainability vision is more certain, focuses on more detailed network assessment and safety aspects at specific locations. That is:

- Regulation 18 is setting the strategy, which identifies how the transport authorities can respond to preferred growth (the 'how') – which is the focus of this report on transport evidence
- Regulation 19 is setting the tactics, which confirms what is required to implement the strategy (the 'what')

The sustainability vision aligns with the vision introduced in Section 2.1. The sustainability of locations for site allocation has been considered in the earlier transport evidence report [21]. This report explores further the practicalities of delivering sustainable transport in different places, especially between rural and urban locations. An example measure of this criteria is mode share.

Keeping people and goods moving should consider all modes and uses (e.g. private vehicles, deliveries, rail, bus, cycling, wheeling and walking) across a network and is the other focus area of this further evidence report. It also needs to consider existing problems which in the diagram is referred to as a blockage, such as Greenstead roundabout in Colchester, which will also affect bus routes. Existing problems at junctions affect the acceptability of performance once growth is added. The transport model provides indicators that help assess if people and goods are predicted to move acceptably through the highway network, which are described in subsequent chapters.

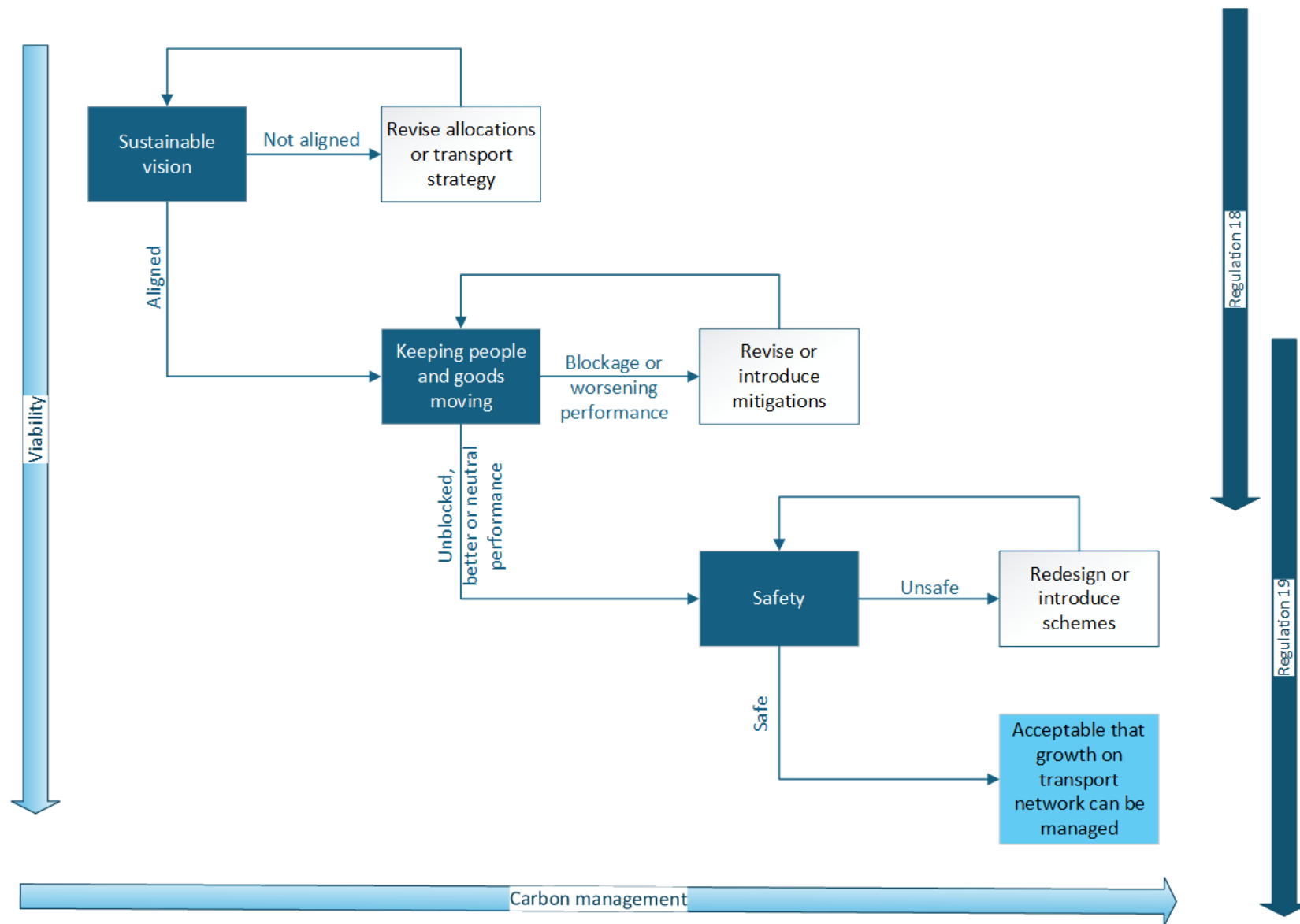


Figure 2.1: Criteria to inform assessment of acceptability of growth from the perspective of transport

To some extent safety is a requirement considered throughout, however, it is only after details on movements, mode shift and mitigation measures are derived that a judgement can be made on residual safety issues. Hence, safety is suggested as a final check, which might prevent or necessitate changes to elements of the Local Plan and its mitigation approach. In this report, safety concerns have informed the requirement for mitigation measures to accompany growth, such as at A12 J29.

Throughout the steps shown in the diagram it is also important to consider viability since the vision, mitigations and schemes need to be affordable and deliverable. Furthermore, it is recommended that carbon implications and the approach to carbon management is developed from the outset to align with the UK's Net Zero Strategy (targeting net zero by 2050). By doing so, opportunities for whole life carbon reductions can be incorporated into decision making.

Appendix B provides further information on the method through which the acceptability of the impact of preferred site allocations is being ascertained.

2.3 Preferred site allocations

Without Colchester's preferred site allocations, some level of growth would reasonably be expected to occur in the council area and in surrounding areas. This growth has been called reference case growth.

In order to compile the reference case, Department for Transport (DfT) guidance has been followed to identify those developments that are near certain or more than likely to come forward [18, p48]. Reference case growth to 2041 has been assumed to include:

- those housing sites in the adopted local plan (2017-2033) that have been identified by CCC as near certain or more than likely to come forward
- general growth in employment calculated using the 2033 jobs growth forecast from the National Trip End Model (NTEM), since employment growth can reasonably be expected to accompany housing growth
- housing and employment development at TCBGC to 2041

Colchester will be particularly affected by growth in the neighbouring North Essex authorities of Braintree and Tendring. Consequently development in these locations has been reviewed to identify near certain and more than likely developments, and whether there is a case for setting growth higher than the NTEM forecast for 2041. In Braintree, near certain and more than likely housing and employment development is less than the NTEM forecast so reference case growth is set to the NTEM forecast. In Tendring, which includes TCBGC, near certain and more than likely housing growth is less than NTEM but employment growth is greater than NTEM. Therefore, in Tendring, housing growth has been set to the NTEM 2041 level but employment growth is set to reflect local information. Elsewhere, growth in districts beyond North Essex is assumed to be at 2041 levels predicted by NTEM.

The preferred site allocations will grow households and jobs in Colchester beyond the reference case estimate. Growth elsewhere remains at reference case levels.

The location of reference case and preferred site allocations for households and jobs growth in Colchester is depicted in Figure 2.2. Preferred sites have either been grouped together with other sites that are geographically close (shown within blue polygons) or, depicted as individual sites (shown within orange polygons). Each of these polygons

has been assigned a reference number. Reference case employment growth is not shown since a general assumption has been made that it is either at TCBGC or linked to the other housing growth.

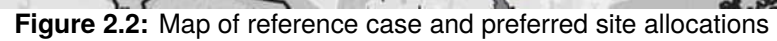
Appendix C provides further details on preferred residential and employment allocations. The reference numbers shown in Tables C.1 and C.2 link to the reference numbers shown in the map in Figure 2.2.

2.4 Conclusion

This chapter has set the scene for the transport analysis of the impact of preferred site allocations. It has considered the vision and objectives at national, regional and local levels to provide a framework to guide the assessment of transport issues and mitigation measures in line with NPPF guidance.

The chapter has also provided information on the scale of housing and employment growth in the preferred site allocations, which will be additional to reference case growth at allocations within the adopted plan (2017-2033) and at TCBGC.

The following chapter (3) introduces the transport model North Essex Model (NEMo), and explains how household and jobs growth is used to derive BaU growth in trips to input into the model. NEMo outputs are then summarised to understand the BaU unmitigated transport impact of this growth.



3 Derivation of baseline and impacts of BaU growth

3.1 Introduction

This chapter introduces the transport model that is being used to carry out the assessment of the impact of growth on the performance of the highway network. Then an explanation of how the baseline has been derived is given, against which the scenarios with preferred sites are tested.

The full set of mitigation measures that would be expected to accompany reference case growth is not at present known – especially how impacts will be managed at A12 J29 and at Greenstead roundabout. Hence deriving an appropriate baseline involved developing:

- Scenario 0 – Reference case demand without mitigation. Committed schemes such as RTS and P&C East for which designs are known are included.
- Scenario 1 – baseline – Reference case demand with mitigation measures at J29 A12 and at Greenstead roundabout/Colne Causeway. The baseline mitigation measures have been identified as being required in the TCBGC DPD. Scenario 1 is the baseline against which the preferred site allocations are tested.

The chapter concludes by identifying the BaU impact of preferred site allocations, to identify the location and scale of problems for which a vision-led approach to mitigation is required.

- Scenario 2 – BaU growth – BaU demand at preferred sites is added to reference case demand. No additional mitigation to those measures in Scenario 1 are included.

Table 3.1: Scenarios assumptions

Name	Description	Demand assumptions			Network assumptions		
		Reference case demand	BaU demand	ST demand	Greenstead improvements	A12 J29 improvements	Additional highway mitigations
Scenario 0	Unmitigated baseline	✓					
Scenario 1	Baseline	✓			✓	✓	
Scenario 2	BaU growth		✓		✓	✓	
Scenario 3	ST growth			✓	✓	✓	
Scenario 4	ST growth with highway mitigation			✓	✓	✓	✓

Chapters 5 and 6 describe mitigation scenarios 3 and 4.

3.2 North Essex Model

NEMo is a strategic highway and public transport model with a base year of 2023. The model has been independently reviewed by NH to verify that it is suitable to use to assess the impact of local plans across North Essex. Forecast year assessments involve

changing the network in the base model along with trip demand to reflect scenarios to be tested.

The NEMo base year model has been developed by expanding and updating the Colchester Transport Model (CTM), which has a base year of 2019. The detailed area of modelling in the CTM was expanded to include parts of Braintree and Tendring to align with options being considered in their local plan reviews. Updates were made to the highway and public transport networks to reflect 2023 conditions; and car, light goods vehicles (LGV), heavy goods vehicles (HGV), bus and rail demand was adjusted to reflect better 2023 travel patterns. The resulting NEMo was then validated against 2023 flow and journey time data to confirm it represents travel conditions.

CTM, and hence NEMo, has been built following DfT Transport Analysis Guidance (TAG) and best modelling practice (including [15], [16] and [17]), and the update process has followed DfT guidance on present day updates, in which models are refreshed rather than reconstructed entirely.

NEMo includes a variable demand model (VDM), also developed in line with DfT guidance [14], which allows trip makers to change destination and switch between car and public transport modes. The VDM considers trip purposes over a 24-hour period and predicts from where trips will be produced, to where they will be attracted and which mode will be used. It then produces origin and destination car, bus and rail matrices for the AM and PM peak hours and average interpeak hours.

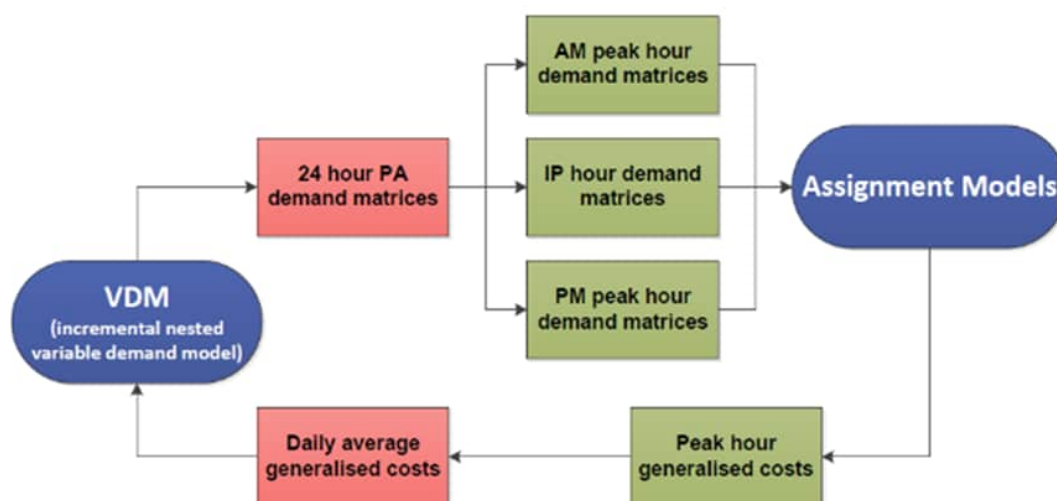


Figure 3.1: Relationship between demand and assignment models

The trips in the car matrix are subdivided into commuting, business and other trips and assigned onto the highway network alongside estimates of LGVs and HGVs using VISUM software. Buses, which travel on the highway network, are also included but follow designated routes. Meanwhile the bus and rail trips are assigned onto the public transport network using EMME software. Some public transport trips use both bus and rail to complete a journey.

Since destination and mode choice is affected by congestion levels, the VDM and assignment models iterate with each other until they reach convergence – which means that the level of congestion in the highway assignment model does not lead to a change in destination or mode choice. For information, the highway assignment model fore-

casts delay as more trips are added to the network. The public transport assignment model allows buses to fall behind scheduled timetables as a result of congestion on the highway network, but rail services are assumed always to run to schedule.

NEMo represents a typical mid-week day in a month without major holidays; hence is skewed towards days with heavier traffic flow. Choosing such conditions tends to maximise normal traffic flow through all parts of the transport network and follows modelling best practice [51]. The highway assignment model shows traffic conditions in the AM peak hour 07.30-08.30 and the PM peak hour 16.30-17.30, since these are, overall, the busiest hours in 2023 across North Essex in the respective peaks. The highway model can also show traffic conditions for an average interpeak hour between 10.00-16.00. The public transport model shows public transport trips for average peak hours in the AM (07.00-10.00), interpeak (10.00-16.00) and PM (16.00-19.00) periods.

In order to set a baseline against which the impact of preferred site allocations can be assessed, a reference case forecast model for 2041 has been developed which represents the growth level described in Section 2.3. In order to calculate the number of trips that will be generated by the reference case growth of households and jobs, the Trip End Model Programme (TEMPro) is used to estimate the number of trips over 24 hours, which are then input into NEMo. The amount of trips which use the core scenario of NTEM is considered to represent BaU levels of car use through reflecting demographic trends. The reference model is run using the VDM process described above.

As mentioned in the introductory Section 3.1, mitigation measures are added to the reference model to create the baseline scenario. The baseline (reference case including reference case mitigations) is run using only the highway assignment model and only in the busiest AM and PM peaks hours, i.e. without using VDM. This allows the impact of the mitigation to be more clearly seen since the transport impact can be masked by changes in destination and mode if VDM is used.

Subsequent chapters also show findings from the assessment case forecast scenarios for 2041, which add trips on top of the baseline model and introduce further mitigation measures. These assessment case models have also been run without VDM using only the highway model. This allows more precision for the number of car trips, which are allowed to switch to sustainable travel, and avoids any double counting through the VDM allowing further switching to public transport.

3.3 Baseline position

3.3.1 Approach to comparative analysis

This subsection outlines the approach to assessing movement performance of scenarios tested in NEMo. The approach is based on assessing if the impact of a scenario when compared to another scenario can be considered acceptable in terms of impact on the transport network. Appendix B provides further technical information underlying the approach.

This approach involves identifying the areas of the Colchester highway network of interest. These were identified by considering the impact of preferred site allocations and existing problems using 2041 forecast models based on earlier model runs [21]. The areas of the network of interest are summarised in Table 3.2 and shown in Figure 3.2.

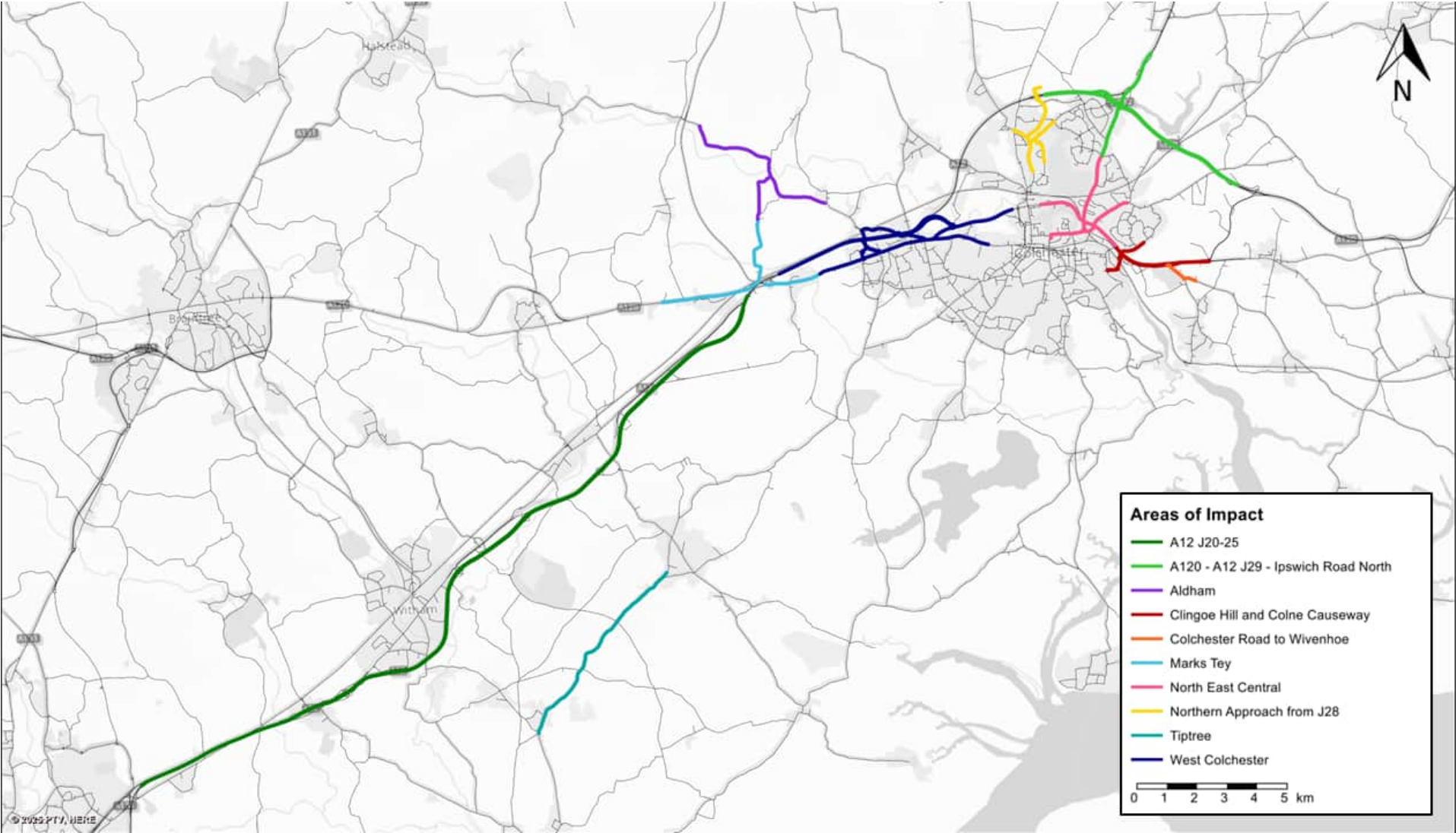


Figure 3.2: Areas of the network of interest

Table 3.2: Areas of interest on the highway network

Sector	Location
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill
	Ipswich Road, East Street, East Hill & Harwich Road
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26
	A12 J25 / A120 (western)
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28
	A12 J29 / A120 (eastern)
Outer	Tiptree
	Aldham
	A12 J20-25

Focusing on the areas of interest shown in Table 3.2 provides an appropriate barometer to assess and cover traffic impact across Colchester. However, our analysis also involves inspecting model outputs and plots to check if there are significant changes in other areas beyond the selected areas of interest.

The approach then involves calculating a movement index on a scale of 1-15 for each of the areas of interest for the scenarios to be compared. A scale of 15 has been chosen in order that differences between areas of interest and scenarios can be perceived. The movement index combines indicators typically used in modelling assessment: queues, speed and capacity. It has an advantage of conciseness over using individual indicators and plots. The index provides an immediate overview of the key performance criteria to keep people and goods moving and helps to identify locations with problems. In addition, the more severe problem movements within each area of interest can be identified, which help focus in on detailed issues. The movement scale can be seen in Table 3.3.

In addition, an overall score for each scenario tested has been calculated. The overall score is a weighted average of the movement scores of the areas of interest by demand. Thus areas with higher demand contribute more to the overall score than those with lower demand. The overall score shown in the final row of assessment tables.

Depending on the change between the scenarios being compared, the change in the movement indices also help identify the the level of concern to inform acceptability:

- passable ✓
- caution !
- unsatisfactory ✗

Table 3.3: Movement scale

Description	Movement scale
More or less free flow	1
	2
	3
Travelling slower	4
	5
	6
Moderate congestion	7
	8
	9
Substantial congestion	10
	11
	12
Extreme congestion	13
	14
	15

In gauging performance movement, consideration has been given to whether the A1331 link road has been completed. It is assumed that the A12 J19-25 widening scheme has not been implemented by 2041 since funding was withdrawn by government in July 2025. However, scenarios with the A12 widening scheme have also been modelled, which are discussed in Section 7.4.

3.3.2 Findings

Table 3.4 shows the summary assessment comparing Scenarios 0 (baseline without mitigation) and Scenario 1 (baseline with mitigation) in futures with link road completion and with delayed link road completion using the approach described in Subsection 3.3.1. Plots from the scenarios are also shown in the the following appendices:

- Appendix D for plots without A12 widening and with A1331 link road completion
- Appendix E for plots without A12 widening and with delayed A1331 link road completion

Table 3.4: AM and PM peak movement assessment of Scenario 1 (baseline) with Scenario 0

Sector	Location	AM Peak				PM Peak			
		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road	
		Scenario 0 (Unmitigated Baseline)	Scenario 1 (Baseline)	Scenario 0 (Unmitigated Baseline)	Scenario 1 (Baseline)	Scenario 0 (Unmitigated Baseline)	Scenario 1 (Baseline)	Scenario 0 (Unmitigated Baseline)	Scenario 1 (Baseline)
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	12	7	13	9	12	8	14	10
	Ipswich Road, East Street, East Hill & Harwich Road	10	9	10	10	9	10	10	10
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	10	10	10	11	8	8	8	8
	A12 J25 / A120 (western)	6	6	6	6	5	5	5	5
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	9	9	9	9	10	9	11
	A12 J29 / A120 (eastern)	10	7	9	8	8	8	8	8
Outer	Tiptree	4	4	4	4	4	4	4	4
	Aldham	3	3	3	3	3	3	3	3
	A12 J20-25	8	8	8	8	7	7	7	7
Overall assesement combining all areas		9	8	9	9	8	8	8	8
More or less free flow		Travelling slower		Moderate congestion		Substantial congestion		Extreme congestion	
		1	2	3	4	5	6	7	8
		9	10	11	12	13	14	15	
		Acceptability of change		Passable ✓		Caution !		Unsatisfactory ✗	

Scenario 0 with preferred site allocations includes substantial growth, especially growth generated from TCBGC. This raises a problem that reference case performance is of concern, especially at Greenstead roundabout and A12 J29, because not all the expected mitigation measures, that would accompany reference case development, are yet known. The problem at J29 is also a concern for road safety since queues on the A120 westbound offslip could extend back to the mainline of the A120.

The first row of Table 3.4 shows that the Greenstead area of interest presents as a substantial to extreme problem in Scenario 0 even with the A1331 link road in place. This problem rises to extreme in both the AM and PM peaks were the link road to be delayed beyond 2041. Meanwhile the sixth row of the table indicates substantial suggestion in the A12 J29 area of interest in the AM peak of Scenario 0 but a lesser, moderate problem in the PM.

The need for improvements at Greenstead roundabout and A12 J29 have been identified in the TCBGC Development Plan Document (DPD); however, TCBGC development plans are not yet at a stage where mitigations at Greenstead or at A12 J29 are known. Therefore, within the further transport evidence project, it has been necessary to identify mitigation measures at these locations.

The Greenstead roundabout concept involves removing the five mini-roundabouts that comprise Greenstead and introducing a traditional roundabout that is fully signalised. In addition, signals are introduced at the junctions along Colne Causeway. The concept also involves co-ordinating signal timings between Greenstead and Colne Causeway signals and with signals along Clingoe Hill. Within the scheme concept, priority is also provided for rapid transit system (RTS) and local buses.

Meanwhile the J29 concept involves widening the westbound off slip from two to three lanes and extending signal controls to each arm of the junction. The concept addresses the problems seen in Scenario 0 because the design provides more capacity for the movement from the A120 to Severalls business park.

Modelling results shown in Scenario 1 columns of Table 3.4 demonstrate that the concept baseline mitigation at Greenstead and A12 J29 alleviate the problems seen in Scenario 0. The index at Greenstead reduces to the moderate category in both the AM and PM peaks with the A1331 link road; though it would rise to a substantial problem if the link road were to be delayed. Scenario 1 also shows that the A12 J29 sector reduces to a moderate problem. Plots in Appendices G and E also confirm that blocking back onto the A120 mainline has been resolved.

It can be inferred from comparing Scenarios 0 and 1 that the Greenstead scheme has a slight impact on the lower Ipswich Road area (second row), which increase from a moderate to low substantial problem in the PM peak; and the A12 J29 scheme has a slight impact on the Northern Approach Road sector, which also increases from a moderate to low substantial problem in the PM peak.

On the west side of Colchester, Table 3.4 also shows the network is coming under stress in the Lexden Road sector (third row), caused by blocking back emanating from the Colne Bank Roundabout. In the 2041 reference case scenarios, Colne Bank Roundabout has had signals added, which are not in the 2023 base model. In the AM peak the movement index for the Lexden Road sector shows as a low substantial problem in the AM but as a moderate problem in the PM.

Overall, traffic is considered to be moving acceptably through the network in Scenario 1, which becomes the baseline against which the transport impact of preferred allocations is assessed. Overall performance is also better in Scenario with A1331 link road completion compared to delayed completion, which is to be expected.

To visualise the network impacts, objectively summarised by the movement index, it might also be helpful to review Figures D.9, D.22, D.10 and D.23, which show how the relative queues have reduced in Scenario 1 compared to Scenario 0. (Relative queue indicates blocking back problems where queues build up over the modelled peak hour.)

3.4 Impact of BaU growth at preferred site allocations

Having established that Scenario 1 forms a satisfactory baseline, growth from preferred site allocations was added to that model assuming BaU car use. Again, the situations with and without link road completion have been considered and plot results of flow difference, speed and relative queue are shown in the appendices as described in Section 3.3.

Table 3.5 shows the impact on movement of growth from Scenario 2 – preferred site allocations with BaU car trip rates – compared to the baseline Scenario 1. Scenario 2 does not include any mitigation assumptions beyond those introduced in the baseline at Greenstead roundabout and J29 A12. The movement index is shown on the coloured 1-15 scale and acceptability of change to Scenario 2 from Scenario 1 denoted as passable ✓, caution ! or unsatisfactory X.

The Scenario 2 AM model with the A1331 Link Road jumps to extreme congestion in sectors with lower Ipswich Road, Lexden Road, A12 J25 and Northern Approach Road. Lower Ipswich Road and Northern Approach Road sectors are similarly severely affected in the PM peak. The overall score, which combines all areas of interest, changes from moderate to substantial congestion. The acceptability algorithm responds sensibly and marks these areas with an unacceptable or caution flag.

It is pertinent that both Greenstead and A12 J29 areas receive a caution flag but are not considered unacceptable in Scenario 2 with A1331 link road completion. While BaU demand worsens traffic the schemes that have been introduced in Scenario 1 (mitigated baseline) offer some resilience to traffic growth. Plots shown in Figures D.11 and D.24 show that the significant build up of relative queues have been avoided in the AM and PM peaks, respectively.

Table 3.5 also shows performance of the areas of interest with delayed A1331 link road completion. The Greenstead area reaches an extreme congestion problem in both the AM and PM peaks due to severe blocking back, which can be seen in Figures E.11 and E.24. This further demonstrates the need for the link road to be in place to mitigate the impact of TCBGC. The worsening performance at Greenstead also explains why the overall performance score with the link road completed is slightly better than with delayed link road completion, the latter reaching high substantial overall congestion in the AM peak.

Table 3.5: AM and PM peak movement assessment of Scenario 2 (unmitigated BaU) with Scenario 1 (baseline)

Sector	Location	AM Peak				PM Peak			
		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road	
		Scenario 1 (Baseline)	Scenario 2 (Unmitigated)	Scenario 1 (Baseline)	Scenario 2 (Unmitigated)	Scenario 1 (Baseline)	Scenario 2 (Unmitigated)	Scenario 1 (Baseline)	Scenario 2 (Unmitigated)
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	7	!	9	x	8	!	10	x
	Ipswich Road, East Street, East Hill & Harwich Road	9	!	10	!	10	x	10	x
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	10	x	11	x	8	!	8	!
	A12 J25 / A120 (western)	6	x	6	x	5	x	5	x
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	x	9	x	10	x	11	x
	A12 J29 / A120 (eastern)	7	!	8	✓	8	✓	8	✓
Outer	Tiptree	4	✓	4	✓	4	✓	4	✓
	Aldham	3	✓	3	✓	3	✓	3	✓
	A12 J20-25	8	!	8	✓	7	✓	7	✓
Overall assesement combining all areas		8	11	9	12	8	11	8	11
More or less free flow		Travelling slower		Moderate congestion		Substantial congestion		Extreme congestion	
		1	2	3	4	5	6	7	8
		9	10	11	12	13	14	15	
								Acceptability of change	
								Passable ✓	
								Caution !	
								Unsatisfactory x	

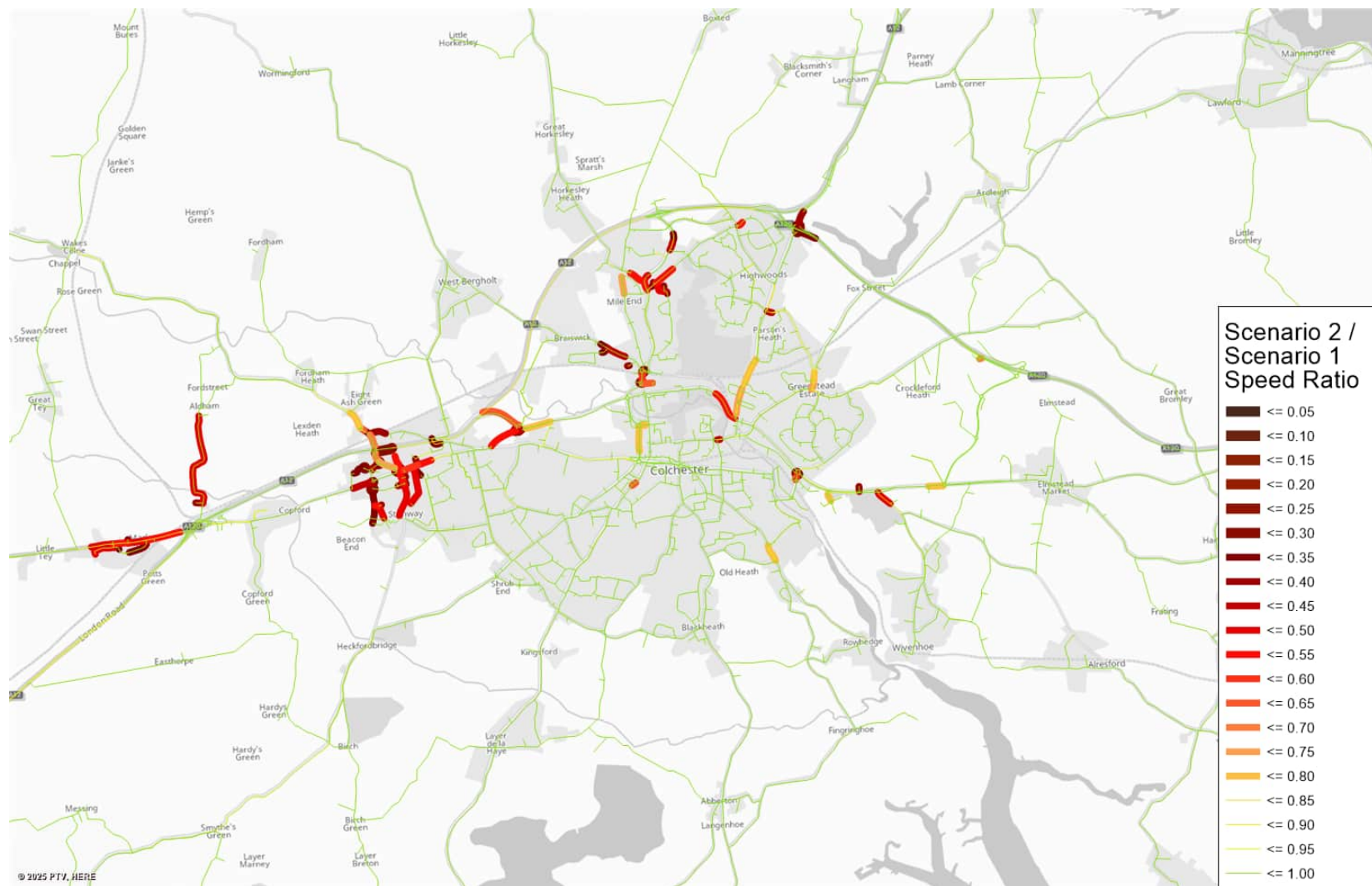


Figure 3.3: Difference in traffic speed between Scenario 2 (unmitigated BaU growth) and Scenario 1 (baseline) – AM peak

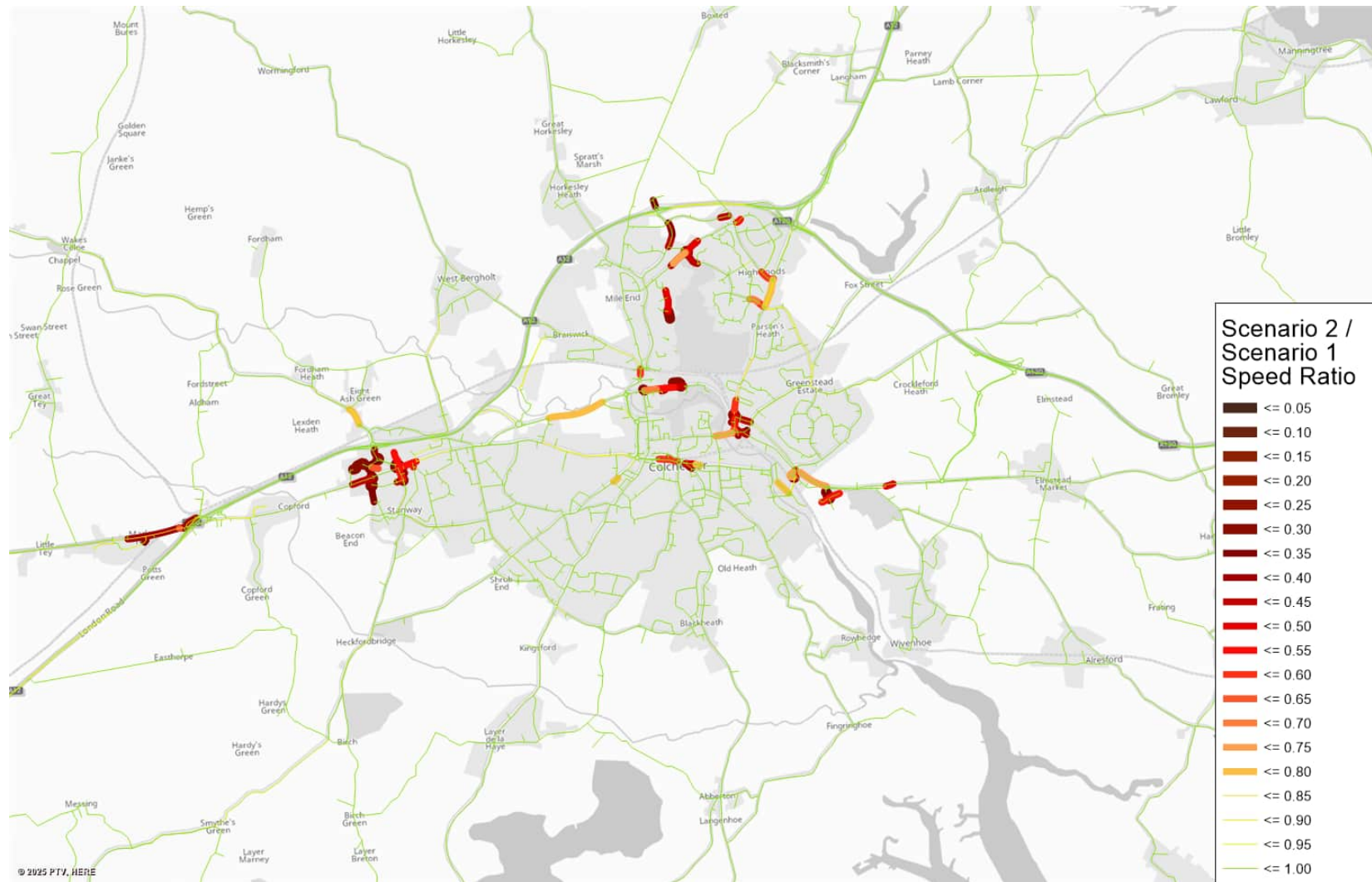


Figure 3.4: Difference in traffic speed between Scenario 2 (unmitigated BaU growth) and Scenario 1 (baseline) – PM peak

To help visualise the impact across the network of BaU growth, Figures 3.3 and 3.4 show the change in speed on links across the network to Scenario 2 from Scenario 1 in the AM and PM peaks, respectively. These difference plots also help identify impacts beyond the main areas of interest. It is noticeable in Figure 3.3 that the link south of Aldham has reduced speed. However, this link is included in the A12 J25 area of interest, for which the movement score worsens, but the Aldham area of interest, for which movement score remains stable.

The appendices show further model plots for Scenario 2, which have been placed adjacent to the other scenarios with the same assumption for link road completion. Speed and relative queue plots of Scenario 2 in the AM and PM peaks can be found in:

- Figures D.6 and D.19 – speed plots of Scenario 2 with A1331 link road completion in the AM and PM peaks, respectively
- Figures E.6 and E.19 – speed plots of Scenario 2 with delayed A1331 link road completion in the AM and PM peaks, respectively
- Figures D.11 and D.24 – relative queue (blocking back) plots of Scenario 2 with A1331 link road completion in the AM and PM peaks, respectively
- Figures E.11 and E.24 – relative queue (blocking back) plots of Scenario 2 with delayed A1331 link road completion in the AM and PM peaks, respectively

3.5 Conclusion

This chapter has introduced the transport model NEMo and established a 2041 baseline – which is a situation that is considered broadly acceptable in terms of keeping people and goods moving, even though there are areas of concern. Arriving at a satisfactory baseline involved identifying concept scheme improvements at Greenstead roundabout and A12 J29, which are expected to accompany reference case growth.

The chapter has then compared BaU growth from preferred site allocations against the baseline scenario with and without A1331 link road completion. The comparison shows that unmitigated BaU growth at preferred site allocations with A1331 link road completion leads to unsatisfactory performance across key parts of the highway network including the lower end of Ipswich Road through to East Hill; the Northern Approach Road sector including Via Urbis Romanae and Mill Road; A12 J25; and Lexden Road emanating from Colne Bank roundabout.

If the link road were delayed, network performance further worsens with noticeable deterioration at Greenstead roundabout. These movement impacts would also work against objectives for environmental improvements, economic growth and sustainable access where road safety and public transport journey times are worsened.

The next chapter proceeds to consider vision-led mitigation to accommodate the preferred sites.

4 Integrated transport measures to achieve vision led mitigation

4.1 Introduction

Chapter 3 presented evidence from NEMo that the unmitigated BaU transport impacts of preferred site allocations leads to unsatisfactory impact on movement through the network, most especially the lower end of Ipswich Road through to East Hill; the Northern Approach Road sector including Via Urbis Romanae and Mill Road; A12 J25; and Lexden Road emanating from Colne Bank roundabout. If the link road were not constructed, network performance further worsens with noticeable deterioration at Greenstead roundabout. These movement impacts would also work against objectives for environmental improvements, economic growth and sustainable access where road safety and public transport journey times are worsened.

The approach to mitigation is grounded in the vision and desired outcomes set out in Section 2.1 and the draft LTP4. This ensures that the transport changes associated with the preferred site allocations contribute to the sustainable growth and the liveability vision which runs through the strategies and policies at local, regional and national levels and build on current plans.

This chapter identifies categories of interventions and provides evidence on their potential impact and alignment with current plans by CCC and ECC. Detailed lists of interventions are presented in Appendix H. Subsequent chapters use the evidence about the effectiveness of sustainable transport (ST) to identify the extent that ST measures mitigate the movement performance issues of preferred site allocations; and then explore a fully integrated mitigation scenario that combines ST and highways and traffic management schemes.

4.2 Transport measures

4.2.1 Categories of interventions

In order to develop the vision-led mitigation approach categories of interventions have been identified:

- land use – such as land use planning and parking policies to support ST
- walking – including legible, safe and secure streetscape design and, where appropriate, pedestrianisation
- cycling – which can include cycle lanes, secure cycle parking and cycle training but also cycle and scooter hire (sometimes called shared micromobility)
- rapid transit and bus – including new or enhanced BRT, local bus or P&R services along with supporting measures such as bus priority schemes, real time information and fare incentives
- mobility hubs and interchanges – which support integrated transport and can include car clubs, demand responsive transport and last mile freight consolidation at key rail and bus interchanges
- travel planning – which include measures to encourage ST at new developments
- highways and networks – which recognise that rebalancing the network towards ST whilst keeping people and goods moving will involve highway schemes, en-

hanced traffic management systems, interventions to support road safety and extended maintenance to look after highway, railway and infrastructure

New rail services *per se* have not been mentioned in the description of the categories as they are not considered a practicable or affordable interventions or aligned with specific problems. However, the categories do cover better access to stations by bus, cycling and BRT, improvements at stations with mobility hub features, and are considered within the highway and networks category.

Figure 4.1 presents a logic map showing how the categories of measures work together to both address desired outcomes and alleviate the types of transport problems that could arise from preferred site allocations. The logic map also considers the range of providers which will need to work together to deliver interventions through new or existing programme. Since travel planning cuts across other ST categories, it has been excluded from the logic map.

4.2.2 Overview of vision-led and integrated package of measures

In Colchester 20% of trips in the urban area undertaken by car are less than 2km; whilst 52% are between 2-5km long. In non-urban areas of Colchester 25% of car trips are less than 5km long. Thus there is a large pool of car trips for which improved sustainable transport is a realistic alternative which would significantly contribute to alleviation of the congestion impact of growth.

In selecting the preferred sites, CCC reviewed the level of access by sustainable transport, in order that this was considered alongside other factors. ST connections to many of the sites could be provided by extending existing networks of walking, cycling and public transport or adjusting existing plans, such as Local Cycling and Walking Infrastructure Plan (LCWIP) and Bus Service Improvement Plan (BSIP). Once the impact from mode shift of these measures was ascertained, highway and mitigation measures were identified, which can also be required to support ST.

Figure 4.2 maps the proposed ST and highway measures alongside preferred allocations. Meanwhile Appendix H lists all the proposed ST and highway and traffic management measures that have been identified using the vision-led approach to mitigation.

The next sections considers each of the categories of ST interventions in turn; provides context of how the measures align with current strategies and plans; and sets out evidence from elsewhere that the ST measures would lead to the desired outcomes and address the expected problems as illustrated in the logic map. Since ST measures also support sustainable travel at reference case developments and in existing settlements, the impact of ST measures on reference case demand is considered as well as the impact on demand at preferred sites.

It is worth noting that it is only subsequently in Chapter 5 that an explanation is provided on how the impacts of categories of ST measures have been implemented in the transport model, which reflect local information on geography and trip distance. Meanwhile highway and network interventions are identified and explored in Chapter 6, once the potential contribution of ST measures has been gauged.

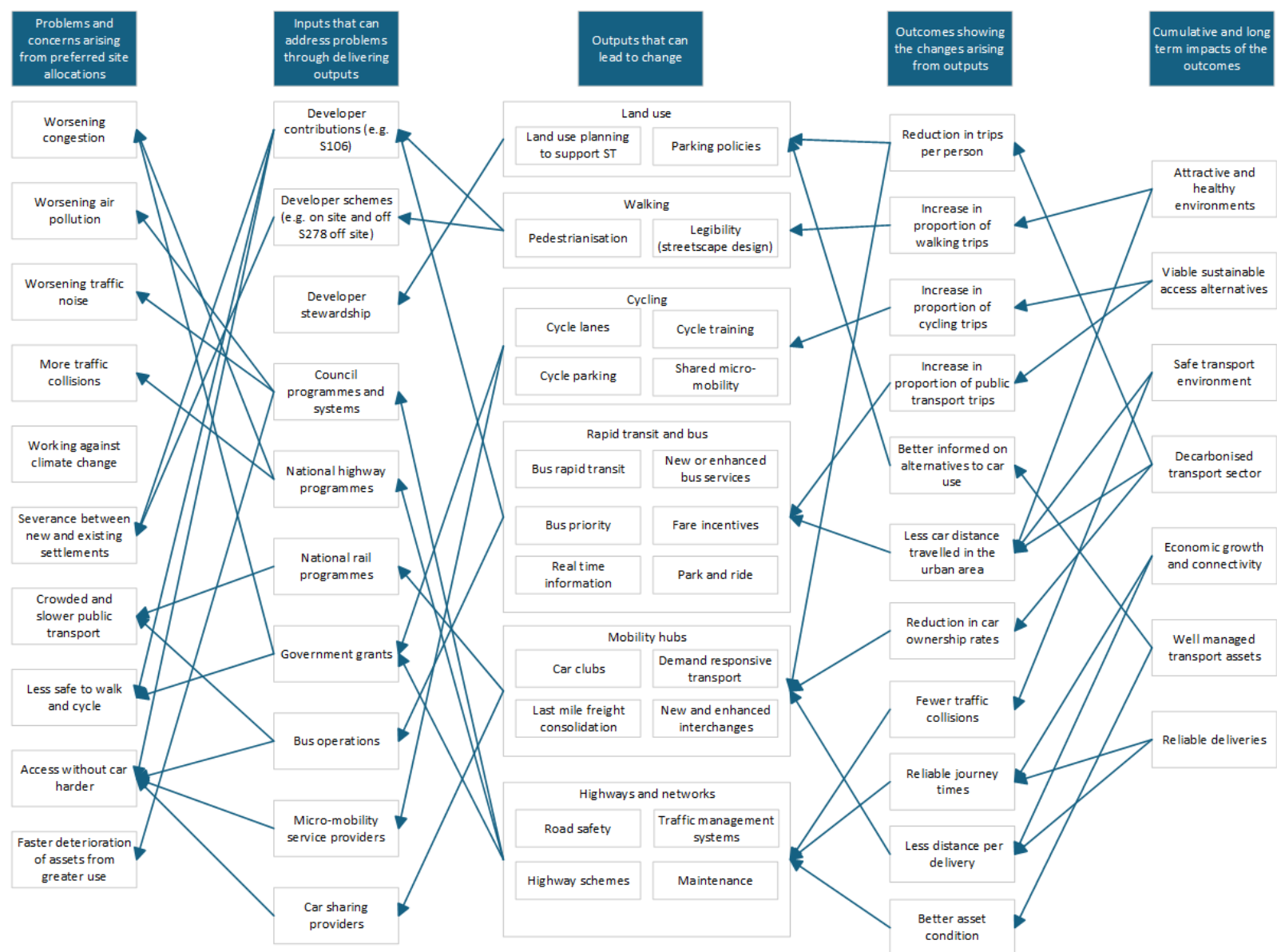


Figure 4.1: Logic map showing approach to address problems and achieve vision

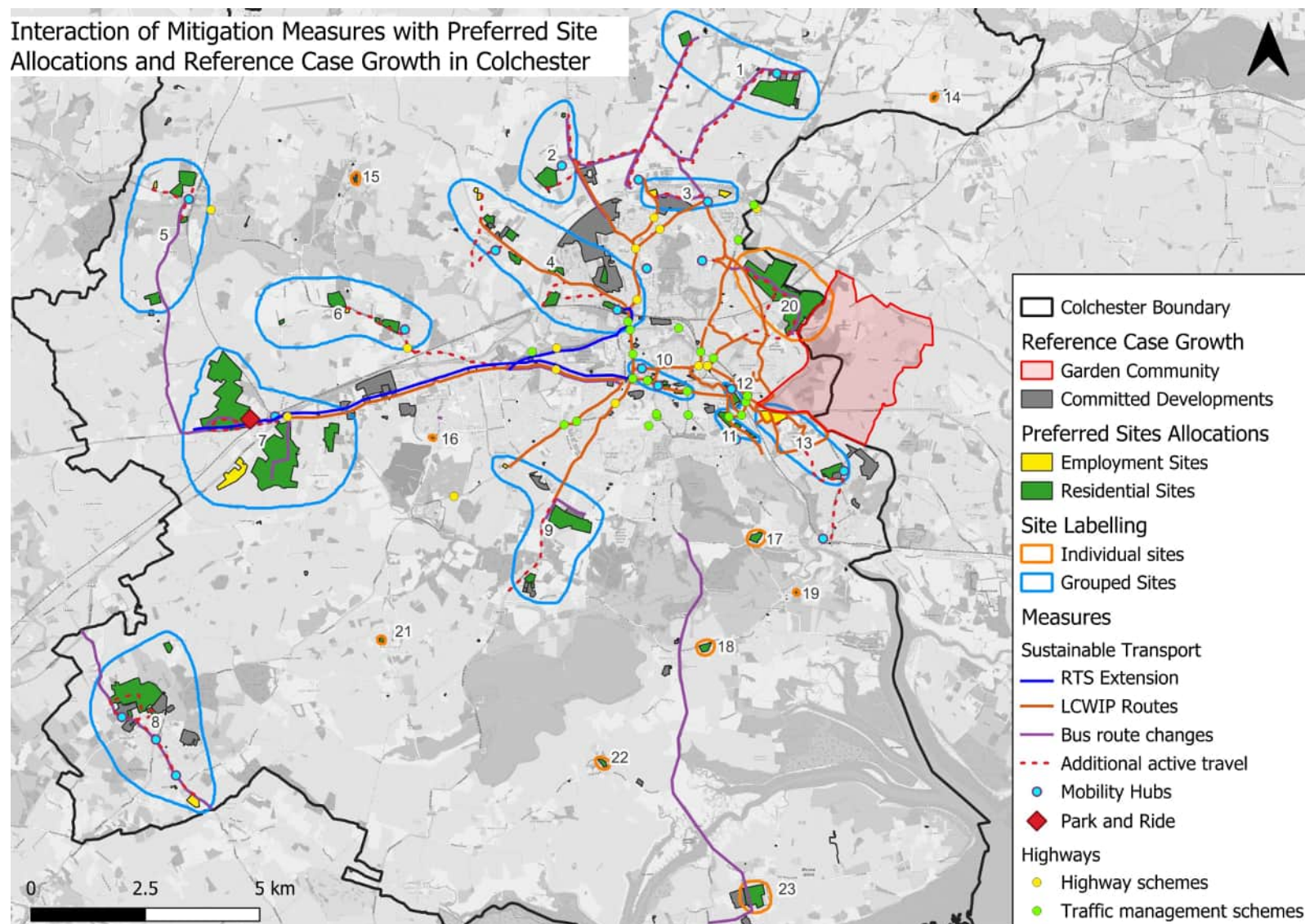


Figure 4.2: Interaction of proposed measures and allocations

4.3 Evidence for ST

4.3.1 Walking

Walking is unlikely to be a practicable replacement for many car trips. Nevertheless, it is a key complementary measure which should accompany land use policies aiming to reduce the distance being travelled and support access to public transport stops and stations.

There is evidence that creating attractive walking routes and pedestrianised and low traffic areas can encourage less car trips and lead to traffic evaporation. Studies have shown that reallocating road space from cars to other mode users can result in significant reductions in total traffic with 14%-25% of traffic not observed to be displaced onto neighbouring streets, as is commonly assumed [46].

Well planned improvements to public spaces can also boost footfall – which can indicate such schemes contribute to changes in travel behaviour as well as the local economy. For example a £10 million investment in Piccadilly, Stoke-on-Trent, to make the area more pedestrian friendly increased footfall by 30%. Similar improvements in Sheffield Peace Gardens and Coventry City Centre resulted in 35% and 25% increases in footfall, respectively. Altrincham (Greater Manchester) and Kelso (Scottish Borders) have also seen increases in footfall following improvements to streets, pavements, and crossing points. Altrincham experienced a 25% increase in footfall between 2010 and 2017, while Kelso saw a 28% increase above 2011 levels [33].

Of course not all pedestrian interventions will be of the scale of the above. It is therefore relevant that small scale pedestrian interventions also lead to changes in the footfall, which can indicate changes in route but also changes in travel choices. A study in New Zealand assessed the impact of kerb extensions, refuge islands and controlled crossings in eight cities and towns. It found that pedestrian use increased in seven of the eight sites, ranging from 7% to 90% [33].

In addition walking can be encouraged through relatively low cost wayfinding measures, which can help visitors find key attraction and interchanges.

Application to modelling assumptions

Proposed measures include walkability at new developments and connecting development to key facilities and infrastructure. In addition, LCWIP measures will improve the pedestrian environment at reference case developments and for existing settlements.

Based on the evidence it is considered reasonable that a reduction in short car trips of less than 2km in urban areas could occur. This reduction is estimated at 15% at preferred allocations and approximately half of this reduction for trips in the reference case, which also benefit from the infrastructure.

4.3.2 Cycling

The implementation of cycle infrastructure in Colchester has shown an increase in cycle movements and associated decrease in vehicle flows. Monitoring of Active Travel Fund schemes by Essex Highways in Colchester recorded that:

- the introduction of two-way cycle tracks in the city centre increased cycle flow by 43%-78%

- the presence of on-road cycling markings and signage was followed by a 3% and 22% increase in cycle flow
- associated vehicle flows on the strategic routes towards the city centre reduced by up to 4%, while vehicle flows within the congested city centre decreased by 10%

The DfT commissioned research to understand the extent to which implementation of cycle lanes and junction treatments convert car trips to cycle trips [6]. Drawing on surveys between 2016 and 2019 the research estimated a conversion percentage ranged from 12%-40% across case studies. Norwich, being a comparable city in size, characteristic and historic value in the East of England showed percentages towards the higher end of this scale.

As would be expected, studies such as by Sustrans [47] and Transport of Scotland [53], concur that for the cycle routes to be effective they must be part of a coherent network linking key destinations.

Developing a network also requires secure and sheltered cycle storage facilities at both ends of a trip. Sustran's Bike Life, the UK's biggest assessment of cycling in 12 cities and towns, found that the absence of sufficient and secure cycle storage facilities is one of the major barriers to encouraging more people to cycle [45]. This is corroborated in research by CCC which found residents prefer secure parking options to standard unsheltered bicycle racks. CCC reports that its secure cycle parking hub operated by Spokesafe is seeing year on year increases in membership and number of individual bike storage entries to the facility. This is forecast to outgrow the existing facility early in the local plan period, with the demand showing the need for new facilities city wide.

Paying for cycle storage can, however, be a deterrent as well as inconvenient locations as found in research in the Netherlands [35] – cheaper cycle parking options are more beneficial than bike storage lockers. This has also been found to be the case in Greater Manchester where Transport for Greater Manchester (TfGM) have moved away from providing secure, paid for cycle lockers to covered shelters with good surveillance and CCTV coverage.

Cycling use can also be boosted significantly in cases where a major barrier is overcome through a bridge or tunnel. In Colchester this is relevant given the need to bridge the A12 to encourage sustainable travel to and from allocations around Marks Tey. Sustrans reports increases ranging from 126% to 1700% [48] – where lower increases were seen in closer proximity to urban and residential areas potentially due to the presence of alternative routes. Extremely high changes can be recorded where a bridge, for example, opens up a new route for cyclists which previously had extremely low flow.

New cyclists can also be encouraged through cycle training and the presence of cycle hire schemes, of which the latter lowers the entry barrier to cycling by avoiding the costs of purchase and maintenance and concerns over secure cycle parking.

An online survey of Dr Bike maintenance session users showed a 38% shift from car to cycling for various journey purposes between 2020 and 2021, based on 20,627 trips. Additionally, Hertfordshire's Bikeability training for schools, combined with NTS data from 2008-2013, demonstrated a 12% car-to-cycle ratio [6]. These findings highlight how cycle training initiatives can reduce car dependency, improve traffic flow, and promote more sustainable transportation options.

For cycle hire schemes, a significant shift is observed from public transport and walking to cycling. For instance, a survey of cycle hire users in London revealed that most new cycle hire trips replaced public transport and walking trips rather than car trips [53]. Although the shift from car usage to bike share is less pronounced, it is still notable. Studies from Melbourne, Brisbane and Minneapolis showed that around 20% of cycle hire users substituted car trips with cycling trips. In Washington, 5% of bike share users sold a household vehicle, with 80% of them citing cycle hire as a factor in their decision [22]. Furthermore, it is estimated that approximately 5-8% of trips taken by cycle hire are new journeys that would not have occurred without the availability of the cycle hire system. Indicating that cycle share can induce new trip demand on the network, which supports cycling infrastructure development [22].

Similar to bike share schemes, e-scooters and e-bikes have shown potential for encouraging modal shift from private cars. For example, the CoMoUK Annual Bike Share Report found that 34% of e-bike users replaced car trips, compared to 24% for regular cyclists [34]. In the Solent e-scooter trial the average trip duration was between 15 and 20 minutes, highlighting the potential for e-scooters to replace short car journeys [34], which relates closely with the Colchester e-scooter trial data where analysis of using data shows average weekly ride trip distance is around 2km. E-bikes share can facilitate seamless integration between cycling and public transport. The CoMoUK Annual Bike Share Report found 46% of respondents use e-bike share to make their journeys easier, and 26% use it due to a lack of access to public transport [34].

Application to modelling assumptions

Proposed measures include a significant expansion of the LCWIP network across the urban area along with enhancements to routes in non-urban locations connecting allocations to key facilities and interchanges. Furthermore planned measures would extend secure cycle parking and training and travel behaviour change towards cycling would be incentivised through travel planning.

Cycleable trips are considered those less than 10km long but are not confined only to urban areas, especially given the rise in e-bikes. Of these trips, it is within the bounds of the evidence that the shift from car should be no less than 15% at site allocations where cycling routes, facilities and travel planning would be concentrated. Reference case trips would also benefit, but a lesser shift of 5% from car trips is estimated.

It should be noted that an increase in cycling will also abstract trips from public transport.

4.3.3 Rapid transit

Colchester and Tendring's proposed RTS is an example of high quality BRT route. It is being designed around principles that have been shown to attract drivers to public transport: fast, frequent, convenient, direct and affordable. Reliable and directly comparable data is difficult to obtain on the impact of such systems due to commercial sensitivity and different data collection methodologies. Nevertheless, Tables 4.1 and 4.2 set out some UK and international evidence.

Table 4.1: UK evidence for bus rapid transit

City / Town	Mode Shift	Mode Share
Luton/Dunstable	9% mode shift in Dunstable	–
Cambridgeshire	75% of busway passengers previously used bus, 24% changed from car as a driver, 13% changed from car as passenger (More than 70% of previous car users had free parking at their destination) Those living 4km from the Busway were 34% more likely to have increased their cycle commuting time than those living 9km away [40]	9% Public Transport, 70% Private Transport, 21% Non-motorised user –
Kent Fast Track	19% of busway passengers shifted from car, 60% of passengers are already bus users	– –
Runcorn	16% shift from public transport to BRT, 75% shift from car to BRT (on surveyed routes).	– –

Table 4.2: International evidence for bus rapid transit

City / Town	Mode Shift	Mode Share
Nantes, France	– – –	16% Public transport 52% Private transport 32% Non-motorised user
Metz,	– – –	11% Public transport 54% Private transport 35% Non-motorised user
Adelaide North East Busway, Australia	Ridership Growth = 24% % Passengers that previously drove = 40%	– –
Sydney Liverpool Parramatta Transitway, Australia	Ridership Growth = 56% 47% of growth new journeys % Passengers that previously drove = 26%	– – –
Brisbane SE Busway Brisbane, Australia	Ridership Growth = 56% 17% new journeys % Passengers who previously drove = 26%	– – –

Continued on next page

Table 4.2: International evidence for bus rapid transit (*continued*)

City / Town	Mode Shift	Mode Share
SmartBus Route 901 Melbourne, Australia	Ridership growth = 42%	–
	% Passengers who previously drove = 34%	–
SmartBus Route 902 Melbourne, Australia	Ridership Growth = 47%	–
	% Passengers who previously drove 29%	–
SmartBus Route 903 Melbourne, Australia	Ridership Growth = 26%	–
	% Passengers who previously drove 21%	–

It is noticeable that studies concur in that BRT do contribute to a significant shift away from car travel, clearly concentrated on corridors with BRT services. This shift would not be constrained to trips at new development but would attract existing residents on the route. In Cambridgeshire it was found 24% changed from driving a car, Kent estimated a 19% mode shift and Runcorn significantly higher. Meanwhile Australian examples range from 21% to 40% shift from car travel.

Application to modelling assumptions

Colchester is already investing in the first route of its RTS. A key mitigation measure will be to extend services from the City Centre to reach allocations in Marks Tey. Furthermore, coordination with route improvements on fast and frequent bus services will extend the reach of BRT standard services.

Car trips that would be scope for switching would only be those in urban areas and going from non-urban to urban areas with a travel distance between 2-20km where there can be considered to be a BRT standard uplift in quality.

Given that there will be added incentives for trips on development sites, the shift from car for trips in scope is estimated at 24%; and for trips at reference case development and at existing settlements at 17%

4.3.4 Park and ride facilities

Colchester already has a P&R site in the north by A12 J28 and, in the reference case, it is assumed that park and choose (P&C) in the east of Colchester opens as part of the TCBGC development. By 2041 both facilities would be served by RTS. It is proposed that a mitigation measure should be a third site to the west – P&C West.

Evidence suggests that the P&R is successful when supported by parking controls in terms of price and restrictions on availability. Through CCC parking strategy, the principles and mechanism for incrementally controlling parking supply have been established which will support successful P&R use.

Therefore it is reasonable to surmise that creating a ring of P&R facilities backed up with parking changes ensure P&R is well used as for example in Chelmsford, Cambridge and Oxford.

Application to modelling assumptions

It is assumed that across P&R North, P&C East and the proposed P&C West there will be no less than 2,400 spaces. By 2041, the parking policies will lead to high usage of the order of 1,800 spaces.

Of these spaces, half, that is 900 spaces would become occupied during the AM peak period between 7.00-10.00, which means that over a peak hour there would be 300 trips made to the P&R sites and not to the urban area.

This estimated is also corroborated using CCC's parking model and aligns well with an extrapolation of observed use at P&R North.

4.3.5 Local bus improvements

While premium RTS and P&R services are important on key corridors and to connect well-used destinations, it would be amiss not to consider local bus services to other destinations, which would have a significant role in modal shift as well as maintaining accessibility for those without access to a car.

The proposed measures include new bus services and bus priority measures, which have been influenced by Colchester BSIP. Case studies from cities like Nottingham and Reading [31] demonstrate that well implemented bus priority strategies lead to higher bus patronage. Research indicates that each percentage-point increase in bus priority coverage can lead to a 1.1% increase in ridership [54].

Furthermore extension of digital Real time information (RTI) displays can improve the predictability of journeys and ease of journey planning, and reduce their wait time at a bus stop, thereby improving the customer experience. RTIs can reduce the transit stop wait time by three minutes [2]. This is particularly beneficial to users boarding a bus in rural areas, where scheduled bus services are less frequent, potential delays to buses may significantly deter users from using bus services, especially as a connection to another stage of their journey such as a connection to a train station. The provision of real time information displays at bus stops may increase the uptake of bus journeys by providing users with the confidence that they are receiving accurate information, allowing users to plan their trips more efficiently [13]. In Norfolk County Council, 162 real time information screens had been installed, contributing to a 16% increase in bus passengers in the last year [38].

New and enhanced bus services themselves also contribute to increases in bus patronage. Overall, studies indicate that increases in bus service frequency and operating times can lead to uplifts in excess of 7% in passenger numbers across various regions in the UK, for example:

- Nottingham – 12% [23]
- Hertfordshire – 7% [23]
- Derbyshire – 17% [23]
- Transport for London (TfL) – 10-15% [49]
- Reading – 9% [5]

In addition, fare incentives have been shown to increase patronage. Nottingham reported a 10% increase [4], West Yorkshire Combined Authority (WYCA) a 15% with fare reductions and simplified ticketing [32] and TfGM a 12% increase in an initiative targeted at young adults and students [41].

Application to modelling assumptions

The proposed vision-led mitigation supports step improvements in extension and enhancement of the local bus network, which includes priority measures, better RTI and simplified ticketing. At preferred allocations incentive schemes would also encourage greater use of local buses.

Car trips considered in scope to switch are those starting and finishing within the Colchester council area that are 2-15km long. At development sites it is estimated local bus improvements could contribute to a 15% modal switch away from car and 13% at reference case sites

4.3.6 Mobility hubs and interchanges

Mobility Hubs combine a range of facilities to support inter-modal travel and facilitate micro-mobility sharing including e-scooters and cycle hire. Mobility hubs can enhance both the legibility of public transport and active travel networks by providing efficient transfer between two modes, such as bus and cycle, thereby further increasing the attractiveness of travelling actively or by public transport for long journeys.

For the purposes of this assessment, and the avoidance of double counting modal shift from walking, cycling, RTS, P&R and bus interventions, mobility hubs will focus on the added contribution from car clubs, demand responsive transport (DRT) and freight consolidation.

4.3.6.1 Car Clubs

DfT commissioned research has found that [3] found that:

- vehicle ownership among car club members decreased by 9.5% - 33.1%. The UK-based example showed that 19% of car club members using the back-to-bay model of car sharing relinquished their household vehicle.
- for the UK-based example, 27% of car club members claimed they would have purchased or leased a private car if they had not joined the car club.
- evidence from a study undertaken in The Netherlands suggests that 15% of kilometres driven by a car club member would not have been travelled without their membership – but still pointed to an overall decrease in distance travelled by car.
- a significant percentage (68%) of UK business-to-business car club members used a car club vehicle for their usual business travel (51% would have used a private car for these trips).
- in the UK-based study, 8% of car club members would swap back to using a rental or private car for journeys they take using car club vehicles.
- where car-club pick up points are located nearby public transport, back-to-bay car club members increased their car club use and were more likely to use public

transport to travel to and from car club pick-up locations.

- in Bristol, car club members say they are 50% less likely to own a car compared to the general population. This is supported by data from Edinburgh and Brighton and Hove where car club membership has been associated with a reduction in private car ownership.
- in London, data suggests that each car club vehicle can replace up to 10 privately owned cars [10], while in Bremen data shows each car club vehicle removes 16 cars from the road [11]. This is supported by data in Bergen which shows after the introduction of car clubs at mobility hubs, usage increased by 70%, resulting in a reduction in street residential car permits being sold [11].
- car sharing schemes, whether point-to-point or free floating, also lead to reduced car ownership with studies indicating 5-15 cars are replaced for each shared car added to the fleet [50].

4.3.6.2 *Demand Responsive Transport (DRT)*

DRT has demonstrated a measurable success in reducing private car trips and in the way of customer satisfaction, reportedly due to the convenience, affordability and flexibility of the service, particularly in largely rural and dispersed areas where local bus services are limited, or it may not be commercially feasible to implement a timetabled bus service:

- the Northwest Downloads service, and the Thatcham Connect service (collectively known as the West Berkshire DRT) have both successfully attracted new users [23]
- West Midlands On-Demand launched in 2019 and reduced private car trips by 20% in the first year [36]
- since the launch of the Arriva Click service in Liverpool, which is known for being particularly affordable, there has been a 15% reduction in private car trips [1]
- Go2 in Oxfordshire has shown a 10% decrease in private car trips within the first 6 months in operation [55]
- Tees Flex, in the Tees Valley, launched in 2020 and has contributed to a 12% reduction in private car trips [44]
- Hertfordshire and West Berkshire noted a large proportion of users were accounted for by concessionary fare users and connecting rural areas [23] (which demonstrates how the service can remove the barriers to transport providing essential connectivity to those who may not have alternative modes of transport)

4.3.6.3 *Sustainable last mile journeys and freight consolidation*

A significant barrier to the adoption of non-car alternatives is the perception that public transport and active modes are less convenient, especially for picking up up deliveries. Mobility hubs therefore provide opportunities for the delivery of goods as they act as convenient collection points, i.e., at parcel lockers, or through the provision of e-cargo bikes as an alternative to last-mile delivery.

Application to modelling assumptions

The proposed vision-led measures support the introduction of a network of mobility hubs, which will improve interchanges between public transport and active modes. Parcel lockers and shared e-cargo bikes will support the convenience of public transport and active modes; while DRT will enhance the reach of the local bus network.

Last mile freight and DRT are considered supporting measures for cycling, RTS and local buses, so no additional contribution to modal shift is estimated.

However, car clubs are seen as able to reduce car trips. On the assumption that one club car could be provided for every 40-50 homes, this could lead to no less than 250 car trips removed from the peak hours. Furthermore, since car clubs can be at other locations this could reduce reference case car trips by no less than 80 trips.

4.3.6.4 *Other measures to encourage sustainable transport*

The list of categories of sustainable transport interventions in Section 4.2.1 also included land use, travel planning and highways and traffic management.

There is strong evidence that concentrating development around public transport interchanges increases public transport use. Indeed, this is a key reason why some continental European cities and towns have greater public transport use than UK cities and towns with comparable public transport systems [43]. However, such a change could only occur over the very long term and there is no evidence to suggest that land use changes would result in additional mode shift by 2041.

This does not mean that new developments should not be taking every opportunity to integrate land use and sustainable transport – thereby reducing the distance of trips and prioritising sustainable travel in accordance with national, ECC and CCC policies. Integrated land use and transport planning will also support the achievement of modal shift evidenced in earlier parts of this section ([52] and [42]). Land use and transport integration also extends to use of parking policies. This was discussed in relation to P&R in Subsection 4.3.4, but would also support sustainable transport choices more widely.

There is wide range of evidence on the effectiveness of travel planning, which would be targeted at new developments. Travel plans at new developments would be expected to set and monitor progress against targets for sustainable transport; promote use of ST through providing information and incentives; and arrange complementary measures to overcome barriers to using ST which could include providing cycles and cycle maintenance facilities, subsidising public transport tickets and arranging car clubs. It is considered sensible that the contribution of travel planning is not counted in addition to the modal shift associated with walking, cycling, RTS, P&R bus and mobility hub measures, as identified in the previous subsections. Nevertheless, travel planning is a key measure to support use of ST infrastructure:

- In Sheffield, the BetterPoints behaviour change program significantly reduced car journeys. Within six months, the initiative eliminated 830,000 car trips and achieved nearly a 200% return on investment in carbon savings [24].
- In Milton Keynes, the Get Around Rewards pilot attracted high levels of engage-

ment and achieved a 62% shift from car travel to more sustainable modes [28].

- Renfrewshire Council's "Not Far? Leave the Car" campaign incentivised local residents to make active and sustainable journeys. Between March 2022 and April 2023, the program successfully shifted 200,000 car journeys to more sustainable transport options [29].
- In Buckinghamshire, 54% of the assessed trips replaced car journeys [25].
- BetterPoints surveys of 9 local areas showed reductions in short car journeys by an average of 20% [30].
- Leicester City and Leicestershire County councils' "Choose How You Move" programme promotes active and sustainable travel while reducing unnecessary car journeys. The successful "Drive Less" campaign, which targeted regular drivers of short trips, resulted in 52% of participants changing their behaviour, collectively making 25% fewer car journeys [27].
- Brighton & Hove City Council's "Move for Change" campaign, launched in 2021, aimed to reduce reliance on private motor vehicles among local residents and workers. In its second year (2022), participants recorded over a million sustainable journeys, with more than 620,000 of these replacing single-occupancy car trips [26].

Highways and traffic management measures also have a key role in supporting sustainable transport, for example, safe walking and cycling routes and priority bus measures. These though are introduced and discussed in Chapter 6. First it is considered useful to calculate the cumulative impact of sustainable transport measures leading to modal shift.

4.4 Conclusion

This chapter has introduced the vision-led, sustainable and integrated transport strategy to support the transport vision of growth and mitigate the impact of BaU levels of car trips arising from the preferred site allocations.

The categories of interventions include integration of land use and transport; walking; cycling; RTS, P&R and local buses; mobility hubs; travel planning; highways and traffic management.

The chapter has provided evidence on the impact of sustainable transport measures and the extent to which they could contribute to modal shift away from private car journeys. In considering modal shift, consideration has been given to the type of car journeys by geography and distance that could switch.

The next chapter explains how a cumulative modal shift amount has been calculated and tested in the transport model.

5 Impact of sustainable transport measures

5.1 Introduction

The previous chapter demonstrated that there is a case for sustainable transport interventions to reduce the amount of car trips from a BaU scenario. This chapter explains how trip reductions have been targeted based on geography of trips (e.g. urban or inter-urban) and the distance of those trips, and grounded in the evidenced experience of other towns and cities, largely in the UK. The chapter then demonstrates the impact of ST measures in the transport model.

A shift to sustainable travel contributes to keeping people and goods moving, however, it does not negate the need for highway and traffic management measures – which are also needed to rebalance acceptably the use of road space towards public and active transport. Hence the findings of this chapter set the scene for consideration of options for highway traffic management measures in the following chapter. Evidence is presented in two parts: out of model car trip reductions; and within model tests showing the impact of remaining car trips.

5.2 Reduction in car trips

5.2.1 Method

Section 4.2.1 introduced categories of interventions and then 4.3 identified the likely modal change from car to sustainable transport. This section explains how the individual changes have been collated and applied to the transport model NEMo in order to estimate the impact of sustainable transport.

Firstly the geography of where trips occur in the council area are defined as being:

- Urban to Urban trips
- Non-Urban to Non-Urban trips
- Non-Urban to Urban trips
- External (outside council area) to Urban trips
- External (outside council area) to Non-Urban trips

Using these trip geographies, for each of the categories of interventions, those trips that are in scope to switch from car to public transport are identified as shown in table 5.1. The number 1 shows that a category of interventions will influence trips in that geography; and 0 that there will be no influence. (Numbers are used to reflect the mathematics underlying the method.)

Table 5.1: Relationship categories of measures and geography of trips

Group	Urban -> Urban	Non-Urban -> Urban	External (council area) -> Urban	Non-Urban -> Non-Urban	External -> Non-Urban
P&R	0	1	1	0	0
RTS	1	1	0	0	0
Bus	1	1	0	1	0
Mobility hubs	1	1	0	1	0
Cycling	1	1	0	1	0
Walking	1	0	0	0	0

Then for each of the categories of interventions, the distance of trips are considered. For example car trips are only considered in scope to switch to cycling if they are under 10km in length (as suggested in section 4.3). Table 5.2 shows the constraints on categories of interventions by distance.

Table 5.2: Relationship categories of measures and distance of trips

Group	0<d<=2 km	2<d<=5 km	5<d<=10 km	10<d<=15 km	15<d<=20 km	20<d<=40 km	d>40 km
P&R	0	1	1	1	1	1	1
RTS	0	1	1	1	1	0	0
Bus	0	1	1	1	0	0	0
Mobility hubs	1	1	1	0	0	0	0
Cycling	1	1	1	0	0	0	0
Walking	1	0	0	0	0	0	0

As presented, Tables 5.1 and 5.2 are matrices. Matrix multiplication can be thought of as a filtering or sorting system. Hence, if the first row of Table 5.1 is multiplied by the first row of Table 5.2 this will produce a new matrix identifying those trips in scope by geography and distance for the P&R category. (The mathematical calculation is the transpose of the first row of Table 5.1 multiplied using matrix multiplication with the first row of Table 5.2). The resulting matrix constrains P&R trips in scope to switch from driving all the way to using P&R is shown in table 5.3.

Table 5.3: Trips in scope to switch to P&R by geography and distance

	0<d≤2 km	2<d≤5 km	5<d≤10 km	10<d≤15 km	15<d≤20 km	20<d≤40 km	d>40 km
Urban -> Urban	0	0	0	0	0	0	0
Non Urban -> Urban	0	1	1	1	1	1	1
External -> Urban	0	1	1	1	1	1	1
Non Urban -> Non Urban	0	0	0	0	0	0	0
External -> Non Urban	0	0	0	0	0	0	0

The process is repeated for subsequent rows of Tables 5.1 and 5.2 to identify trips in scope, constraining by geography and distance, for the remaining categories of measures. These are not shown.

Next the impact of each of the categories of measures is considered. Firstly it is necessary to identify between which modes would trips switch. For example, there was evidence that cycling improvements would abstract trips from public transport as well as car. This is reflected in Table 5.4.

Table 5.4: Switching of trips between modes by category of intervention

Group	Car	P&R	Bus	Rail	Cycling	Walking
P&R	-1	1	0	0	0	0
RTS	-1	0	1	0	0	0
Bus	-1	0	1	0	0	0
Mobility hubs	-1	0	0.5	0	0.5	0
Cycling	-0.5	0	-0.5	0	1	0
Walking	-1	0	0	0	0	1

Then for each of the categories of interventions the scale of switching from car was defined – noting that estimates of the scale of impact of categories of interventions were considered in terms of abstraction from car trips. The scale of impact also differs between preferred site allocations and settlements in the reference case as shown in Table 5.5.

Table 5.5: Scale of abstraction from car trips to sustainable transport by category of sustainable transport interventions

Group	Unit of change	Impact on development car trips	Impact on reference car trips
P&R	Cars	40	260
RTS	Proportion	0.24	0.17
Bus	Proportion	0.15	0.13
Mobility hubs	Cars	250	80
Cycling	Proportion	0.15	0.05
Walking	Proportion	0.15	0.08

Having ascertained car trips in scope for switching, to which modes they will switch and the scale of car trips in scope, the next part of the method applies the information to trips in the Colchester council area.

5.2.2 Change in car trips

The transport model contains detailed information on origins and destinations of trips by car commuting, car business, car other, LGV, HGV, bus and rail trips. In addition, there is a spreadsheet model that estimates P&R trips.

Consequently, the model was interrogated to identify the number of trips in each of the geographies and for each of the distance bands described in Subsection 5.2.1. However, the transport model does not include cycling and walking trips. Therefore, the latest National Travel Survey (NTS) was used to estimate the proportionate of walking and cycling trips in the geographic and distance bands being used. For example, NTS can provide an estimate of the proportion of walk or cycle trips compared to car trips by its geographic categories and distance bands. These were sufficient to derive an estimate of walking and cycling trips in the council area given that the amounts of car trip were known from NEMo.

It should be noted that this method is likely to under-estimate the total amount of sustainable travel since car trips in a strategic transport model do not accurately represent very short trips of which there are a large number. Nevertheless, these short trips, most of which are already walked, are unlikely to be impacted by the interventions proposed to mitigate the transport impact of preferred site allocations.

The top rows of the tables below show the BaU car and ST trips for preferred allocations, reference case trips and total trips in the 2041 AM and PM peaks by geography. The middle rows show the reduction in car trips for each of the categories of measures by geography (which, using the method above, have also been constrained by distance). The final rows show the resulting amount of trips after the ST reductions.

Table 5.6: AM peak hour impact of sustainable transport measures on car trips at preferred allocations

Trip type	Local urban	Local rural	Local rural to urban	External to urban	External to rural	Total trips
BAU car trips	1184	671	1279	821	1986	5941
Approximate BAU car mode share	0.64	0.76	0.67	0.77	0.87	0.74
Impact of RTS	-24	0	-25	0	0	-49
Impact of BSIP	-13	-11	-12	0	0	-36
Impact of P&R	0	0	-24	-16	0	-40
Impact of mobility hubs	-119	-46	-85	0	0	-250
Impact of LCWIP	-85	-5	-4	0	0	-95
Total impact of ST and other responses	-241	-62	-150	-16	0	-470
Car trips after ST	943	609	1128	805	1986	5472
Car mode share after ST	0.5	0.71	0.61	0.76	0.87	0.69
Proportion reduction in mode share	-0.22	-0.06	-0.09	0	0	-0.07

Table 5.7: AM peak hour impact of sustainable transport measures on car trips in the reference case

Trip type	Local urban	Local rural	Local rural to urban	External to urban	External to rural	Total trips
BAU car trips	10737	1092	4095	11932	5832	33689
Approximate BAU car mode share	0.65	0.76	0.67	0.8	0.87	0.74
Impact of RTS	-520	0	-56	0	0	-576
Impact of BSIP	-393	-1	-40	0	0	-434
Impact of P&R	0	0	-65	-195	0	-260
Impact of mobility hubs	-62	-4	-14	0	0	-80
Impact of LCWIP	-327	-1	-10	0	0	-338
Total impact of ST and other responses	-1302	-6	-186	-195	0	-1688
Car trips after ST	9435	1087	3909	11737	5832	32001
Car mode share after ST	0.57	0.76	0.65	0.8	0.87	0.7
Proportion reduction in mode share	-0.12	0	-0.03	0	0	-0.04

Table 5.8: AM peak hour combined impact of sustainable transport measures on car trips on reference case and preferred allocations

Trip type	Local urban	Local rural	Local rural to urban	External to urban	External to rural	Total trips
BAU car trips	11921	1763	5374	12753	7818	39630
Approximate BAU car mode share	0.65	0.76	0.67	0.8	0.87	0.74
Impact of RTS	-544	0	-81	0	0	-625
Impact of BSIP	-406	-12	-52	0	0	-470
Impact of P&R	0	0	-89	-211	0	-300
Impact of mobility hubs	-181	-49	-100	0	0	-330
Impact of LCWIP	-412	-6	-15	0	0	-433
Total impact of ST and other responses	-1543	-67	-336	-211	0	-2158
Car trips after ST	10378	1696	5037	12542	7818	37472
Car mode share after ST	0.56	0.74	0.64	0.8	0.87	0.7
Proportion reduction in mode share	-0.13	-0.03	-0.04	0	0	-0.05

The tables indicate that the evidence on the impact of ST leads to a modest change in car mode share of all trips. In some respect, this runs counter to rhetoric on mode share targets and the estimate could be criticised for not being ambitious or visionary enough. However, it is hoped that the reader will gather the effort being placed in ensuring that mode share is grounded strongly in evidence of what has been attained elsewhere. Nevertheless, as will be shown in Section 5.3, the amount of modal shift away from car trips is enough to significantly contribute to the alleviation of the transport impact of preferred site allocations.

It is worth noting that care needs to be taken in making a direct comparison between the car mode share information in the above tables and mode share targets because short distance trips are being excluded. The tables do *not* provide evidence that large developments should *not* set ambitious targets as part of their visions – which would exceed the modal shift to ST estimated in this report. However, the NPPF vision-based approach needs to be validated against empirical evidence. Whilst modal shift at development shown in the above tables may be less than aimed for by developers and written into policies such as the TCBGC DPD, the evidence does point to a shift towards ST for reference case trips, which is not surprising given route interventions benefit others outside of preferred site allocations. While the percentage mode share change at preferred allocations is much greater than for reference case trips, the absolute impact on car trips is greater for reference case trips than for trips at preferred allocations.

This, of course, is why the local plan is vision-based. It is not providing a vision for only preferred site allocations, but for the whole council area – to ensure that growth is carried out in a way that benefits all.

Table 5.9: Impact of sustainable transport measures and other responses on car trips at preferred allocations

Trip type	Local urban	Local rural	Local rural to urban	External to urban	External to rural	Total trips
BAU car trips	1157	752	1346	834	2076	6165
Approximate BAU car mode share	0.63	0.75	0.66	0.81	0.87	0.74
Impact of RTS	-24	0	-25	0	0	-49
Impact of BSIP	-13	-13	-12	0	0	-38
Impact of P&R	0	0	-24	-16	0	-40
Impact of mobility hubs	-114	-48	-88	0	0	-250
Impact of LCWIP	-90	-7	-5	0	0	-102
Total impact of ST and other responses	-241	-68	-154	-16	0	-479
Car trips after ST	916	684	1192	819	2076	5686
Car mode share after ST	0.48	0.7	0.61	0.81	0.87	0.69
Proportion reduction in mode share	-0.23	-0.06	-0.08	0	0	-0.07

Table 5.10: Impact of sustainable transport measures and other responses on car trips in the reference case

Trip type	Local urban	Local rural	Local rural to urban	External to urban	External to rural	Total trips
BAU car trips	11700	1161	4319	12143	6234	35557
Approximate BAU car mode share	0.63	0.75	0.66	0.83	0.88	0.74
Impact of RTS	-635	0	-57	0	0	-693
Impact of BSIP	-479	-2	-41	0	0	-521
Impact of P&R	0	0	-67	-193	0	-260
Impact of mobility hubs	-62	-3	-14	0	0	-80
Impact of LCWIP	-238	0	-12	0	0	-347
Total impact of ST and other responses	-1512	-5	-191	-193	0	-1901
Car trips after ST	10189	1156	4127	11950	6234	33656
Car mode share after ST	0.56	0.75	0.64	0.83	0.88	0.71
Proportion reduction in mode share	-0.11	0	-0.03	0	0	-0.04

Table 5.11: Combined impact of sustainable transport measures and other responses on car trips at preferred allocations and in the reference case

Trip type	Local urban	Local rural	Local rural to urban	External to urban	External to rural	Total trips
BAU car trips	12857	1914	5665	12977	8309	41722
Approximate BAU car mode share	0.63	0.75	0.66	0.83	0.88	0.74
Impact of RTS	-660	0	-82	0	0	-742
Impact of BSIP	-492	-15	-53	0	0	-559
Impact of P&R	0	0	-92	-208	0	-300
Impact of mobility hubs	-176	-52	-102	0	0	-330
Impact of LCWIP	-425	-7	-16	0	0	-449
Total impact of ST and other responses	-1753	-74	-345	-208	0	-2380
Car trips after ST	11104	1840	5320	12769	8309	39342
Car mode share after ST	0.56	0.73	0.63	0.83	0.88	0.7
Proportion reduction in mode share	-0.12	-0.02	-0.04	0	0	-0.04

Having established the likely scale of reduction in car trips, the next section tests the impact of this reduction in NEMo.

5.3 Impact of sustainable transport packages with reduced car trips

To assess the impact of sustainable transport mitigations, the BaU car trip demand is reduced to reflect the ST reductions. This is achieved by only reducing trips between model zones with the right geography or distance band. The resulting scenario is:

- Scenario 3 – ST growth – ST demand replaces reference case and BaU demand, which reflects a reduction in car trips arising from sustainable transport mitigation measures proposed for the new local plan.

Using the approach to comparative analysis introduced in Subsection 3.3.1, Scenario 3 is assessed against the Scenario 1 baseline. Scenario 3 only includes changes to car trips with no other mitigations than the ones already discussed for the baseline. As a reminder, the movement performance is shown by the coloured scale 1-15, whilst concern over the level of change is denoted passable ✓, caution ! or unsatisfactory X.

Table 5.12 compares results for Scenario 1 and Scenario 3 across key locations for models with and without the A1331 Link Road. The overall score in both the AM and PM peaks with link road completion falls one level to low substantial congestion (Level 10) compared to being at Level 11 in Scenario 2 without ST reduction. A similar one point fall is seen in the AM and PM in the model without link road completion compared to Scenario 2. Hence, overall ST reductions are helping to alleviate the impact of growth.

However, compared to Scenario 1, there is still an overall worsening that can be considered unacceptable at locations. In Scenario 3 with the link road, the Lexden Road

and A12 J25 areas of interest in the western sectors (third and fourth rows in Table 5.12) both are showing extreme congestion and are flagged as caution and unsatisfactory, respectively. Meanwhile, the lower Ipswich Road sector shows substantial congestion; while less than in Scenario 2, the change from Scenario 1 still produces a caution flag.

In the PM peak with the link road, extreme congestion is predicted in the area including Northern Approach Road, Mill Road, Via Urbis Romanae and A12 J28. High moderate to substantial congestion is also seen at Greenstead, lower Ipswich Road, Lexden Road A12 J25 sectors. Accordingly, across these sectors, caution and unsatisfactory flags are shown in Table 5.12. The exception is at lower Ipswich Road where the change from Scenario 1 conditions is not significant enough to raise a warning flag.

In Scenario 3 without link road completion, Greenstead roundabout is still predicted to suffer from extreme congestion in both the AM and PM peaks, which changes little from Scenario 2. The reason that ST does not impact significantly at Greenstead is because reference case trips coming from the east are already benefiting from RTS and P&C; and there are no preferred site allocations to the east for which BaU car trips could switch to ST. The observation, nevertheless, provided confidence that the model is behaving sensibly and appropriately reducing trips only where it is realistic to do so.

To help visualise the impact across the network of ST growth, Figures 5.1 and 5.2 show the the change in speed on links across the network to Scenario 2 from Scenario 1 with link road completion in the AM and PM peaks, respectively:

- in the AM comparing Figure 5.1 with Figure 3.3 shows the relative change in speed is noticeably lessened across the network in the AM peak except around A12 J25 and A12 J26 (which is part of the Lexden Road area of interest)
- in the PM comparing Figure 5.2 with Figure 3.4 shows a better position with respect to speed change is being achieved with ST but not as great an impact as in the AM

The appendices show further model plots for Scenario 3, which have been placed adjacent to the other scenarios with the same assumption for link road completion. Speed and relative queue plots of Scenario 3 in the AM and PM peaks are as follows:

- Figures D.7 and D.20 – speed plots of Scenario 3 with A1331 link road completion in the AM and PM peaks, respectively
- Figures E.7 and E.20 Speed – speed plots of Scenario 3 with delayed A1331 link road completion in the AM and PM peaks, respectively
- Figures D.12 Relative Queue and D.25 – relative queue (blocking back) plots of Scenario 3 with A1331 link road completion in the AM and PM peaks, respectively
- Figures E.12 Relative Queue and E.25 Relative Queue – relative queue (blocking back) plots of Scenario 3 with delayed A1331 link road completion in the AM and PM peaks, respectively

Table 5.12: AM and PM peak movement assessment of Scenario 3 (ST) with Scenario 1 (baseline)

Sector	Location	AM Peak				PM Peak			
		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road	
		Scenario 1 (Baseline)	Scenario 3 (ST)	Scenario 1 (Baseline)	Scenario 3 (ST)	Scenario 1 (Baseline)	Scenario 3 (ST)	Scenario 1 (Baseline)	Scenario 3 (ST)
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	7	✓	9	✗	8	!	10	✗
	Ipswich Road, East Street, East Hill & Harwich Road	9	!	10	✓	10	✓	10	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	10	!	11	!	8	!	8	!
	A12 J25 / A120 (western)	6	✗	6	✗	5	✗	5	✗
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	✓	9	!	10	✗	11	✗
	A12 J29 / A120 (eastern)	7	✓	8	✓	8	✓	8	✓
Outer	Tiptree	4	✓	4	✓	4	✓	4	✓
	Aldham	3	✓	3	✓	3	✓	3	✓
	A12 J20-25	8	✓	8	!	7	✓	7	✓
Overall assesement combining all areas		8	10	9	11	8	10	8	10
More or less free flow Travelling slower Moderate congestion Substantial congestion Extreme congestion Acceptability of change									
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Passable ✓ Caution ! Unsatisfactory ✗									

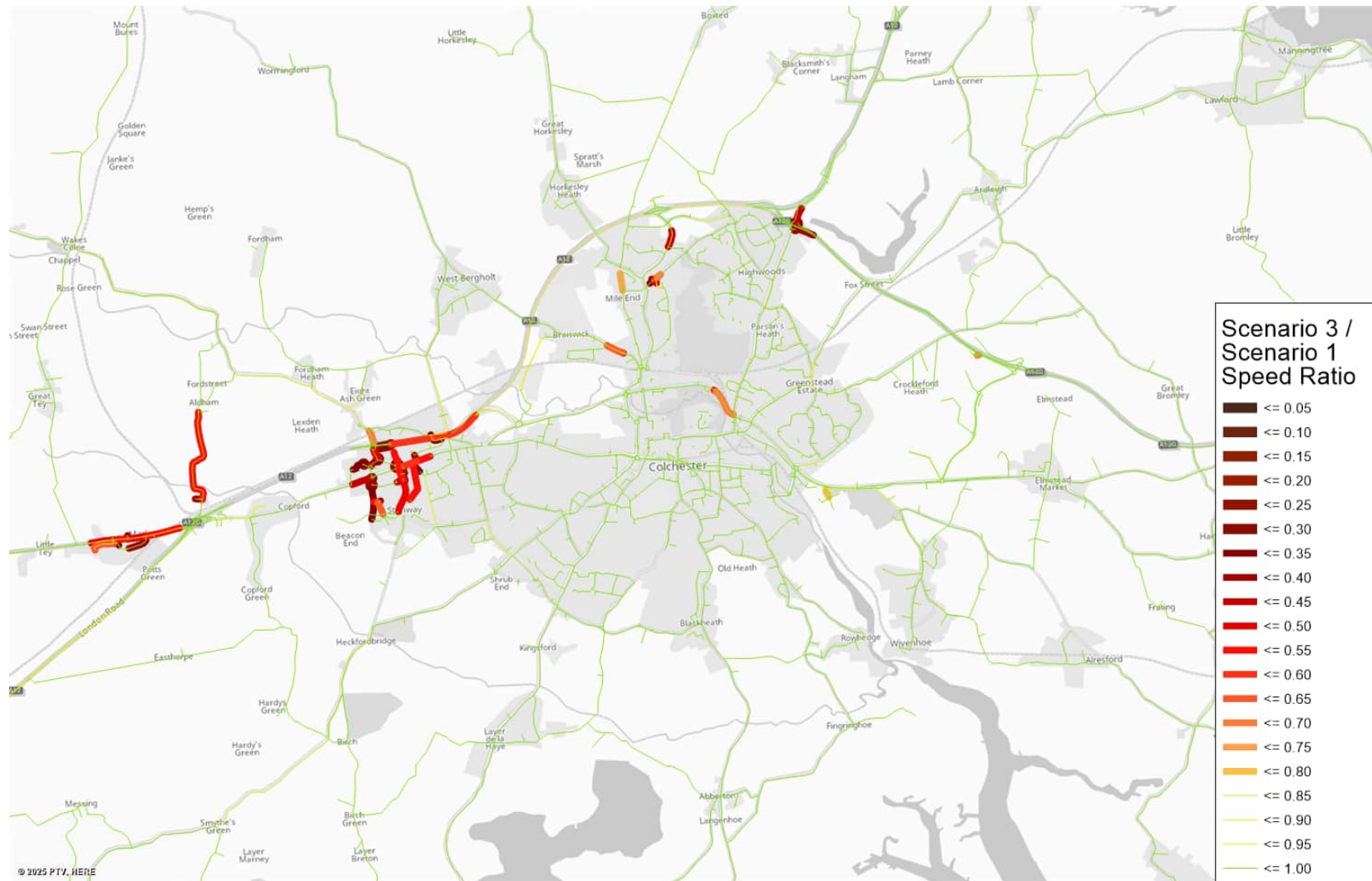


Figure 5.1: Difference in traffic speed between Scenario 3 (ST growth) and Scenario 1 (baseline) – AM peak

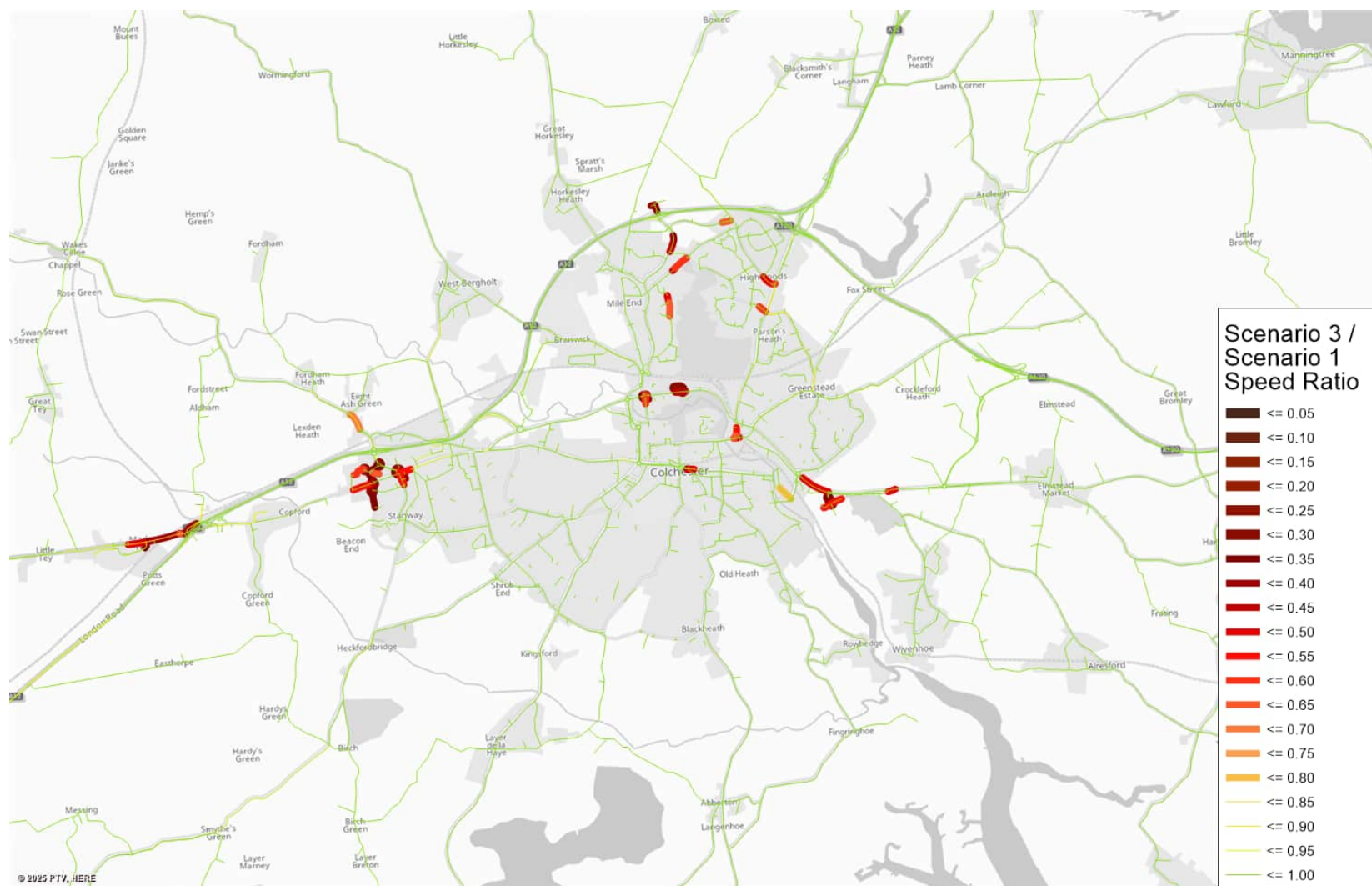


Figure 5.2: Difference in traffic speed between Scenario 3 (ST growth) and Scenario 1 (baseline) – PM peak

5.4 Conclusion

This chapter has explained how the scale of modal shift as a result of ST mitigations has been estimated and applied in the transport model NEMo. The resulting ST scenario (Scenario 3) was then compared to the baseline (Scenario 1).

The comparison shows an improving position with respect to BaU scenario without mitigation (Scenario 2). This shows that the sustainable transport measures will contribute significantly to mitigation. However, there are still areas of caution and unsatisfactory performance on the road network due to the impact of preferred allocations which point to the need for further mitigation.

The next chapter considers additional highways and traffic management mitigation, which would also support ST interventions.

6 Integrating sustainable transport with traffic management and highways measures

6.1 Introduction

Chapter 3 established the challenges on the highway network arising from the transport impact of preferred site allocations. Modelling evidence shows that unmitigated BaU growth at preferred site allocations with A1331 link road completion leads to unsatisfactory performance in either the AM or PM peaks across key parts of the highway network including the lower end of Ipswich Road through to East Hill; the Northern Approach Road sector including A12 J28, Via Urbis Romanae and Mill Road; A12 J25; and the London Road and Lexden Road corridor from A12 J26 to Colne Bank roundabout. If the link road were delayed, which is required to support the transport mitigation of TCBGC, then performance through Greenstead roundabout would also be unsatisfactory.

In order to alleviate the transport impact of preferred site allocations, Chapter 5 established that investment in ST begins to alleviate traffic problems. However, across either the AM or PM peaks with link road completion there is unsatisfactory performance at A12 J25 and the Northern Approach Road sectors; and other areas are flagged as requiring caution. Should the link road not be completed then the impact of growth at Greenstead roundabout would also be unsatisfactory.

Consequently, in addition to ST measures, there is a need to introduce highway and traffic management schemes to complement the contribution from sustainable travel and land use measures. In order to identify appropriate measures the highway network has been considered in parts relating to the main line SRN, the approaches to the SRN where the interaction between NH and ECC networks is the most pronounced, city centre approaches where movement of people is shifting more noticeably to ST and outer areas.

This chapter outlines the approach to highways mitigations in these parts of the network which comprise junction schemes and expansion of signal controls, and better co-ordination of between signals and balancing the movement modes using the highway network. The chapter also assesses the impact of the highways and traffic management strategy in NEMo by adding in measures and signal co-ordination to the ST scenario.

6.2 Approach to identifying solutions

The current list of proposed highway and traffic management interventions is shown in Tables H.8 and H.9. It should be noted that these measures do not include local access arrangements to developments as, in most cases, these details are not known. Nevertheless, allowances for access arrangements, proportionate to the sizes and locations of site allocations, have been included in the IADP. As the plan progresses, further details on access arrangements and co-ordination with other IADP measures will be added into the evidence base.

6.2.1 A12 and A120 approaches

The baseline mitigation at A12 J29 has addressed the queueing back to the mainline on the westbound offslip from the A120. At other locations on the SRN mainline no blocking back in the model is identified although there are slow speeds at some loc-

ations, which would have been assisted by the now cancelled J19-25 A12 widening scheme.

The model shows that the impact of preferred allocations is of greater concern on the approaches to and off A12 junctions: J25, J26, J27 and J28. Such issues could, if they worsen, lead to issues exiting the A12 and contribute to lower speeds.

The suggested solution for J25 focuses on increasing capacity on the A120 approaches and introducing traffic signals to better balance movements between the A12 and A120, particularly on the station-side (northbound off-slip roundabout). Early assessments suggest that this may also involve reconfiguring the existing roundabout to enhance capacity and performance. Options under consideration include converting the roundabout into a large, signalised crossroads junction or retaining the roundabout with a revised layout. This would be delivered alongside a package of sustainable transport mitigation measures, including improved pedestrian and cycle crossings over the A12, a proposed new P&R facility, mobility hubs, and integration with an extension of the RTS.

At J26, J27 and J28 there are more limited opportunities to increase capacity; consequently, the preferred strategy is concentrating investment in traffic management solutions by:

- extending signalisation to the Essex Yeomanry Way/Western Approach to J26 and J27 Spring Lane roundabout
- co-ordinating new signals and existing signals – for which the IADP includes an allowance for upgrades to the urban traffic control system to utilise latest technologies to dynamically manage traffic, respond to incidents in real time and prioritise green time for public transport and pedestrian and cycle crossings, which will assist J25 through to J29

6.2.2 City centre approaches

The baseline mitigation has addressed current problems at Greenstead roundabout which seem able to handle growth from preferred site allocations. However, other city centre approaches away from the SRN are shown in the model to be straining from the impact of growth even after ST mitigation. For example, the lower end of Ipswich Road through to East Hill and Colne Bank roundabout extending to North Station – even though Colne Bank roundabout benefits from signalisation as a committed scheme, it is not able to handle the impact of preferred sites.

In these locations, there is a greater trade off between the movement of general traffic with buses and active travel. Therefore some congestion would be expected to facilitate priorities for, and to some extent encourage, public transport and active travel.

The most practicable approach is again through traffic management solutions which involve:

- extending signalisation - including Albert and Essex Hall roundabouts, and Harwich Road and Ipswich Road roundabouts with St Andrew Avenue
- using the proposed dynamic traffic management co-ordinate and prioritise flow to keep people and goods moving – which could at times involve metering the flows of traffic - holding general traffic back at locations to avoid severe congestion at others and support fast and reliable public transport

6.2.3 Outer areas

While the main focus is on the urban area, the forecast 2041 model plots have been inspected to identify issues in outer areas. However, since some outer areas are not in the area of detailed modelling, issues can sometimes be understated in the strategic model. Therefore interpretation of issues needs to be complemented by local intelligence, and where available, studies involving junction models.

This wider review has noted the need for improvements to the priority junction between B1022 Maldon Road / Warren Lane Junction near Heckfordbridge, south west of Colchester – which involves creating a roundabout to address road safety and delay.

In addition, it is recommended, that further checks on potential local issues at Aldham and Tiptree are reviewed at the Regulation 19 stage, though at present, there is not strong evidence in NEMo of a need for additional highway mitigation beyond sensible access arrangements at nearby site allocations. It is expected that the slowing of traffic between Aldham and A12 J25 can be addressed by the J25 scheme that has been recommended in Subsection 6.2.1

Further traffic management and highway measures are also set out in Appendix Tables H.8 and H.9.

6.2.4 Dynamic traffic management

The previous subsection have outlined a key role for dynamic traffic management. This subsection expands on the importance of this intervention and how it could be achieved.

The existing urban traffic control system managed by ECC already helps keep traffic in Colchester moving through systems such as SCOOT and MOVA. The system is also evolving to remotely detect RTS and bus vehicles in order to trigger green time for public transport. In addition, there are experiments with imaging technologies such as the Vivacity system to detect different types of road users and dynamically alter signals. The current system also supports priority for cyclists and pedestrians and is an essential component of road safety.

It is recognised, however, that the ability to harness data across all modes and the skills to predict and respond to changing conditions in real time through advance in computing are improving all the time. Therefore it is proposed that a key intervention, funded collectively across site allocations, should be towards the next generation of traffic control and management.

This will use traditional data sources e.g. vehicle and speed detection and new data sources supported by techniques including machine learning and artificial intelligence. By incorporating this new approach, alongside the latest in real time traffic modelling systems, a world class state of the art adaptive and integrated traffic management system would be developed. Through such investment, it is also expected it would support the local technology sector and link to areas of computing excellence at the University of Essex.

Supporting this will be a digital communications backbone providing connectivity between all on-street assets. This infrastructure lays the foundations for data collation into a cloud-based database and this will allow for real time traffic modelling and simulations to trigger signal patterns across the urban area. It would naturally co-ordinate with NH traffic management systems used on the SRN.

Vision

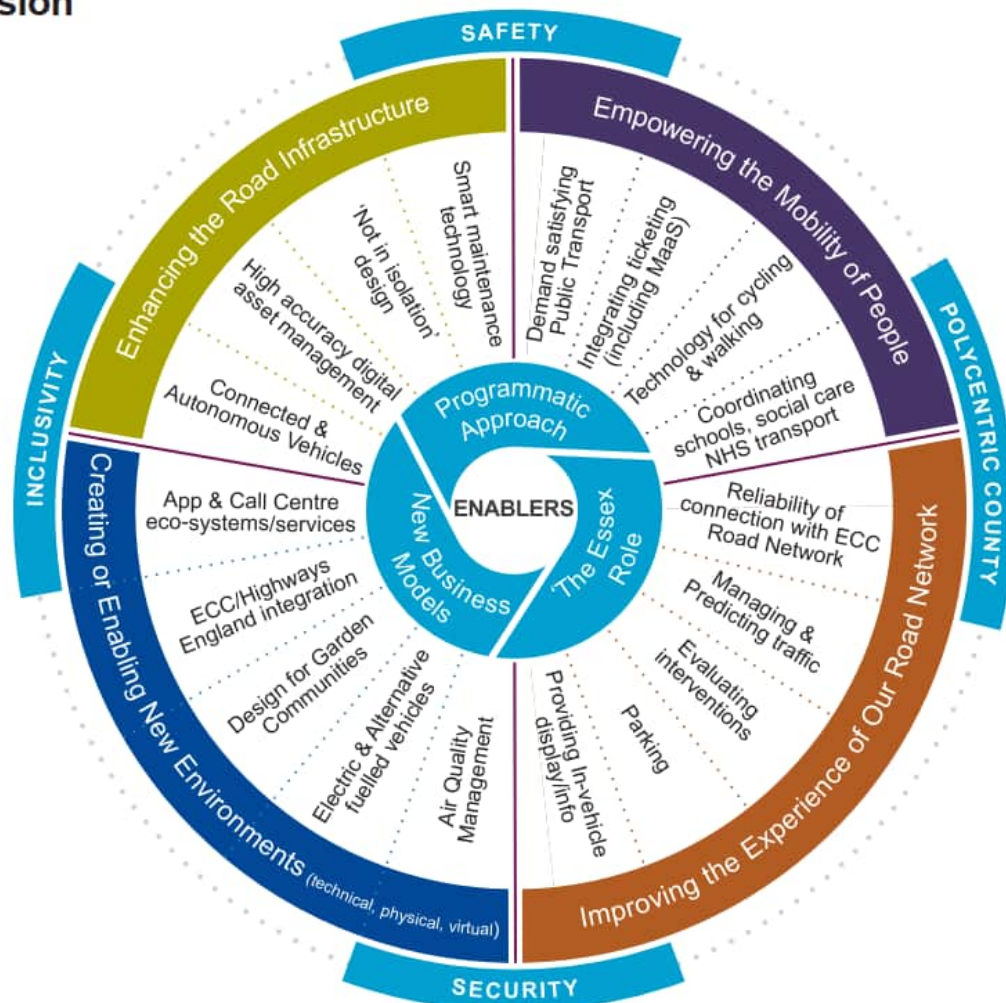


Figure 6.1: Dynamic movement management vision

The vision for the system is shown in Figure 6.1 whilst the operational components are outlined in Figure 6.2. The investment in the system would require on going revenue support opposed to a one-off single investment. Therefore, in many respects, it is a more affordable option than large infrastructure projects as developers could pay contributions only after housing has been completed.

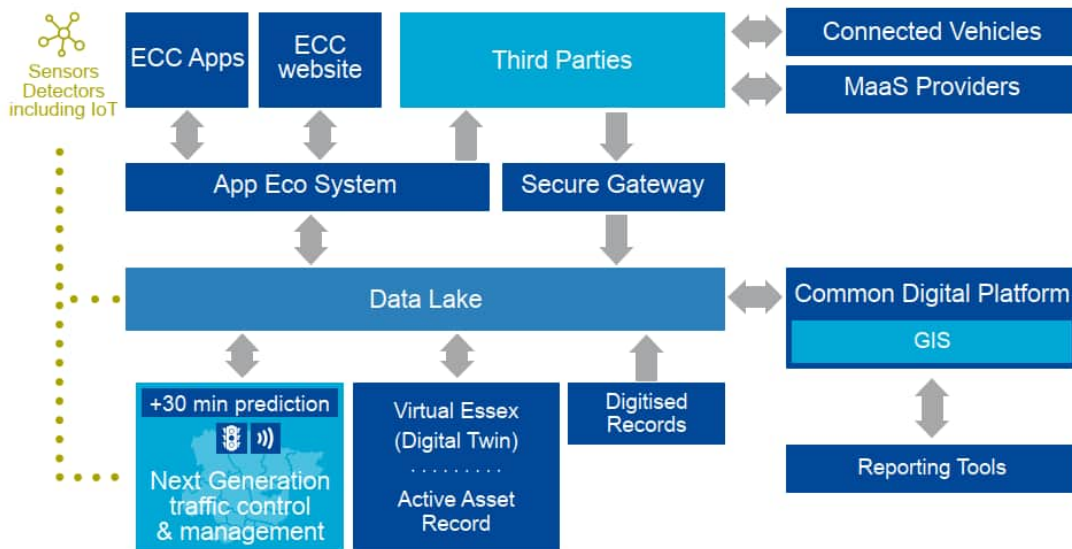


Figure 6.2: Dynamic movement management components

6.3 Cumulative impact of sustainable transport and highways mitigation

To reflect the traffic management based strategy described in Section 6.2, traffic signals have been added to NEMo at recommended locations; and the traffic control system improvements have been represented by altering signal timings and increasing the level of platooning. Platooning is where traffic passes through a set of signals more efficiently than if the signals operated independently of each other. In addition, improvements to A12 J25 have been included.

The ST level of demand was then added to the network representing the traffic management mitigations to create:

- Scenario 4 – ST growth and highway mitigation – ST demand along with additional highway and traffic management mitigation measures. Using ST demand reflects the introduction of proposed sustainable transport measures. Meanwhile, inclusion of highway and traffic management changes represent further mitigations that have been identified as being required to keep people and goods moving in order to alleviate the transport impact of preferred site allocations.

Scenario 4 (ST with mitigation) is then compared with Scenario 1 (baseline) using the method of comparative analysis introduced in Subsection 3.3.1. As a reminder, the movement performance is shown on the coloured scale 1-15, whilst concern over the level of change is denoted as passable ✓, caution ! or unsatisfactory X.

Table 6.1: AM and PM peak movement assessment of Scenario 4 (ST and highways mitigation) with Scenario 1 (baseline)

Sector	Location	AM Peak				PM Peak			
		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road		Without A12 Widening and With A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road	
		2041 S1 Mit. ref.	2041 S4 Mit. ST	2041 S1 Mit. ref.	2041 S4 Mit. ST	2041 S1 Mit. ref.	2041 S4 Mit. ST	2041 S1 Mit. ref.	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	7	✓	9	✗	8	!	10	✓
	Ipswich Road, East Street, East Hill & Harwich Road	9	✓	10	✓	10	✓	10	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	10	✓	11	✓	8	!	8	!
	A12 J25 / A120 (western)	6	✓	6	✓	5	✓	5	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	✓	9	✓	10	✓	11	✓
	A12 J29 / A120 (eastern)	7	✓	8	✓	8	✓	8	✓
Outer	Tiptree	4	✓	4	✓	4	✓	4	✓
	Aldham	3	✓	3	✓	3	✓	3	✓
	A12 J20-25	8	✓	8	!	7	✓	7	✓
Overall assesement combining all areas		8	9	9	10	8	8	8	9
More or less free flow Travelling slower Moderate congestion Substantial congestion Extreme congestion Acceptability of change									
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Passable ✓ Caution ! Unsatisfactory ✗									

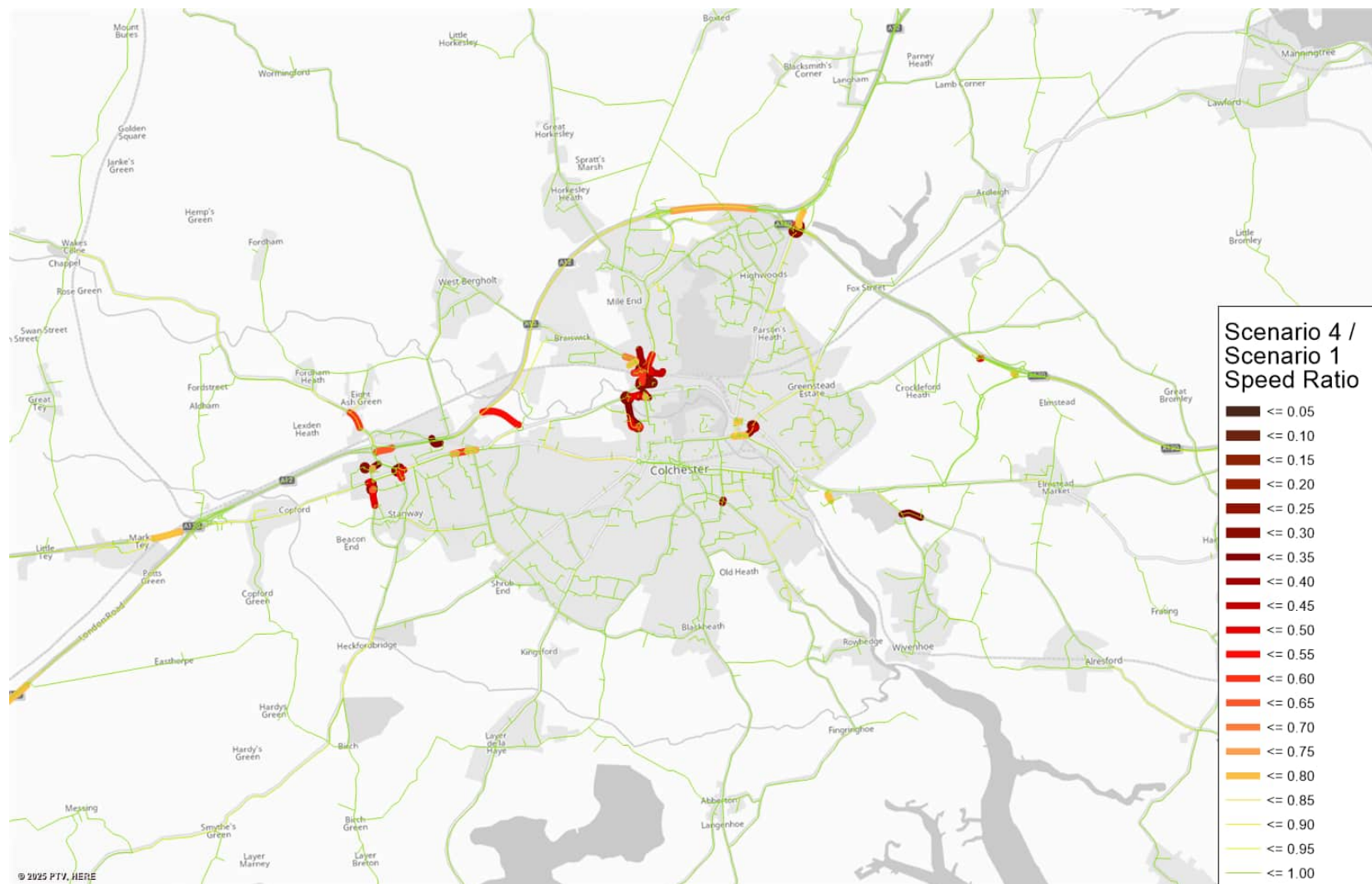


Figure 6.3: Difference in traffic speed between Scenario 4 (mitigated ST growth) and Scenario 1 (baseline) – AM peak

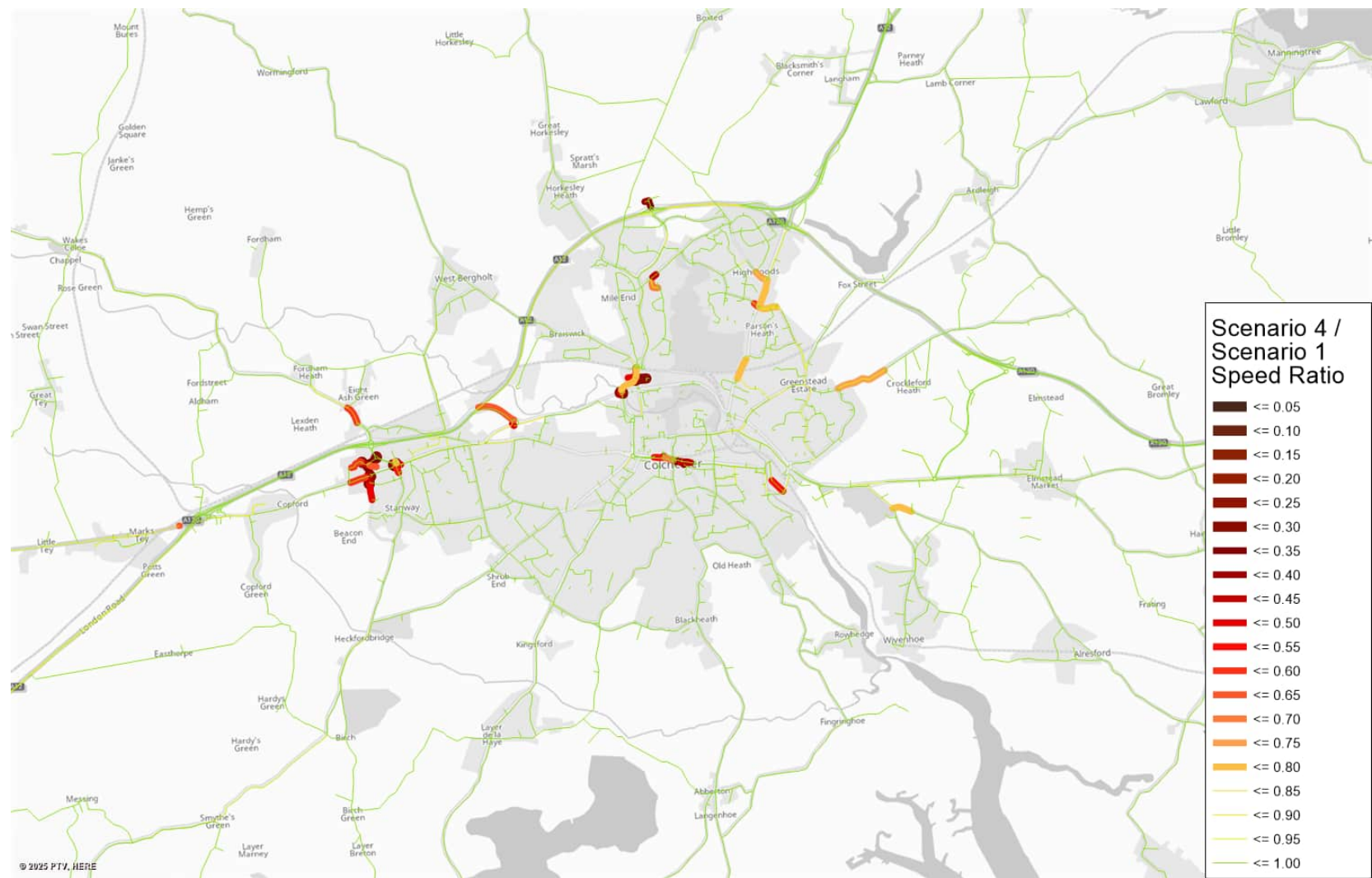


Figure 6.4: Difference in traffic speed between Scenario 4 (mitigated ST growth) and Scenario 1 (baseline) – PM peak

Table 6.1 compares results for Scenario 1 and Scenario 4 across key locations for models with the A1331 link road and with delayed completion. Meanwhile Figures 5.1 and 5.2 show the change in speed on links across the network to Scenario 4 from Scenario 1 with link road completion in the AM and PM peaks, respectively.

Table 6.1 shows that the overall network performance score in the AM reduces to Level 9 (high moderate congestion) which is one level above that in the mitigated reference baseline Scenario 1. Meanwhile the overall network performance score in the PM returns to Level 8 (moderate congestion), which is the same as assessed in Scenario 1. Hence, overall, it is reasonable to conclude the transport impact of growth of preferred allocation is able to be managed with the mitigation strategy for ST and highways and traffic management measures in the future in which the A1331 link road is completed.

Even though the table shows alleviation of the selected areas of interest, Figure 6.3 indicates that resolution of issues on the Lexden Road corridor, which includes J26, J27 and Colne Bank, is letting slightly too much traffic into the city centre, causing delay on streets including Balmerne Hill and around North Station. While the overall network is performing better, this shows the importance of dynamic traffic management systems to manage and balance traffic across the network in real time.

In the AM scenario without the link road, a similar pattern is observed, but Greenstead roundabout remains with extreme congestion – indicating that even with investment in dynamic traffic management technologies that link road completion would be required.

6.4 Balancing speed and blocking back in each area of interest

6.4.1 How speed and blocking back indicators inform the movement index

To help understand why the impact is considered acceptable in Scenario 4 with link road completion, it is also useful to consider change in speed and blocking back indicators, which are used in the movement index, for each of the areas of interest.

The overall assessment has been based on applying the movement index, which combines three indicators, over a selection of areas of interest which would likely be affected by growth at preferred site allocations. This approach has been taken since it helps identify the cumulative impact of growth as well as providing an objective and concise assessment framework. Relevantly, the approach also aligns with the NPPF, which states that "development should only be prevented or refused on highways grounds, if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network, following mitigation, would be severe, taking into account all reasonable future scenarios" [37, para.106].

Each area of interest comprises several paths, which are routes through an area. For example, one path may go straight ahead at a junction whereas another path may turn left or right. The movement index combines information on speed and blocking back for each path. (The index also includes another indicator of capacity, though this is not considered in this subsection).

In the transport model, a blocking back indicator called relative queue is used to identify parts of the network where the desired amount of modelled traffic is not able to pass through in the modelled time period, which causes queues to form. This indicator only appears on the worst performing parts of the modelled network and is shown as the percentage of a link which is blocked. Relative queue ranges between 0 (no queue) to 100% (where the entire path link is blocked by the end of the modelled hour).

Within the movement index, each path comprises a number of links. For each of these links information on speed (as a ratio of free flow speed) and relative queue is extracted from the model. The movement index then combines the information to provide a score for each area of interest, which is then represented on the coloured 1-15 movement scale. In combining the information, weighted averages are used in order that paths with greater demand influence the movement index score more than paths with less demand.

An increase in car trips likely leads to a decrease in speed but people and goods could still be able to move around the network acceptably if there is sufficient capacity. An increase in blocking back, however, indicates a build up of severe queues on sections of the network where there is insufficient capacity. Where this happens there is likely to be greater variability in journey time and people and goods would not be moving acceptably through the network.

The following subsection describe changes in averaged speed and blocking back (relative queue) indicators for the sectors in the eastern, western and northern areas of interest for the base model (2023) and the forecast 2041 scenarios. The forecast Scenarios 0-4 include the A1331 link road completion and exclude the A12 J19-25 widening. Rather than show speed as a ratio to free flow speed, which is used in the index, speed is shown as an absolute value in the charts.

6.4.2 Performance in the eastern areas of interest

6.4.2.1 *Greenstead area of interest*

Subfigures 6.5a and 6.5b show change in speed and relative queue across the base model and Scenarios 0-4 for the Greenstead area of interest in the AM and PM peaks, respectively. The speed in the 2023 base model is high since the A133 and A1331 link road roundabout has not yet been introduced. This change produces lower speeds when vehicles are approaching the roundabout in Scenarios 0-4. The substantial problem seen in Scenario 0 (unmitigated baseline) is mainly influenced, however, by the increase in relative queue, which increases substantially from the base to Scenario 0.

The average speeds fall slightly in the mitigated baseline, Scenario 1, due to the introduction of the mitigation at Greenstead and Colne Causeway. However, the blocking back reduces significantly. This betters the movement score, which is categorised as a moderate problem in both the AM and PM periods in Scenario 1. This change can also be seen in Appendix Figures D.10 and D.23.

In both Scenarios 2 and 3 the average speeds through the Greenstead area of interest remain steady but relative queue is returning. Blocking back is worse in the PM than AM, as can also be seen by comparing the AM and PM relative queue plots shown in Figures D.11 and D.24. Comparing the bar charts for Scenario 2 and 3, also provides an indication of the impact of ST to contribute to reducing blocking back by encouraging some trips to switch to sustainable modes.

In Scenario 4, further optimisation of signals has been implemented in order to represent the impact of investment in dynamic traffic management. The impact of this change was to increase average speed and remove the build up of relative queue, which was not fully removed in the PM following the ST changes in Scenario 3. Thus, the speed and blocking changes shown in the bar chart for Scenario 4 explain why the movement index score in the Greenstead area of interest is able to return to a moderate problem in both the AM and PM time periods and be considered acceptable.

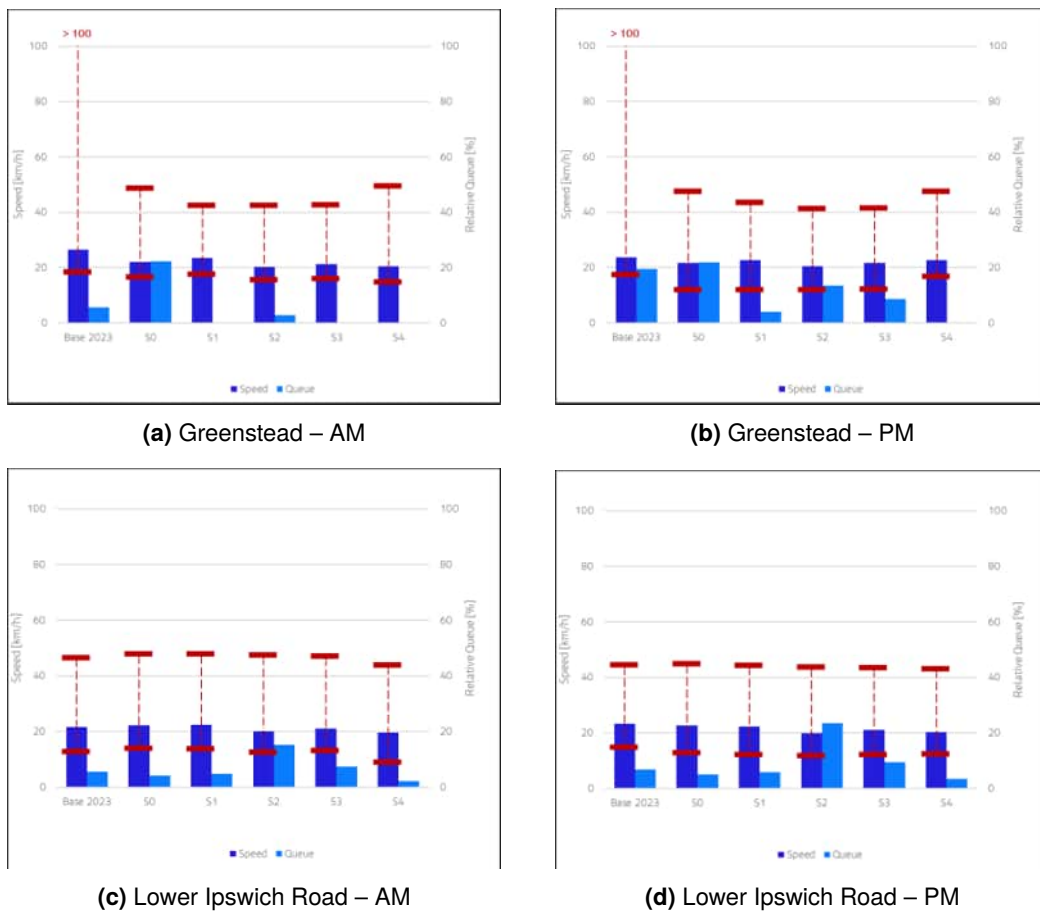


Figure 6.5: Change in speed and blocking back for the eastern sector in the AM and PM peak hours for the 2023 base model and 2041 Scenarios 0-4 with A1331 link road completion and without J19-25 A12 widening

6.4.2.2 Lower Ipswich Road area of interest

Subfigures 6.5c and 6.5d show the change in speed and relative queue across the base model and Scenarios 0-4 for the lower Ipswich Road area of interest in the AM and PM peaks, respectively. The speed and blocking back quantities remain steady over the 2023 base model and Scenarios 0 and 1, with no significant change perceived in the bar chart.

In Scenario 2, there is a large increase in blocking back which is greatest in the PM peak. The increase in blocking back would likely lead to greater variation in journey times as it indicates capacity is insufficient for demand. When demand exceeds capacity, a small further increase in demand or decrease in capacity (e.g. such as road works or a vehicle collision) is more likely to lead to gridlock on that part of the network.

The transport model, however, allows trip makers to find optimum routes through the network to avoid the model locking up. As long as this is possible, the average speed in congested networks is able to remain relatively steady. That is, even if severe queuing on parts of links comprising lower Ipswich Road increases, slightly fewer trip makers will choose that route enabling speed to be increased on those parts of links without severe queues. This explains why in the lower Ipswich Road area average speeds remain steady in Scenario 2 even though blocking back has increased significantly. The increase in blocking back problems in Scenario 2 can be seen in Appendix Figures D.11

and D.24 while the speed ratios can be seen in Appendix Figures D.6 and D.19. The blocking back problems in the lower Ipswich Road area of interest affect, in particular, links on Cowdray Avenue and East Street.

Scenario 3 in the bar chart shows that ST significantly reduces the blocking back problem, which illustrates why the movement score reduces. However, in order to reduce blocking back problems further, Scenario 4, has also introduced signals at the roundabouts along St Andrews Avenue with Harwich Road and Ipswich Road. The signals have also been co-ordinated with signals which had been introduced at Greenstead roundabout in Scenario 1.

The AM bars in Subfigure 6.5c show that the introduction of signals has decreased average speed slightly, which is to be expected as drivers will have to halt at the signals whilst waiting. In the PM, the impact on speed shown in Subfigure 6.5d is perceptible but less than in the AM. However, in both the AM and PM time periods, blocking back problems have reduced significantly, indicating a more stable network position with less variability in journey times, able to accommodate traffic demand. Although still showing at the low end of a substantial congestion problem, it is at a level similar to now and at a level expected in busy city centre areas.

The extent of remaining blocking back issues for the lower Ipswich Road area of interest can be seen in Appendix Figures D.13 and D.26. Meanwhile Figures 6.3 and 6.4, which compare changes in speed between Scenario 4 and 1, show how speed is falling through the area.

6.4.3 Performance in the western areas of interest

6.4.3.1 Lexden Road corridor area of interest

Subfigures 6.6a and 6.6b show change in speed and relative queue across the base model and Scenarios 0-4 for the Lexden Road corridor area of interest in the AM and PM peaks, respectively. The Lexden Road corridor area of interest has been defined as extending from London Road through J26 and J27, along Lexden Road and along Cymbeline Way to Colne Bank roundabout.

While the Lexden Road corridor can experience delays at present, the performance in the 2023 base model is placed in the travelling slower category on the movement scale. Perceivable blocking back issues are not recorded in the base transport model.

However, in Scenarios 0 and 1, the unmitigated and mitigated 2041 baselines, in which signals have been introduced at Colne Bank roundabout in both scenarios, and reference case growth added to the model, there are large increases in blocking back problems and small changes in average speed, most noticeable in the AM peak. This is why a substantial problem is recorded in Scenario 1 in the AM and a moderate problem in the PM. Appendix Figures D.10 and D.23 show that the blocking back problems occur along Cymbeline Way towards Colne Bank roundabout, but also at A12 J26 on the approaches to the Tollgate roundabout.

The blocking back issues in Scenario 0 were not considered severe enough to warrant further mitigation in Scenario 1, beyond the committed scheme, to introduce signals at the Colne Bank roundabout, which was included in Scenario 0. However, the blocking back issues recorded in Scenario 1 indicate that significant deterioration in performance would be expected if demand increased further.

This deterioration is seen in speed and blocking back bar charts for Scenario 2 in

both the AM and PM periods in which growth from preferred allocations is added to the model. The extent of blocking back in the AM, shown in Appendix Figure D.11, increases around J26 and along Cymbeline Way and J27; and the blocking back problems in the PM peak for Scenario 2, shown in D.24, extend nearly as far as in the AM. Consequently, the movement index category worsens to extreme and substantial congestion problems in the AM and PM peaks, respectively.

In Scenario 3, the reduction in demand for car trips is able to increase the speed in the AM peak on some paths, as the maximum speed does increase, however, there is not a noticeable change in blocking back. The movement index, while decreasing a level, is still classed as extreme congestion. In the PM peak, ST changes have a greater impact on blocking back than in the AM and there is a slight increase in average speed. The movement index improves by a level, but it is still classed as a substantial problem.

In Scenario 4, signals have been adjusted at J26 and introduced at J27 ensuring co-ordination along the corridor and with adjacent areas. As a result of the changes at these junctions, there is slight drop in maximum speed on some paths (shown by the lowering of the red horizontal line in Scenario 4, which is more noticeable in the PM than the AM). There is also a reduction in the amount of blocking back, which is greater in the AM than the PM. The reduction in blocking back can also be seen in Appendix Figures D.13 and D.26.

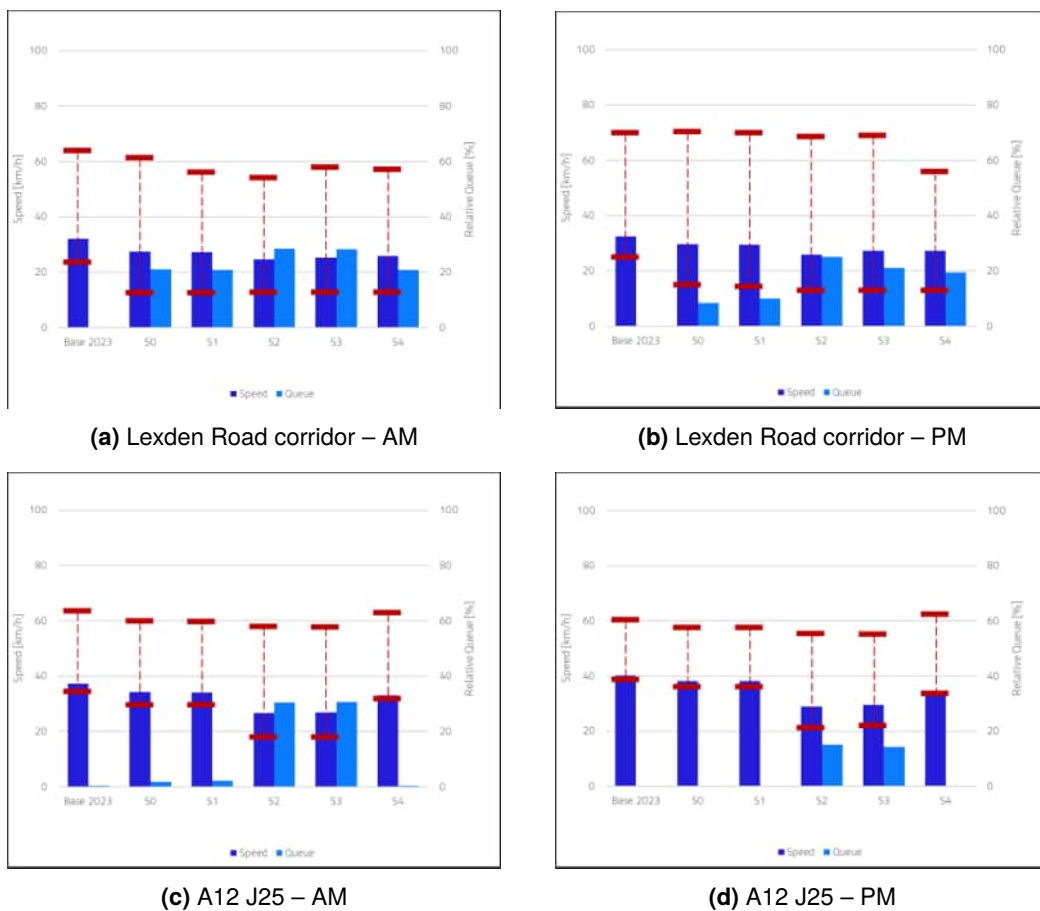


Figure 6.6: Change in speed and blocking back for the western sector in the AM and PM peak hours for the 2023 base model and 2041 Scenarios 0-4 with A1331 link road completion and without J19-25 A12 widening

This change is significant enough to lessen the problem to substantial congestion in the AM and to moderate congestion in the PM. In the AM, speed and blocking back problems return to levels similar to the Scenario 1 baseline; but the PM Scenario 4 does have a greater amount of blocking back compared to the baseline Scenario 1. However, since, this is classed at the lower level of a moderate problem on the movement scale, it is flagged as an area requiring caution and further investigation at the Regulation 19 stage of plan making rather than as unsatisfactory at this stage.

As mentioned in Section 6.3, which summarises the cumulative impact of Scenario 4 across all areas of interest, the relative queue and speed plots also show that delay is increasing on Balmerne Hill and around North Station, which is not picked up in the bar charts. As highways and traffic management plans are developed further at the Regulation 19 stage, it will be important that signals across these locations are co-ordinated – which is why investment in dynamic traffic management is a key part of the mitigation package.

6.4.3.2 *A12 J25 area of interest*

Subfigures 6.6c and 6.6d show change in speed and relative queue across the base model and Scenarios 0-4 for the A12 J25 area of interest in the AM and PM peaks, respectively.

The 2023 base and Scenarios 0 and 1 show relatively stable performance, with a low level of blocking back perceptible in the AM peak. Even though traffic performance through J25 can deteriorate, in typical conditions, it is classed in the travelling slower category on the movement index.

The introduction of preferred allocation growth in Scenario 2 leads to a significant worsening with a noticeable drop in average speed and a significant increase in blocking back. It is classed as an extreme problem in the AM and a substantial problem in the PM. The ST reduction in car trips shown in Scenario 3 does not have noticeable impacts in the AM or PM peaks. The reason for this is that P&C West, which is a proposed ST mitigation, has been introduced in the model between J25 and J26. Hence, any decrease in trips through J25 might not incur until P&C is reached.

Appendix Figures D.12 and D.25 show the impact is most significant on the A120 approach from the west, at the Station Road J25 roundabout and along Station Road. Accordingly, the concept solution introduced in Section 6.2.1 increases the capacity on the approaches from the A120 and also the offslip from the A12 – creating an extra lane on both approaches to the existing roundabout. The concept anticipates that the layout of the existing roundabout would also be significantly altered in order to introduce signals on each arm and maximise green time for main movements to reduce the build up of queues.

Appendix Figures D.13 and D.26 show that the blocking back is limited to the new A12 J25 junction itself in the AM peak and eliminated in the PM peak. In AM peak, the plots suggest that there will be queueing on the widened A120 approach from the west and at the top of the widened northbound off slip from the A12. This amount of blocking back is much reduced from Scenario 2 and allows J25 to improve to a travelling slower category on the movement index.

It is relevant to note that the J25 area of interest needs to be co-ordinated with the Lexden Road corridor which includes J26 and J27. Further coordination will be required with movements to Marks Tey station, with the proposed RTS extension, and with any

crossings of LCWIP routes. In addition, improvements to the quality of place will be required to support growth at nearby allocations.

Growth from preferred allocations and the changes outlined in the above paragraph will likely lead to a reduction of speed through J25. However, the significant reduction in blocking back shown in Scenario 4 indicates that variability in journey time can be improved.

6.4.4 Performance in the northern areas of interest

6.4.4.1 Northern Approach Road corridor area of interest

Subfigures 6.7a and 6.7b show change in speed and relative queue across the base model and Scenarios 0-4 in the AM and PM peaks, respectively, for the Northern Approach Road area of interest, which includes A12 J28, Urbis Romanae and Mill Road.

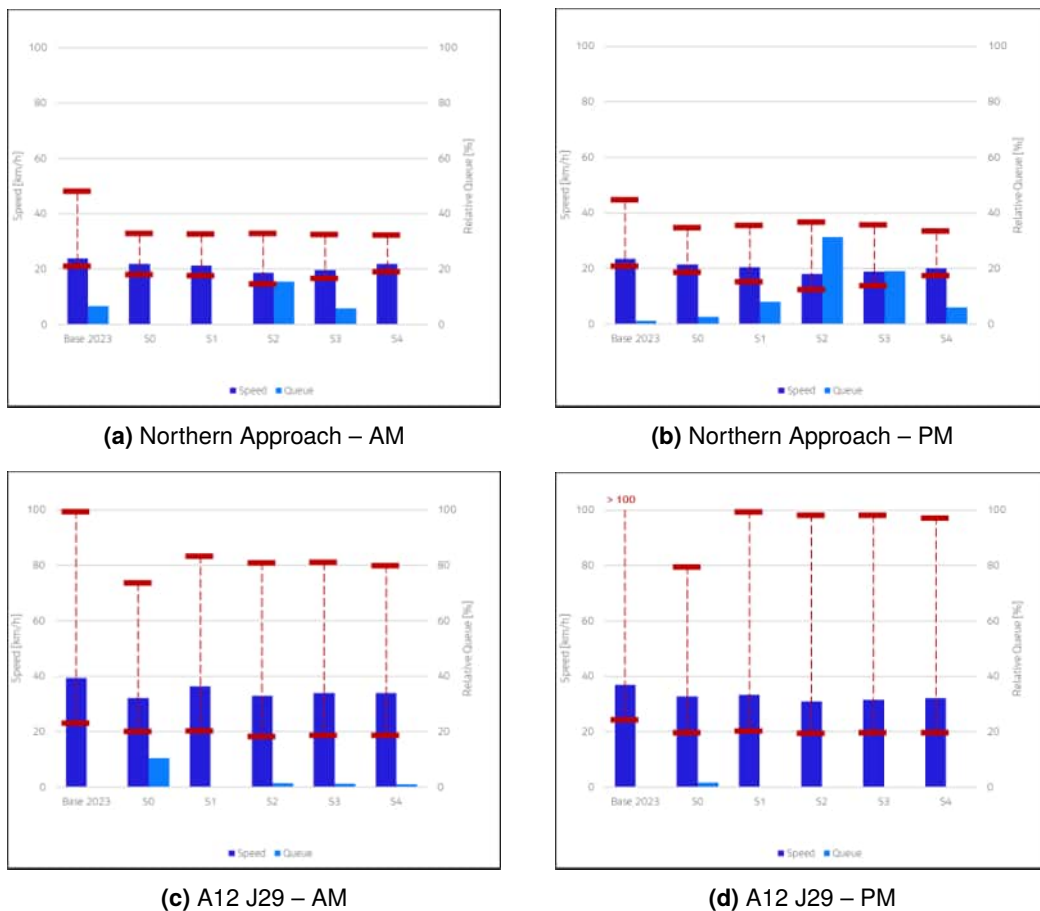


Figure 6.7: Change in speed and blocking back for the northern sector in the AM and PM peak hours for the 2023 base model and 2041 Scenarios 0-4 with A1331 link road completion and without J19-25 A12 widening

It is noticeable that the 2023 base model shows a higher maximum speed on some paths (indicated by the red line) than Scenario 0 and Scenario 1. Meanwhile the blocking back problems seen in the base in the AM are fully eliminated in Scenarios 0 and 1; yet blocking back increases in these scenarios in the PM. In Scenario 0, these changes are the result of committed growth along the corridor which includes junction improvements at Axial Way and Mill Road, and the introduction of the dedicated RTS lane between Bruff Close and Mill Road, adjacent to Northern Approach Road. The further

changes seen in Scenario 1, which are more significant in the PM, are likely caused by the A12 J29 scheme that has been introduced in Scenario 1 to help mitigate the impact of committed growth. For these reasons, the Northern Approach Road corridor is considered as a moderate to substantial problem on the movement scale.

When growth from preferred allocations is added in Scenario 2, it is unsurprising that there is a large jump in the amount of blocking back and a small decrease in average speed. The proposed ST measures make a significant contribution to a reduction in blocking back problems in both the AM and PM peaks alongside a small increase in average speed. However, it is still considered a substantial congestion problem in the AM and an extreme problem in the PM on the movement scale.

Since most junctions are already signalised, Scenario 4 only attempt to better co-ordinate existing signals to reflect the impact of investment in latest dynamic traffic management technologies. As shown in the bar charts for Scenario 4, this leads to further improvements with only a negligible amount of block back left in the AM and the PM returning to baseline conditions, in which blocking back is a problem on Mill Road and north of J28. The reduction in blocking back can also be seen in Appendix Figures D.13 and D.26. While this area of interest is still classed as a moderate to substantial problem, the return to baseline conditions is seen as sufficient evidence that the transport impact of preferred site allocation can be managed through the mitigation strategy of ST and traffic management measures.

6.4.4.2 *A12 J29 corridor area of interest*

Subfigures 6.7c and 6.7d show change in speed and relative queue across the base model and Scenarios 0-4 in the AM and PM peaks, respectively, for the A12 J29 area of interest, which includes the A120, upper Ipswich Road and part of the A12.

While the 2023 base performs well and is classed as a moderate problem in the AM and PM periods, it jumps to a substantial congestion problem in Scenario 0 in the AM, for which relative queue plots indicate a risk of blocking back on the mainline A120 from the westbound A120 off-slip. In Scenario 1, a concept to mitigate the impact of reference case growth has been added with the result that blocking back problem were alleviated.

Scenarios 2-4 show that when growth from preferred allocations are added, the blocking back problems do not return to a significant extent. While small relative queue problems do return in the AM, these are much less than in Scenario 0. Consequently, movement of traffic through the A12 J29 area of interest is considered a moderate congestion problem in Scenario 4.

6.5 Conclusion

This chapter has developed an approach to highways and traffic management to complement ST measures. The approach recommends investing in the next generation of traffic control systems, which will optimise use of road space for all modes, allow real time responses to incidents and, where necessary, hold back traffic on parts of the network to keep people and goods moving in other parts. In addition, a major intervention is identified at J25 to be co-ordinated with walking and cycling crossing improvements of the A12, P&C West and an RTS extension. Furthermore signalisation is expanded to include J26 and J27, and Ipswich and Harwich Road roundabouts with St Andrews Avenue.

The chapter has also tested the effectiveness of ST, highway and traffic management measures in NEMo. This shows that the transport impacts of preferred site allocations are able to be managed through such package of measures. Assessing the acceptability of movement through the highway network at the Regulation 18 stage of local plan making should consider that highway mitigations have not been optimised for developments. Therefore it is to be expected that some issues remain on the highway network, which would be addressed as the plan proceeds to Regulation 19 and as individual developments are designed.

7 Conclusion

7.1 Summary of process

This report has considered the transport impact of preferred site allocations for homes and employment in the Colchester council area being considered for the Regulation 18 Local Plan. This growth is in addition to reference case growth that is near certain or more than likely to come forward, which includes TCBGC. It also assumes that there is substantial growth in adjacent districts. Overall the preferred site allocations provide for approximately 11,000 new homes and 11,000 new jobs.

The assessment and identification of mitigation measures has been grounded in the vision-based approach recommended in the NPPF. The vision reflects CCC and ECC policy aims to widen viable ST choices whilst keeping all people and goods moving safely on the county and NH road networks. In order to support the assessment a movement index has been developed, which measures the ease of movement on a 1-15 scale, where 1 is close to free flow and 15 represents extreme congestion.

In the report it has been assumed that A12 J19-J25 widening has been cancelled and will not come forward before 2041. Nevertheless, transport model runs including A12 widening have been carried out. The next section considers whether the A12 widening should be considered essential in order help manage the transport impact at preferred site allocations.

The first step to the assessment was to establish an acceptable 2041 baseline, which has been called Scenario 1. It was observed that movement through Greenstead roundabout and A12 J29 was problematic with the reference case level of traffic, due to TCBGC. Hence highway scheme concepts were developed and tested. The proposed Greenstead scheme involves signalising each arm and moving to a traditional clockwise roundabout along with signalisation of junctions along Colne Causeway. The proposed A12 J29 scheme involves widening the A120 westbound off slip to three lanes and fully signalising each arm of the J29 roundabout. The resulting network operated satisfactorily.

The second step was to add growth from preferred site allocations to the acceptable baseline scenario. This scenario, called Scenario 2, represents a 2041 future in which the amount of car trips at preferred allocations are at BaU levels and in which there is no additional mitigation (beyond the mitigation in baseline). Using the movement index a worsening of movement through the road network was identified in futures with and without link road completion.

The third step was to identify a package of sustainable transport measures and collate evidence on its impact – measures include P&C West, RTS extensions, BSIP bus improvements and LCWIP expansion. Only those car trips in the transport model considered viable to switch to sustainable travel were allowed to do so. This was achieved by constraining switching of trips in the model by geography and distance. Scenario 3 of the transport model tested the ST trip reduction. It found movement improved in futures with and without the link road, but there were still areas of caution or unsatisfactory worsening requiring additional mitigation.

The fourth step therefore identified highway and traffic management measures that would be required in addition to ST measures. These measures introduce signals and co-ordination of those signals to balance better traffic through A12 J25 - J28, Urbis

Romanae, Mill Road and Colne Bank, and Ipswich and Harwich Road roundabouts with St Andrews Avenue. The combination of highway and ST improvements were tested in Scenario 4.

7.2 Summary of findings with A1331 link road completion

Tables 7.1 and 7.2 show that the strategy of ST with highway and traffic management mitigation is helping to manage the impact growth in the AM peak with the link road in place but without A12 widening.

The first columns of the tables below provide the movement scale scores for current conditions (2023 Base). This provides a good indication of the significant deterioration that could be brought about if the reference case growth to 2041 occurred without appropriate transport mitigation shown in the second column (2041 unmitigated reference). Adding mitigation at Greenstead and A12 J29 to the 2041 reference case, however, shows satisfactory performance is attainable in the third column (2041 mitigated reference), which becomes the baseline against which the impact of preferred site allocations is assessed.

The fourth columns of Tables 7.1 and 7.2 show that adding growth from preferred site allocations leads to unsatisfactory network performance across the eastern, western and northern sections with the worst deterioration experienced at lower Ipswich Road through the East Hill, the Lexden Road corridor from J26 to Colne Bank, A12 J25 around Marks Tey, and Northern Approach Road with Via Urbis Romanae and Mill Road. The improvements at Greenstead and A12 J29 are also coming under pressure.

Table 7.1: AM peak summary impact assessment of scenarios without A12 widening and with link road completion

AM peak impacts		Without A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. Ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST (inc.J25)
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	12	7	!	✓	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	9	!	!	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	6	10	10	x	!	✓
	A12 J25 / A120 (western)	5	6	6	x	x	✓
North	Northern Approach Road, Via Urbis Romanae, Mill Road & A12 J28	9	8	9	x	✓	✓
	A12 J29 / A120 (eastern)	7	10	7	!	✓	✓

Continued on next page

Table 7.1: AM peak summary impact assessment of scenarios without A12 widening and with link road completion (*continued*)

AM peak impacts			Without A12 Widening and With A1331 Link Road					
Sector	Location		2023 Base	2041 S0 Unmit. Ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST (inc.J25)
Outer	Tiptree		3	4	4	✓	✓	✓
	Aldham		3	3	3	✓	✓	✓
	A12 J20-25		6	8	8	!	✓	!
Overall assesement combining all areas			7	9	8	11	10	9

Key to movement scale and acceptability of change											
More or less free flow				Travelling slower		Moderate congestion			Substantial congestion		
1	2	3	4	5	6	7	8	9	10	11	12
Extreme congestion				Acceptability of change							
13	14	15	Passable ✓			Caution !			Unsatisfactory ✗		

The fifth columns of the tables show the positive impact of ST measures, which reduce the amount of car trips only if ST provides a realistic alternative (2041 Scenario 3 unmitigated ST). Scenario 3 does not include highway mitigation measures so has been labelled as unmitigated ST. Scenario 3 shows that the severity of congestion at all locations is reduced except at A12 J25. It is also not enough to avoid extreme congestion on the Lexden Road corridor in the AM or along the North Approach Road corridor in the PM. However, since the overall movement index score drops one level to Level 10 in both the AM and PM peaks, this indicates ST mitigation is making a significant contribution to alleviating the impact of traffic growth.

The sixth columns of Tables 7.1 and 7.2 add in highway and traffic management mitigation measures on top of a reduction in car trips due to ST (Scenario 4 mitigated ST), which include improvements at J25 and expansion of intelligent transport systems and application of new dynamic traffic management technologies to better manage the flow of traffic across the network, maintain safety and prioritise walking, cycling and public transport. Scenario 4 shows that the impact on performance can be considered acceptable at all locations in the table with the exception of caution flags along the Lexden Road corridor in the PM peak and on the A12 mainline in the AM peak, the latter of which experiences slower speed but no blocking back problems. These issues would be able to be addressed at the design stage and the change is not significant enough to be considered unacceptable. It is worth remembering that the NPPF states that "development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network, following mitigation, would be severe, taking into account all reasonable future scenarios" [37, para.106]

The overall network performance score in the AM reduces to Level 9 (high moderate

congestion) which is one level above that in the mitigated reference baseline Scenario 1. Meanwhile the overall network performance score in the PM returns to Level 8 (moderate congestion), which is the same as assessed in Scenario 1. Hence, overall, it is reasonable to conclude the transport impact of growth of preferred allocations is able to be managed with the mitigation strategy for ST and highways and traffic management measures in the future in which the A1331 link road is completed.

Table 7.2: PM peak summary impact assessment of scenarios without A12 widening and with link road completion

PM peak impacts		Without A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. Ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST (inc.J25)
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	11	12	8	!	!	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	9	10	x	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	5	8	8	!	!	!
	A12 J25 / A120 (western)	5	5	5	x	x	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	9	10	x	x	✓
	A12 J29 / A120 (eastern)	7	8	8	✓	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	5	7	7	✓	✓	✓
Overall assesement combining all areas		7	8	8	11	10	8

Key to movement scale and acceptability of change

More or less free flow			Travelling slower			Moderate congestion			Substantial congestion		
1	2	3	4	5	6	7	8	9	10	11	12
Extreme congestion			Acceptability of change								
13	14	15	Passable ✓			Caution !			Unsatisfactory x		

7.3 Summary of findings with delayed A1331 link road completion

It is informative to compare Tables 7.1 and 7.4 with Tables 7.3 and 7.4, in which the link road has not been completed. Whilst the mitigation strategy is having an impact, it is not as effective without the link road. In particular, movement through Greenstead roundabout worsens in the AM peak though is faring better in the PM.

Table 7.3: AM peak summary impact assessment of scenarios without A12 widening and with delayed link road completion

AM peak impacts		Without A12 Widening and Delayed A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. Ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	13	9	x	x	x
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	!	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	6	10	11	x	!	✓
	A12 J25 / A120 (western)	5	6	6	x	x	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	9	9	x	!	✓
	A12 J29 / A120 (eastern)	7	9	8	✓	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	6	8	8	✓	!	!
Overall assesement combining all areas		7	9	9	12	11	10

Table 7.4: PM peak summary impact assessment of scenarios without A12 widening and with delayed link road completion

PM peak impacts		Without A12 Widening and Delayed A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. Ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	11	14	10	x	x	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	x	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	5	8	8	!	!	!
	A12 J25 / A120 (western)	5	5	5	x	x	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	9	11	x	x	✓
	A12 J29 / A120 (eastern)	7	8	8	✓	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	5	7	7	✓	✓	✓
Overall assesement combining all areas		7	8	8	11	10	9

These results show the importance of completing the link road and why it is considered a committed scheme required to accompany TCBGC in line with the DPD which states that "before any planning approval is granted for development forming part of the Garden Community the full delivery of the A120-A133 link road must have secured planning consent and a commitment to full funding must be demonstrated." [9, p.106]

7.4 Impact of cancellation of J19-25 A12 widening

Government announced on 8 July 2025 that the A12 (Chelmsford to A120) improvement scheme between J19-25 had been cancelled, which follows its spending review. Whilst transport evidence for CCC's local plan review anticipated a future without the A12 widening scheme, it is informative to consider if the cancellation of the scheme makes it more challenging to manage the transport impacts of growth from preferred

site allocations to 2041.

Tables 7.5 and 7.6 bring together 2041 AM and PM peak hour summary movement assessments for baseline scenarios (Scenarios 1) and growth scenarios with mitigation (Scenarios 4) for each of the futures with and without A12 widening and link road completion.

It is also worth noting that the AM and PM versions of Scenario 4 with A12 widening in Table 7.6 include an earlier iteration of signal optimisation at Greenstead roundabout and on the lower Ipswich Road sector compared to the without A12 versions. However, this does not deter from understanding the highway network benefits arising from the full A12 widening scheme.

In the AM and PM summary tables it is evident that the scenarios with A12 widening perform significantly better overall than comparable scenarios without A12 widening. The difference in overall performance is largely due to better performance between J19-25 on the A12 – this stretch is rated as Level 3 on the movement scale in the AM and PM peaks in scenarios with widening, but worsens to Levels 7-9, which is moderate congestion in scenarios without widening.

The impact of removing the widening scheme elsewhere on the network is limited to worsening movement through:

- J25 A12 and A120 which worsens to a situation with extreme congestion in the AM and substantial congestion with or without completion of the link road
- the Lexden Road corridor from J26 and J27 to Colne Bank which drops from moderate to substantial congestion in the PM (with or without link road completion)

The extent of the impact of A12 widening can also be seen by comparing speeds plots in the appendices. The useful comparison are:

- Figures F.8 (with A12 and with link road) v. D.8 (without A12 and with link road) in the AM
- Figures G.8 (with A12 and with delayed link road) v. E.8 (without A12 and with delayed link road) in the AM
- Figures F.21 (with A12 and with link road) v. D.21 (without A12 and with link road) in the PM
- Figures G.21 (with A12 and with delayed link road) v. E.21 (without A12 and with delayed link road) in the PM

The analysis of models with and without J19-25 A12 widening has provided the rationale for including a scheme at A12 J25 as part of the plan for mitigation following the cancellation on the A12 widening scheme. Beyond J25, there is not considered a case for CCC to direct IADP contributions towards A12 widening up to 2041. Doing so would be at the expense of the ST vision and addressing more troublesome traffic management problems on the county road network – both of which contribute to keeping people and goods moving on the SRN.

Table 7.5: AM peak movement assessment of Scenario 4 (ST and highways mitigation) with Scenario 1 (baseline) for all A12 widening and link road completion futures

		With A12 Widening and With A1331 Link Road		Without A12 Widening and With A1331 Link Road		With A12 Widening and Delayed A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road	
Sector	Location	2041 S1 Mit. ref.	2041 S4 Mit. ST	2041 S1 Mit. ref.	2041 S4 Mit. ST	2041 S1 Mit. ref.	2041 S4 Mit. ST	2041 S1 Mit. ref.	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	7	✓	7	✓	9	✗	9	✗
	Ipswich Road, East Street, East Hill & Harwich Road	10	✓	9	✓	11	✓	10	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	9	!	10	✓	10	✓	11	✓
	A12 J25 / A120 (western)	5	✓	6	✓	5	✓	6	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	✓	9	✓	9	✓	9	✓
	A12 J29 / A120 (eastern)	7	✓	7	✓	8	✓	8	✓
Outer	Tiptree	3	✓	4	✓	3	✓	4	✓
	Aldham	3	✓	3	✓	3	✓	3	✓
	A12 J20-25	3	✓	8	!	3	✓	8	!
Overall assesement combining all areas		7	8	8	9	8	9	9	10

More or less free flow															Travelling slower			Moderate congestion			Substantial congestion			Extreme congestion			Acceptability of change		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Passable ✓			Caution !		Unsatisfactory ✗									

Table 7.6: PM peak movement assessment of Scenario 4 (ST and highways mitigation) with Scenario 1 (baseline) for all A12 widening and link road completion futures

		With A12 Widening and With A1331 Link Road		Without A12 Widening and With A1331 Link Road		With A12 Widening and Delayed A1331 Link Road		Without A12 Widening and Delayed A1331 Link Road	
Sector	Location	Scenario 1 (Baseline)	Scenario 4 (ST and mitigation)	Scenario 1 (Baseline)	Scenario 4 (ST and mitigation)	Scenario 1 (Baseline)	Scenario 4 (ST and mitigation)	Scenario 1 (Baseline)	Scenario 4 (ST and mitigation)
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	!	8	✓	10	x	10	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	!	10	✓	10	!	10	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	7	✓	8	!	7	✓	8	!
	A12 J25 / A120 (western)	5	✓	5	✓	5	✓	5	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	11	✓	10	✓	11	✓	11	✓
	A12 J29 / A120 (eastern)	8	✓	8	✓	8	✓	8	✓
Outer	Tiptree	3	✓	4	✓	3	✓	4	✓
	Aldham	3	✓	3	✓	3	✓	3	✓
	A12 J20-25	3	✓	7	✓	3	✓	7	✓
Overall assesement combining all areas		7	8	8	8	8	9	8	9

More or less free flow			Travelling slower			Moderate congestion			Substantial congestion			Extreme congestion			Acceptability of change		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Passable ✓	Caution !	Unsatisfactory x

It should be noted, however, that including J25 improvements does not replace need for wider investment in the strategic road network:

- A12 widening is still advocated to contribute to regional growth and economic development, and would likely be essential for growth in the Colchester council area beyond 2041
- investment in the SRN will be expected to be required to support growth between Chelmsford and the A120 required by other districts for their local plan revisions and achieving growth targets
- SRN infrastructure investment is essential to support ongoing growth and productivity across Essex

7.5 Recommendations

Figure 2.1 introduced a framework that brought together NPPF and LTP4 considerations: sustainable transport; keeping people and goods moving; and safety. The transport model NEMo has been used to assess vehicle movement through the highway network, which is a good proxy for all movements, as buses, cyclist and pedestrians can be affected by general traffic delay.

The further transport evidence study concludes that it is appropriate to proceed to consult on the Regulation 18 preferred site allocations. This recommendation is based on reasonable evidence that the scale of transport impacts arising from preferred site allocations can be managed through the vision-based strategy of sustainable and integrated transport mitigations.

The report provides evidence from the UK that expanding the network of high quality walking, cycling and public transport routes can achieve a significant level of modal shift away from car travel for short journeys concentrated in the urban area. Meanwhile the transport model demonstrates that remaining traffic growth can be mitigated through highway and traffic management schemes. Whilst general traffic would likely travel slower, the mitigation measures combine to reduce severe queues and blocking back, which would lead to more reliable journey times.

Assessing the acceptability of movement through the highway network at the Regulation 18 stage of local plan making should consider that highway mitigations have not been optimised for developments. Therefore it is to be expected that some issues remain on the highway network, which would be addressed as the plan proceeds to Regulation 19 and as individual developments are designed.

As the plan proceeds it will be expected that further details are developed on vision-led mitigation measures needed to manage the transport impacts arising from both reference case growth and preferred site allocations, which would include:

- solutions at Greenstead and J29 A12, which could be based on the concepts introduced in this report
- integrated land use and transport planning of new developments to reduce car dependency
- significant expansion of the LCWIP network across the urban area
- extension of RTS from the city centre to Marks Tey

- general bus quality improvements, including a new bus station, aligned with BSIP
- mobility hubs
- travel planning at developments to incentivise and manage and monitor progress towards mode share targets
- A12 J25 improvements to offset partly the cancellation of the A12 J19-25 widening scheme
- wider highway and dynamic traffic management investments

The report has also reconfirmed the importance of completing the A1331 link road to contribute to the mitigation of the traffic impact of the TCBGC development, in accordance with previous studies which supported the link road's business case and planning application.

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Glossary

Term	Description
Bus rapid transit	Bus rapid transit is used to refer to high quality, rubber-tyred public transport. BRT services are typically faster than local bus services with less stops. In Colchester the rapid transit system (RTS) is a form of BRT.
Colchester Transport Model	A strategic highway and public transport model. It was expanded and updated to produce the North Essex Model
Development Plan Document	Development Plan Documents provide policies and land allocation details which complement local plans. This report refers to the TCBGC DPD.
EMME	Public transport assignment software package used in the North Essex Model
Future Transport Strategy	Transport strategy for Colchester
Local Transport Plan	ECC is currently consulting on its fourth Local Transport Plan call 'A Better Connected Essex'. It sets out the transport vision and priorities for Essex and the approach to delivery in order to achieve desired outcomes. See [19]
National Travel Survey	NTS is an annual survey commissioned by the UK DfT which provides information on travel behaviour. Whilst the sample is in the region of 3,000, it is able to provide statistically reliable insight at regional levels and by urban and rural geographies.
National Trip End Model	National Trip End Model is used to forecast trips
North Essex Model	North Essex Model
Park and choose	P&C reflect that there are a choice of modes from the site as well as P&R
Rapid transit system	Bus Rapid Transit System
Scenario 0	Reference case demand without mitigation. Committed schemes such as RTS and P&C East for which designs are known are included.
Scenario 1 – baseline	Reference case demand with mitigation measures at J29 A12 and at Greenstead roundabout/Colne Causeway. The baseline mitigation measures have been identified as being required in the TCBGC DPD. Scenario 1 is the baseline against which the preferred site allocations are tested.

Term	Description
Scenario 2 – BaU growth	BaU demand at preferred sites is added to reference case demand. No additional mitigation to those measures in Scenario 1 are included.
Scenario 3 – ST growth	ST demand replaces reference case and BaU demand, which reflects a reduction in car trips arising from sustainable transport mitigation measures proposed for the new local plan.
Scenario 4 – ST growth and highway mitigation	ST demand along with additional highway and traffic management mitigation measures. Using ST demand reflects the introduction of proposed sustainable transport measures. Meanwhile, inclusion of highway and traffic management changes represent further mitigations that have been identified as being required to keep people and goods moving in order to alleviate the transport impact of preferred site allocations.
Strategic Road Network	Major roads administered by National Highways
Transport Analysis Guidance	DfT's Transport Analysis Guidance
Trip End Model Programme	Trip End Model Programme is used to access National Trip End Model (NTEM)
Variable demand model	Variable demand model which allows trips to change destination or change between car and public transport modes. North Essex Model combines VDM and highway assignment models.
VISUM	Highway assignment software package used in the North Essex Model

A Policy context supporting the vision-led approach

A.1 Introduction

Section 2.1 grounds the vision-led approach in sustainable travel through widening viable alternatives for public transport, cycling, wheeling and walking to reduce dependency on car travel. This vision will enhance and protect health, economy and communities thereby enabling Colchester to achieve its wider aims. This appendix provides more information on the regional and local transport plan, which have informed and support the sustainable transport vision.

A.2 National policies

One of the key objectives of the NPPF is to promote sustainable development, which includes the integration of sustainable transport measures, by encouraging local plans to prioritise walking, cycling and public transport over car use. The vision and approach to the Colchester Local Plan, as explored in Chapters 1 and 2, align with the NPPF as the vision-led approach focuses on delivering sustainable places through the provision of sustainable transport solutions.

The implementation of mitigation measures which revolve around encouraging sustainable movement throughout developments, establishing new links to existing public transport for new developments, enhancing public transport options and improving walking and cycling networks will help to achieve the sustainable transport vision of the Colchester Local plan as it follows the guidance provided by the NPPF. The recent revision to the policy framework in December 2024 has strengthened this connection due to the stronger emphasis on supporting sustainable transport and encouraging a stronger shift from car-based travel to more sustainable modes in order to reduce carbon emissions and contribute towards tackling climate change.

Decarbonising Transport: A Better, Greener Britain produced by the DfT focuses on sustainable transport measures as a core component of local plan development [12]. Emphasis is placed on active travel and the ability for the local plan to promote walking and cycling as primary modes of transport, as well as public transport and the push for enhancing the existing public transport systems to reduce reliance on private vehicles. Local plans are also encouraged to integrate land use and sustainable transport planning in order to ensure that new developments are well-connected by sustainable transport measures. This is a key factor in the production of the Colchester Local Plan as the mitigation measures have been developed to help connect new employment and residential developments and to promote sustainable transport use for new and existing communities reaching these preferred site allocations.

A.3 NH Planning for the Future

Planning for the future: a guide to working with National Highways on planning matters, published in October 2023, states that one of the key assessment considerations for NH is the principles of sustainable development [39]. NH emphasise that "where developments are located, how they are designed and how well delivery and public transport services are integrated has a huge impact on people's mode of travel for short journeys" (para. 29). This supports the vision-led approach adopted by the Colchester Local Plan as the mitigation measures aim to improve sustainable transport connections and generate a mode shift from private car reliance to walking, cycling and public transport use. The guidance further solidifies this connection by stating

that NH "will therefore expect those responsible for preparing local and neighbourhood plans to only promote development at locations that are or can be made sustainable and where opportunities to maximise walking, wheeling, cycling, public transport and shared travel have been identified" (para. 29).

A.4 Transport East

The vision of the Transport East Transport Strategy (2023-2050), published in February 2023, is centred around establishing a thriving eastern region with safe, efficient and net-zero transport networks advancing a future of inclusive and sustainable growth for decades to come. The strategy sets out how the vision will be experienced by people and businesses in different parts of the Transport East region. For larger urban areas this looks like:

- high quality, accessible, fast and efficient urban public transport networks, e.g., buses, supported by dedicated infrastructure
- comprehensive, safe, high quality, inclusive urban walking and cycling networks
- seamless interchanges to sustainable modes for last mile trips into and out of urban areas (e.g., Park and Ride / Park and Pedal)
- sustainable development concentrated around existing and new public transport hubs

The first two goals from the Transport East Transport Strategy's Path to Decarbonisation are as follows:

Goal 1 Reduce demand for carbon intensive transport trips through local living by making it easier for people to access services locally or by digital means

Goal 2 Shift modes by supporting people to switch from private car to active, shared and passenger transport, and goods to more sustainable modes like rail

A.5 ECC Climate Action Plan

The ECC Climate Action Plan outlines the Avoid Shift Improve approach designed to support ECCs commitment of delivering a step change in carbon emissions related to transport. The approach focuses on:

- avoiding unnecessary motor vehicle trips
- encouraging residents to shift to sustainable modes such as walking, cycling and public transport
- improving the efficiency and sustainability of essential journeys through initiatives focused on improving bus provision

Within the Net Zero: Making Essex Carbon Neutral report produced by the Essex Climate Action Commission and published in July 2021, the vision is developed based on what the Commission expect Essex to look like in 2031. It is emphasised that when travel is required, it is safer and easier for residents to walk and cycle or get on public transport. New homes are also built with the ability for residents to walk or cycle to the things they need locally including shops, doctors, schools and parks.

Everyone Essex aims to achieve, among many things, a high quality environment which involves delivering a step change in sustainable travel across the county by growing

passenger transport and active travel. The plan focuses on supporting the move towards net zero, climate resilient developments, including new garden communities, by delivering sustainable, healthy neighbourhoods in the future.

A.6 ECC Local Transport Plan

The draft LTP4 grounds the vision for transport across Essex in achieving desired outcomes for which transport is a means to an end. Whilst LTP4 is currently being drafted it aims that:

- people and goods can get where they need to go efficiently and sustainably
- everyone should have good sustainable access to work, education and training, essential services and leisure activities, wherever in the county they live
- investment should focus on ways to travel which protect and enhance the local environment
- decarbonisation of the transport sector should be promoted and implemented

Within the emerging LTP4, a policy is expected to mandate the integration of planning and transport to ensure people and places are at the heart of all decisions to secure new development at the most appropriate and sustainable locations. A further policy is expected that supports connectivity and journey reliability for all modes of transport, which would encourage sustainable travel alternatives.

In order to integrate planning and transport, the LTP4 will require all new development:

- at all stages of planning to comply with our 'Place and Movement Approach' to balance the location-specific needs of cars, buses, goods vehicles, and other motorised traffic, with the needs of cyclists, pedestrians, residents, shoppers, and local businesses, in both urban, suburban and rural locations
- to embed inclusive design and 'Healthy Streets' principles into their design
- to support the implementation of 'walkable neighbourhood principles' in the re-design of existing neighbourhoods and design of new neighbourhoods providing attractive local spaces, easy access to local and wider services and facilities
- to be designed and delivered in line with our Essex Healthy Places Guidance. Developers should produce a Health Impact Assessment and use the Essex Healthy Places Checklist as part of their application to ensure the impact of travel and transport – both positive and negative – is considered regarding the health and wellbeing of residents and communities

With regard to encouraging sustainable travel alternatives the LTP4 will require ECC to work alongside partners to identify, develop and deliver essential enhancements to the network to improve the economy and overall quality of life for people in Essex. To do this ECC will work with our partners to:

- make it easy for everyone to move around new development and to wider areas by walking, cycling and public transport
- consider connectivity needs both within Essex and across our boundaries into neighbouring areas

- identify, make the case for and deliver essential improvements to the network including nationally significant rail and road connections.
- identify and deliver improved connectivity between rural areas and key services in towns and cities
- support the delivery of improved rail station and line capacity (passengers and freight), line speed enhancements, better frequencies (to at least two trains per hour for every Essex station), and better links to places such as London, London Stansted Airport, Cambridge and East Anglia
- implement high quality public transport solutions in appropriate locations, by applying measures consistent with our 'Rapid Transit System Operational Model' to offer a fast, frequent and reliable service with an affordable and accessible ticketing and fares policy
- focus on improving people's journey experience to and from rail stations, bus stations and rapid transit halts to make end-to-end journeys quicker and easier for everyone
- secure better public spaces and access around our rail stations and bus stations
- seek opportunities to reallocate road space to create better walking and cycling routes and faster routes for buses
- improve the quality of service and fares information and extend and improve the availability of static and real-time passenger information at stops/stations, on vehicles/trains and digitally via apps
- improve the journey time reliability of bus services, through measures including bus priority lanes/corridors/gates, and traffic signal priority

A.7 Local implementation plans

LTP4 aims to be delivered through local implementation plans, which for Colchester is expected to resemble the Future Transport Strategy (FTS), which provides a clear statement of intent to transform Colchester into a place which prioritises active and safe sustainable travel to bring about health, environmental and economic benefits [20] through six objectives:

- providing attractive and healthy environments
- improving sustainable transport modes
- supporting economic growth and connectivity
- providing a safer transport environment
- managing demand
- managing highways assets

Meanwhile the Colchester City Centre Masterplan applies a similar vision for transport and access to the city centre, with the intent that "as many people as possible should walk, cycle or use public transport to travel into the city centre through re- connecting neighbourhoods to the city centre with attractive and easy walking and cycling routes; and improving public transport, particularly bus provision and including the new Rapid

Transit System, and improving the interchanges between different modes of transport [7, p.30]

The Colchester City Council (CCC) Active Travel SPD , published in December 2023, outlines the elements required to encourage active travel including:

- the provision of good quality infrastructure in new developments to create an active sustainable development from the outset
- improvements to existing infrastructure to upgrade unconnected cycle routes to create a coherent network that is accessible by all and attractive to prospective users
- cycle and wheel parking that is convenient, covered, safe and secure
- other sustainable travel measures, promotion and community projects to overcome the challenges and barriers faced by many residents and their perceptions of active travel

B Method for assessing the acceptability of transport impact from preferred site allocations

Section 2.2 introduces a framework for helping transport authorities consider the acceptability of transport impacts arising from local plan growth and supporting the identification of appropriate mitigation measures in line with the NPPF vision-led approach to transport planning and the county's LTP4. This appendix provides technical information on the transport assessment method, which has guided the findings and recommendations.

B.1 Strategic versus detailed

Traditional approaches to acceptability of local plan development often focus on using level of service (LoS), volume/capacity (V/C) and queue length indicators around junctions.

At the preferred options, plan making, Regulation 18 stage of local plan preparation there is risk that sole use of these indicators would tilt plans to highway schemes at the expense of the vision for sustainable transport; and put focus on specific problem locations while losing sight of the strategic tapestry of the transport network, and the cumulative impact of how people and goods move through the network using all modes.

At the Regulation 19 stage and in site-specific, developer-led transport assessments, LoS, V/C and queue length indicators have their role – ideally when used to test the effectiveness of mitigation measures to strike the right balance between pedestrian, cycle, bus, car and goods vehicle movements aligned with a sustainable transport vision. It is also appropriate that they are considered at key junctions such as found on the strategic road network managed by National Highways (NH).

However, at the Regulation 18 stage, a more strategic approach is recommended, aligned with the intent of the NPPF and the draft LTP4.

B.2 Assessment of keeping people and goods moving (theory and method)

The assessment of keeping people and goods moving is, arguably, the key criterium for which an objective judgement is required, to be informed by transport modelling. This section explains the theory and method.

Transport models can produce numerous indicators which are difficult to combine and interpret – it is metaphorically difficult to see the wood for the trees. In addition, strategic transport models are good at showing change between a reference case (without local plan growth and mitigations) and an assessment case (with local plan growth and with or without mitigations). However, strategic models are not as good at interpreting the level of problem in either of the cases.

We make an assumption that highway traffic indicators provide the most useful high level indicators since increases in flow, congestion and delay will likely impact all people and goods movements regardless of mode. Secondary analysis would then consider impact on each mode informed by findings from the sustainable transport criterium and the traffic forecasts (discussed in 7).

As illustrated in Subsection 3.3.1, the assessment of movement performance commences by identifying key areas of the network where there are problems or change is expected. Each area of interest is then subdivided into paths, which are routes through

an area. For example, one path may go straight ahead at a junction whereas another path may turn left or right. For each path the following indicators are extracted from the model.

- Relative queue (q) which shows blocking back of traffic on that path, i.e. traffic that doesn't get through in the modelled time period, which causes queues to form. This indicator only appears on the worst performing parts of the modelled network and is shown as the percentage of a link which is blocked. Relative queue ranges between 0 (no queue) to 100% (where the entire path link is blocked by the end of the modelled hour).
- The ratio between modelled speed and free flow speed along the path (s). This indicator reflects delay in situations where traffic is slow moving and is calculated by dividing modelled speed by free flow speed. Traffic can be slow moving without there being a relative queue. The ratio ranges from 0+ (very slow but never 0 since some traffic must have travelled along a path even if it ends up fully blocked with traffic unable to move at the end of the modelled hour) to 1 (where there is no delay whatsoever).
- The ratio between the demand for traffic to flow along a path and the actual modelled flow that is predicted to get through a path over the modelled hour (d). This indicator reflects issues where demand exceeds capacity. It is calculated by dividing demand flow by actual flow. It ranges from 1 (where all traffic can get through) to, potentially, a high number in an exceptionally congested network – though in reality the indicator will range between 1 and 2.

These indicators (q , s and d) have then been combined into a movement index (I) using the following formula:

$$I = \left(\frac{(1 + q)^2}{s} \right)^d$$

The index I ranges from 1 (with no queue and delay with all traffic demand passing through) to, in extreme situations, a high number. In practice it ranges from 1 to 4 for the majority of paths with some outliers ranging to 15.

There is an index score for each of the paths through each of the areas of interest. For each area of interest, a combined index score is then calculated. This is done by calculating a weighted average of the index scores of the paths through an area. The average is weighted by path length.

In order to interpret the severity of conditions represented by the index score, a seven point scale 1-15 has also been developed, shown in B.1. Since the function is non-linear the scale is also non-linear. To develop the scale, a technique borrowed from mathematical approximation theory has been used to identify the most efficient set of intervals to represent change.

Table B.1: Relationship between the movement scale and index values

Description	Movement scale	Index values
More or less free flow	1	$1.00 \leq I < 1.04$
	2	$1.04 \leq I < 1.11$
	3	$1.11 \leq I < 1.22$
Travelling slower	4	$1.22 \leq I < 1.36$
	5	$1.36 \leq I < 1.53$
	6	$1.53 \leq I < 1.73$
Moderate congestion	7	$1.73 \leq I < 1.96$
	8	$1.96 \leq I < 2.22$
	9	$2.22 \leq I < 2.50$
Substantial congestion	10	$2.50 \leq I < 2.80$
	11	$2.80 \leq I < 3.12$
	12	$3.12 \leq I < 3.45$
Extreme congestion	13	$3.45 \leq I < 3.80$
	14	$3.80 \leq I < 4.15$
	15	$I \geq 4.15$

Using the scale, the level of movement performance can be assessed in each area of interest. Also, problems on specific paths can be identified by looking at the indices on individuals paths. The question then arises that if growth is added to the network or mitigations made whether performance is acceptable or not.

To answer this question, it is assumed that there will be two scenarios (reference and assessment scenarios) to be compared against each other. Depending on the changes between scenarios and the scale of problem, the matrix shown in B.2 shows how a judgement can be reached on whether the assessment scenario can be found broadly acceptable in terms of movement performance – noting that sustainable transport and safety impacts also need to be considered.

The main report illustrates how this method is being applied in praxis in the Colchester local plan further evidence project. For example, see The assessment of the different scenarios is discussed in chapters 3, 5 and 6.

Depending on the change between the scenarios being compared, the change in the movement indices also help identify the level of concern to inform acceptability:

- passable ✓
- caution !
- unsatisfactory ✗

Table B.2: Acceptability matrix for initial assessment

Referenc case level of prob- lem	Assessment case level of problem														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	✓	✓	!	!	!	!	x	x	x	x	x	x	x	x	x
2	✓	✓	✓	!	!	!	!	x	x	x	x	x	x	x	x
3	✓	✓	✓	✓	!	!	!	!	x	x	x	x	x	x	x
4	✓	✓	✓	✓	!	!	!	!	!	x	x	x	x	x	x
5	✓	✓	✓	✓	✓	!	!	!	!	!	x	x	x	x	x
6	✓	✓	✓	✓	✓	✓	!	!	!	!	!	x	x	x	x
7	✓	✓	✓	✓	✓	✓	✓	!	!	!	!	x	x	x	x
8	✓	✓	✓	✓	✓	✓	✓	✓	!	!	!	!	x	x	x
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	!	!	!	x	x	x
10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	!	!	x	x	x
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	!	!	x	x
12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	!	!	x
13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	!	!	x
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	!	!
15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	!

B.3 Reaching a view on acceptability

Information on movements of vehicles through the highway network is a good proxy for all movement, as buses, cyclists and pedestrians can be affected by general traffic delay, however to reach a view on the acceptability of a local plan from the perspective of transport, additional interpretation is needed to assess also the impact on other modes and safety.

C Preferred site allocations

C.1 Preferred residential site allocations

Table C.1: Preferred residential site allocations

Location	Map reference	Site name	Number of dwellings
Outer N	1	Land North Boxted Straight Road	150
Outer N	1	Land north of Park Lane	900
Outer N	1	Land opposite Wick Road	10
Outer N	2	The Old School	13
Outer N	2	Land North of Coach Road	400
Inner NW	4	Braiswick	30
Outer N	4	Chesterwell	50
Outer N	4	Land between White Hart Lane and Manor Road	50
Outer N	4	Land north of Colchester Road	100
Outer N	4	Land off Colchester Road	100
Inner NW	4	Land off Bakers Lane	100
Inner NW	4	North Station	250
Outer N	5	Land west of Station Road	200
Outer N	5	Land at Earls Colne Road	125
Outer N	5	Swan Grove	35
Outer N	6	Land north of Halstead Road east of Wood Lane	180
Outer N	6	Land off New Road	15
Outer N	6	Land West of Brood Chase	250
Outer S	7	Land South of Marks Tey Village	1500
Outer S	7	Land East of School Road	300
Outer N	7	Land North of A120 - Marks Tey	1000
Outer S	8	Land North Oak Road	600
Outer S	8	Land Adjacent Bonnie Blue Oak	30
Outer S	8	Highlands	10
Outer S	8	Land at Kelvedon Road	25
Outer S	8	Former Telephone Exchange	5
Outer S	9	Land south of Berechurch Hall Road	875

Continued on next page

Table C.1: Preferred residential site allocations (*continued*)

Location	Map reference	Site name	Number of dwellings
Outer S	9	The Furze	10
Outer S	9	Land west The Folley	60
Central	10	Britannia Car Park	100
Central	10	Vineyard Street Development	100
Inner SE	10	Europit and Magdalen Garage Site	40
Central	10	St Runwald Car Park	40
Inner SE	10	Robertson Van Hire	6
Inner SE	10	146 Magdalen Street	15
Inner SE	10	Ford Car Showroom	100
Inner SE	11	Gas Works and Hythe Scrap Yard	200
Inner SE	11	King Edward Quay	200
Inner NE	12	Derelict Coal Yard Site	50
Inner NE	12	Land West of Hawkins Road	50
Inner NE	12	Land East of Hawkins Road	150
Outer S	13	Land North of the Fire Station	175
Outer N	14	Land south Long Road West	15
Outer N	15	Land East of Plummers Road	25
Outer S	16	Lakelands Crescent	5
Outer S	17	Rowhedge Business Park	50
Outer S	18	View Park	50
Inner SW	19	Picketts	5
Inner NE	20	North East Colchester	2000
Outer S	21	Land at Birch Green	15
Outer S	22	Land at St Ives Road	25
Outer S	23	Land east Dawes Lane	300
Total dwellings			11 089

C.2 Preferred employment site allocations

Note that the employment allocations at preferred site allocations have been derived from information provided by CCC. The estimated floor area leads to the creation of about 11,000 jobs in order that one job is created for each home built, which is the intention of the local plan. This calculation was required, in order that trip demand could be estimated, to input into the transport model NEMO. The total floor area is

consistent with the total floor area in the preferred allocations. However, the allocation of this floor space between employment land use classes and individual sites (apart from those sites which are carried forward from the adopted local plan) has needed to be assumed. While the assumptions are reasonable, land use class and floor area are expected to differ in reality.

Table C.2: Representation of preferred employment site allocations

Area	Map reference	Site name	Land use class	Estimated net internal floor area (m ²)	Estimated jobs
Outer N	6	Bullbanks Farm Halsted Road Eight Ash Green	B1	9214	768
Outer N	6	Bullbanks Farm Halsted Road Eight Ash Green	B2	8786	244
Outer N	6	Bullbanks Farm Halsted Road Eight Ash Green	B8	9643	138
Outer S	8	Land south of Factory Hill - Tiptree	B2	8786	244
Outer S	8	Land south of Factory Hill - Tiptree	B1	9214	768
Outer S	8	Land south of Factory Hill - Tiptree	B8	9643	138
Outer N	4	Land at Patterns Yard West Bergholt	B1	9214	768
Outer N	4	Land at Patterns Yard West Bergholt	B2	8786	244
Outer N	4	Land at Patterns Yard West Bergholt	B8	9643	138
Outer N	5	Wakes Hall Business Centre Wakes Colne	B8	9643	138
Outer N	5	Wakes Hall Business Centre Wakes Colne	B1	9214	768
Outer N	5	Wakes Hall Business Centre Wakes Colne	B2	8786	244
Outer N	7	Land South of A12 and north of proposed new route of A12 - Marks Tey	B8	9643	138
Outer N	7	Land South of A12 and north of proposed new route of A12 - Marks Tey	B1	9214	768
Outer N	7	Land South of A12 and north of proposed new route of A12 - Marks Tey	B2	8786	244
Inner NE	3	Land North of Axial Way - Colchester	B1	9214	768
Inner NE	3	Land North of Axial Way - Colchester	B2	8786	244

Continued on next page

Table C.2: Representation of preferred employment site allocations (*continued*)

Area	Map reference	Site name	Land use class	Estimated net internal floor area (m ²)	Estimated jobs
Inner NE	3	Land North of Axial Way - Colchester	B8	9643	138
Inner NE	3	Colchester Business Park - The Crescent - Colchester	B2	8786	244
Inner NE	3	Colchester Business Park - The Crescent - Colchester	B8	9643	138
Inner NE	3	Colchester Business Park - The Crescent - Colchester	B1	9214	768
Inner NE	13	Knowledge Gateway	B1	33 750	2813
Inner SW	9	Land North of Maldon Road - Colchester	B2	6000	167
		<i>Subtotal</i>	<i>B1</i>	98 248	8189
		<i>Subtotal</i>	<i>B2</i>	67 502	1875
		<i>Subtotal</i>	<i>B8</i>	67 501	966
		Total	All classes	233 251	11 030

D Transport modelling outputs for scenarios with A1331 link road completion (without A12 widening)

Introduction

This appendix provides flow difference, relative queue and speed plots from the 2041 NEMo reference and assessment cases in scenarios without A12 J19-25 widening and with completion of the A1331 link road. Hence, in a future with these schemes, it is possible to sequentially look at the impact of:

- 2041 reference case demand without all mitigations
- 2041 reference case demand with expected mitigations at A12 J29 and Greenstead roundabout (called the baseline with A12 widening and with the link road)
- 2041 BaU demand from preferred site allocations added on top of the baseline scenario
- 2041 ST demand from preferred site allocations added on top of the baseline scenario – which reduced car trips to reflect the impact of a shift to sustainable modes as a result of sustainable travel measures
- 2041 ST demand from preferred site allocations with highway mitigations added on top of the baseline scenario – which combines all mitigation measures that are considered as required to achieve acceptable performance of the transport network.

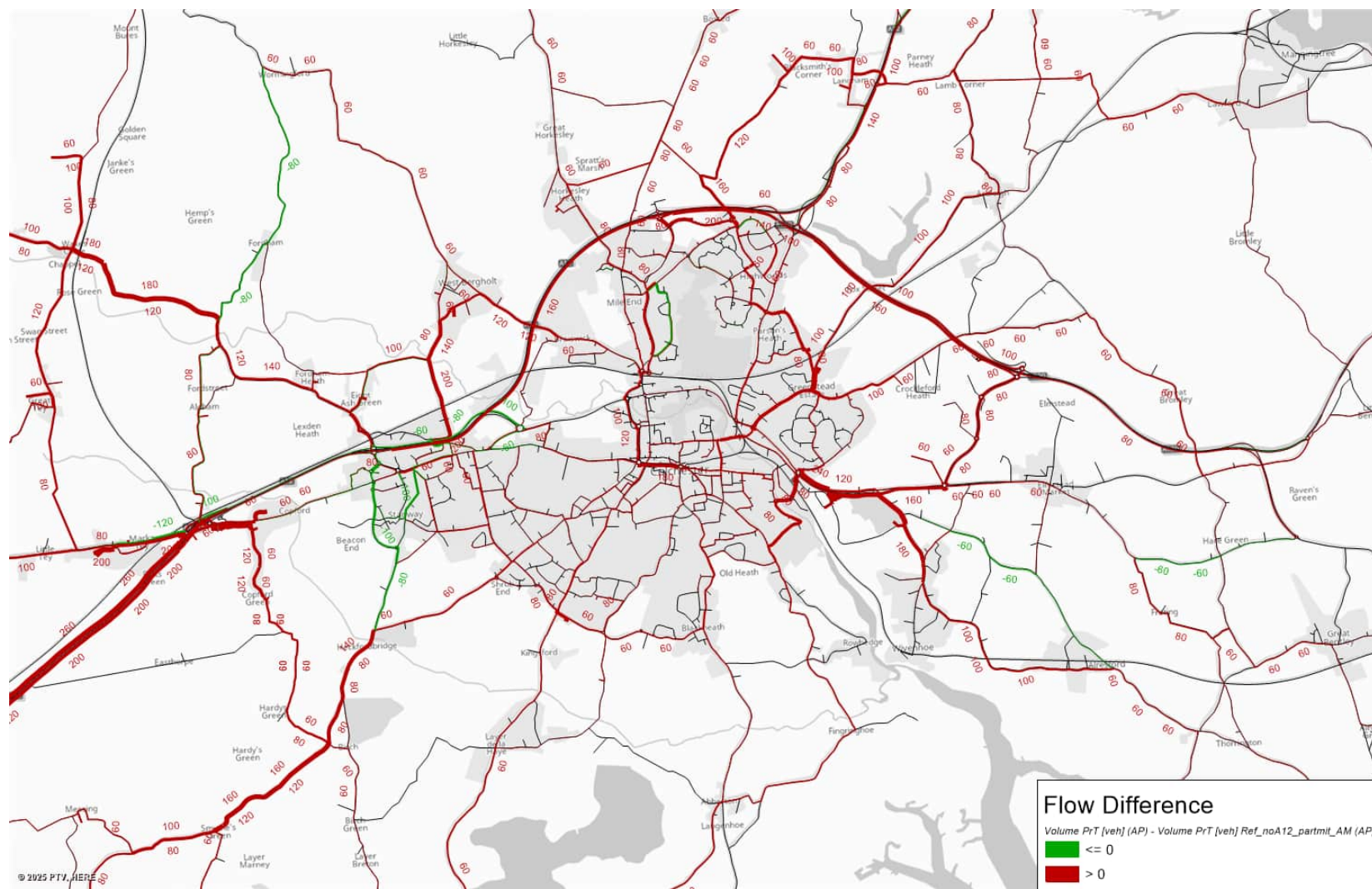
D.1 AM flow, speed queue plots

D.1.1 Summary of impact in the AM

Table D.1: AM peak summary impact assessment of scenarios without A12 widening and with link road completion

AM peak impacts		Without A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	12	7	!	✓	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	9	!	!	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	6	10	10	x	!	✓
	A12 J25 / A120 (western)	5	6	6	x	x	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	8	9	x	✓	✓
	A12 J29 / A120 (eastern)	7	10	7	!	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	6	8	8	!	✓	!
Overall assesement combining all areas		7	9	8	11	10	9

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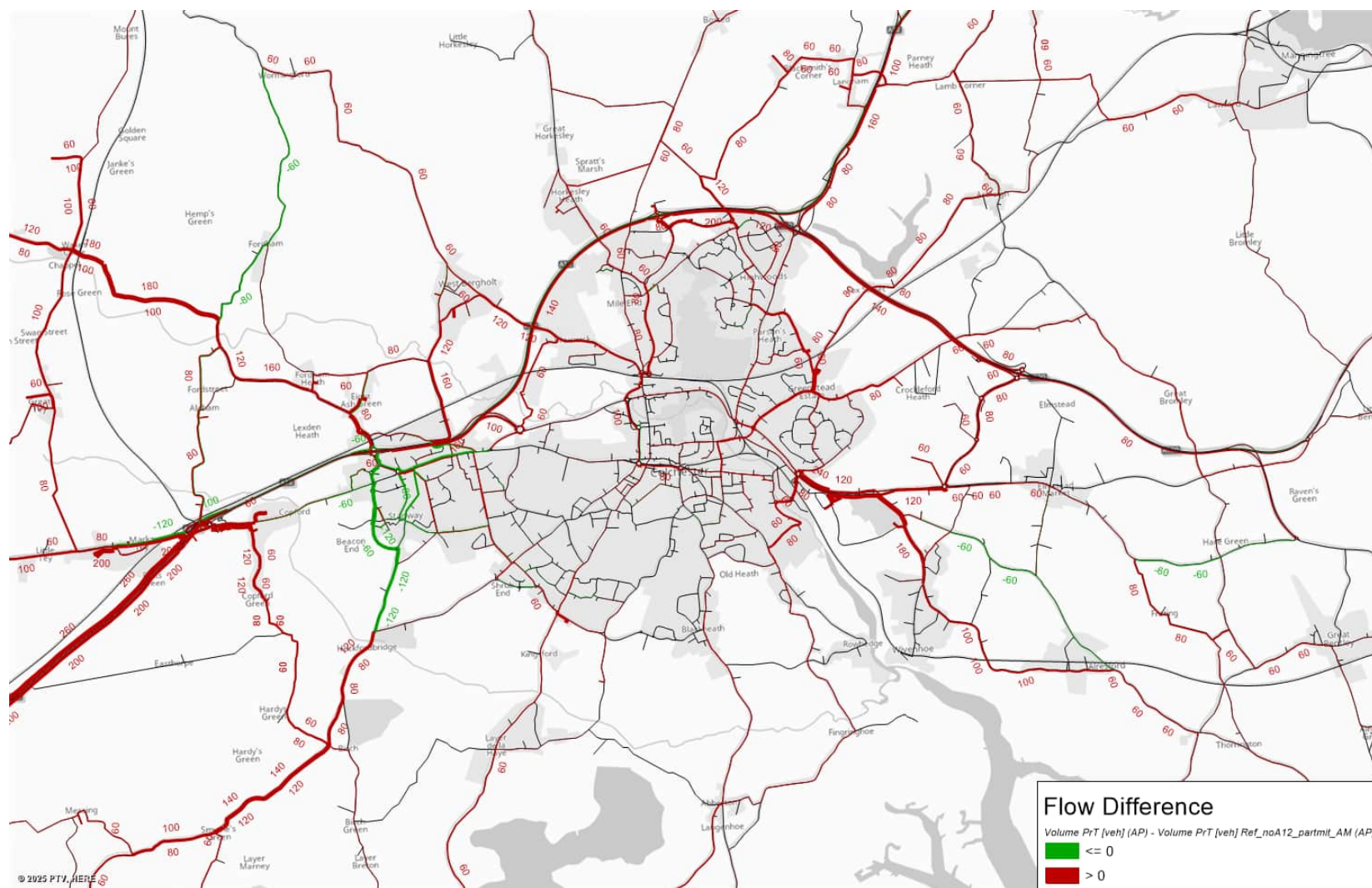


Figure D.2: Flow difference – Scenario 3 v. Scenario 1 (without A12 widening and with A1331)– AM

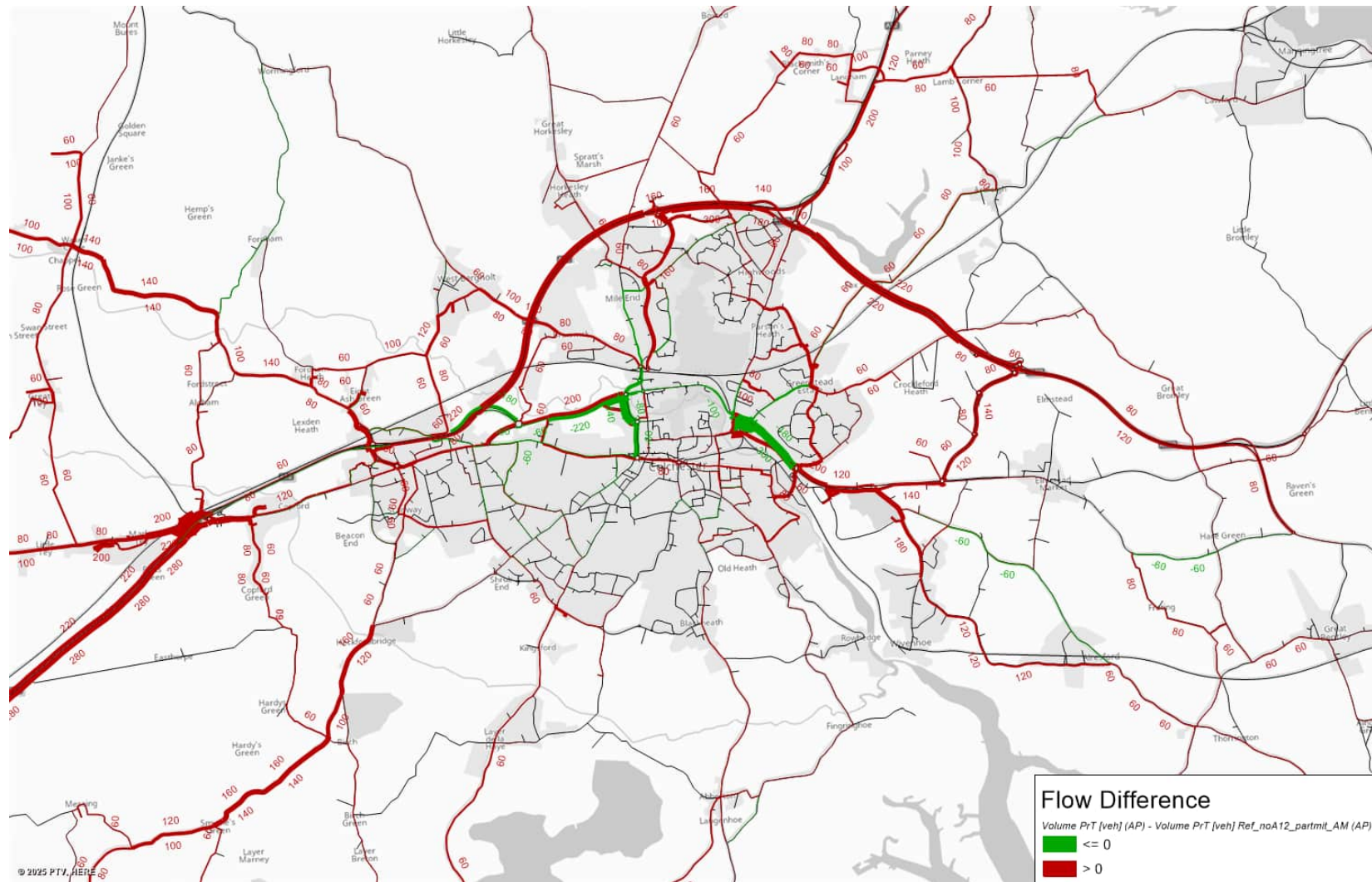


Figure D.3: Flow difference – Scenario 4 v. Scenario 1 (without A12 widening and with A1331)– AM

D.1.3 AM speed plots (modelled speed / free flow speed)**Figure D.4:** Speed ratio – Scenario 0 without A12 widening and with A331 completion – AM



Figure D.5: Speed ratio – Scenario 1 without A12 widening and with A331 completion – AM



Figure D.6: Speed ratio – Scenario 2 without A12 widening and with A331 completion – AM

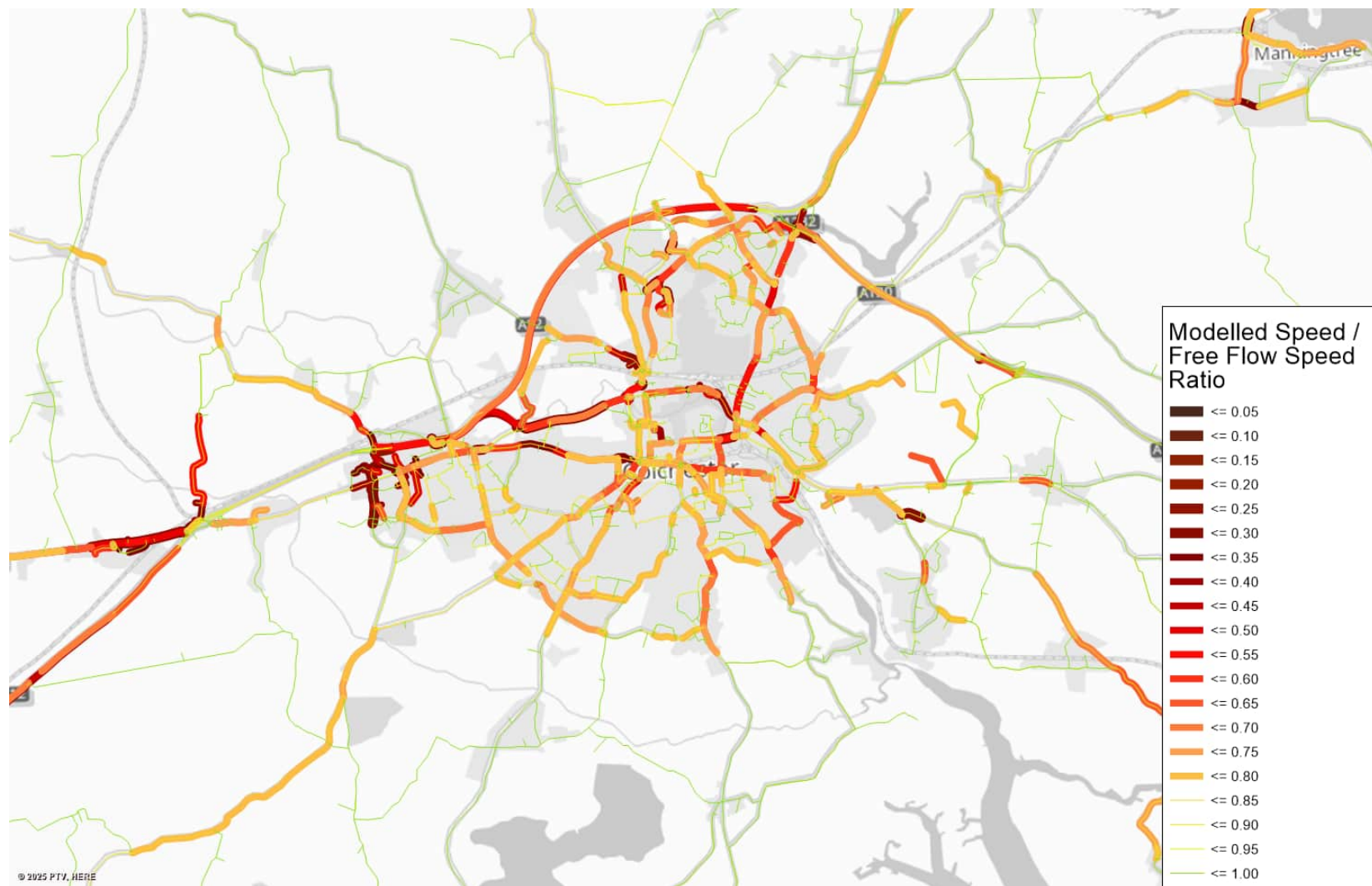


Figure D.7: Speed ratio – Scenario 3 without A12 widening and with A331 completion – AM

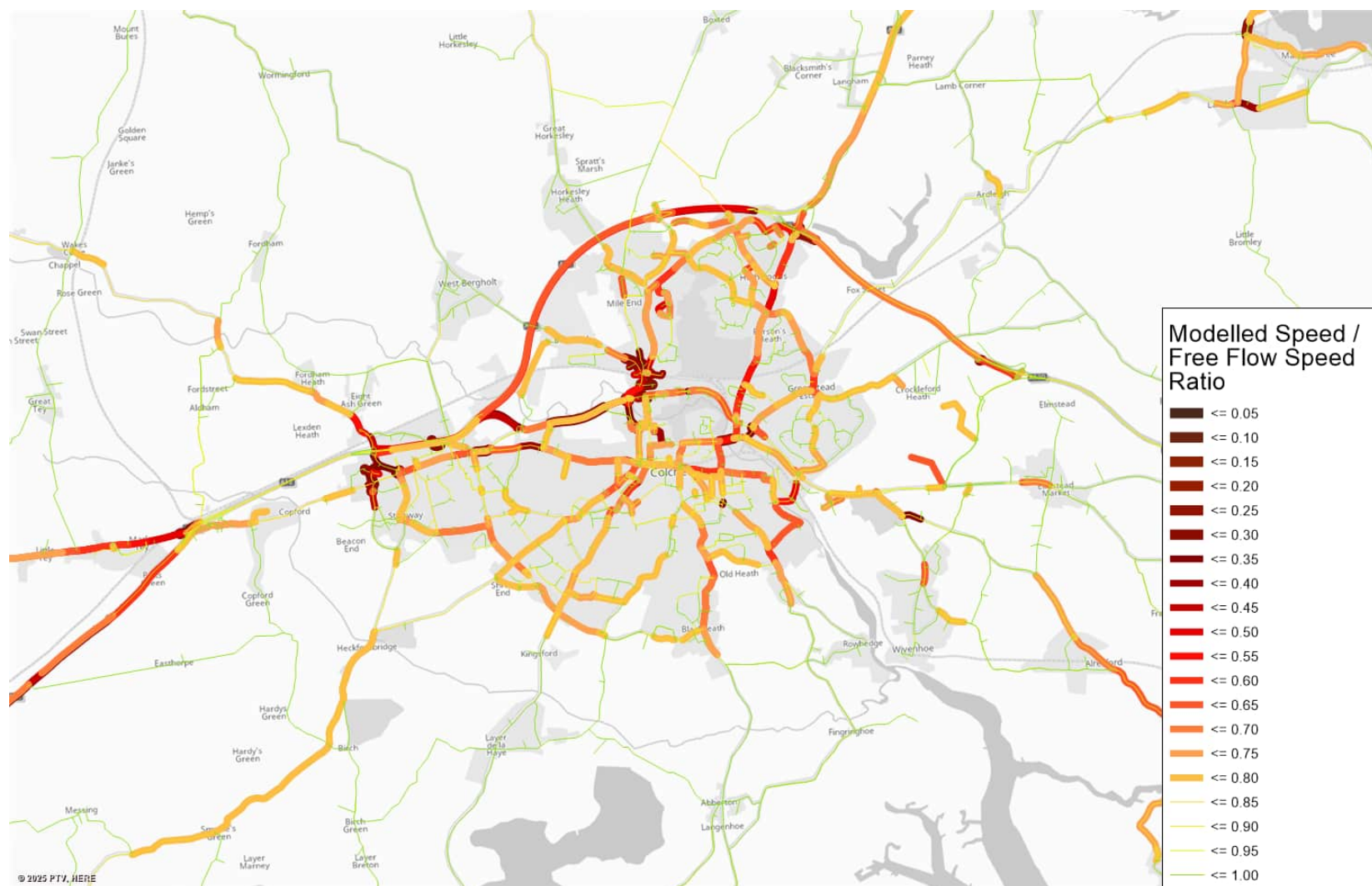


Figure D.8: Speed ratio – Scenario 4 without A12 widening and with A331 completion – AM

D.1.4 AM relative queue plots (100% queues on road links in the model)



Figure D.9: Relative queue – Scenario 0 without A12 widening and with A1331 completion – AM



Figure D.10: Relative queue – Scenario 1 without A12 widening and with A1331 completion – AM



Figure D.11: Relative queue – Scenario 2 without A12 widening and with A1331 completion – AM



Figure D.12: Relative queue – Scenario 3 without A12 widening and with A1331 completion – AM



Figure D.13: Relative queue – Scenario 4 with all mitigations, without A12 widening and with A1331 completion – AM

D.2 PM speed and queue plots

D.2.1 Summary of impact in the PM

Table D.2: PM peak summary impact assessment of scenarios without A12 widening and with link road completion

PM peak impacts		Without A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	11	12	8	!	!	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	9	10	x	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	5	8	8	!	!	!
	A12 J25 / A120 (western)	5	5	5	x	x	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	9	10	x	x	✓
	A12 J29 / A120 (eastern)	7	8	8	✓	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	5	7	7	✓	✓	✓
Overall assesement combining all areas		7	8	8	11	10	8

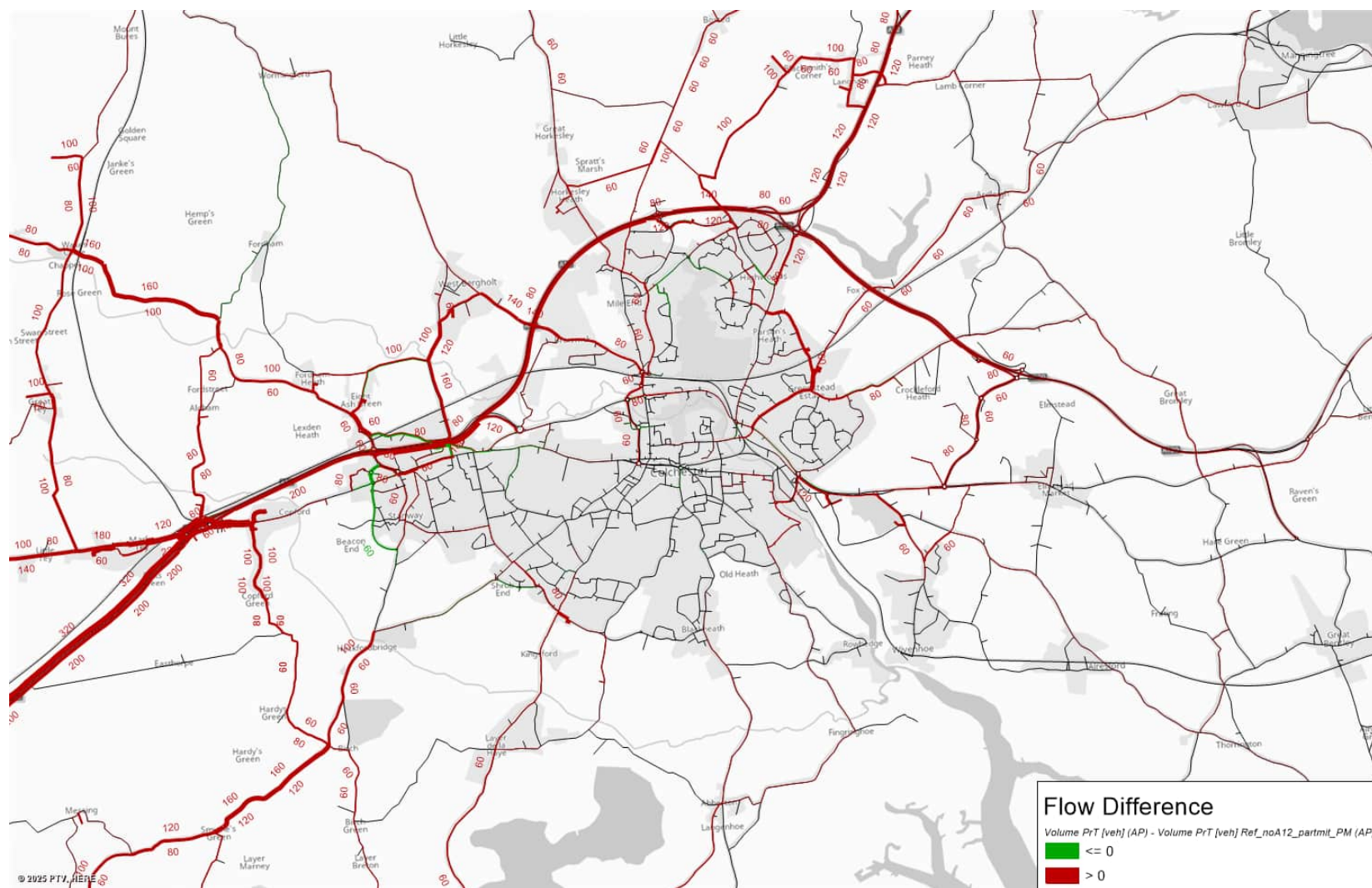


Figure D.15: Flow difference – Scenario 3 v. Scenario 1 (without A12 widening and with A1331)– PM

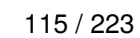


Figure D.16: Flow difference – Scenario 4 v. Scenario 1 (without A12 widening and with A1331)– PM

D.2.3 PM speed plots (modelled speed / free flow speed)

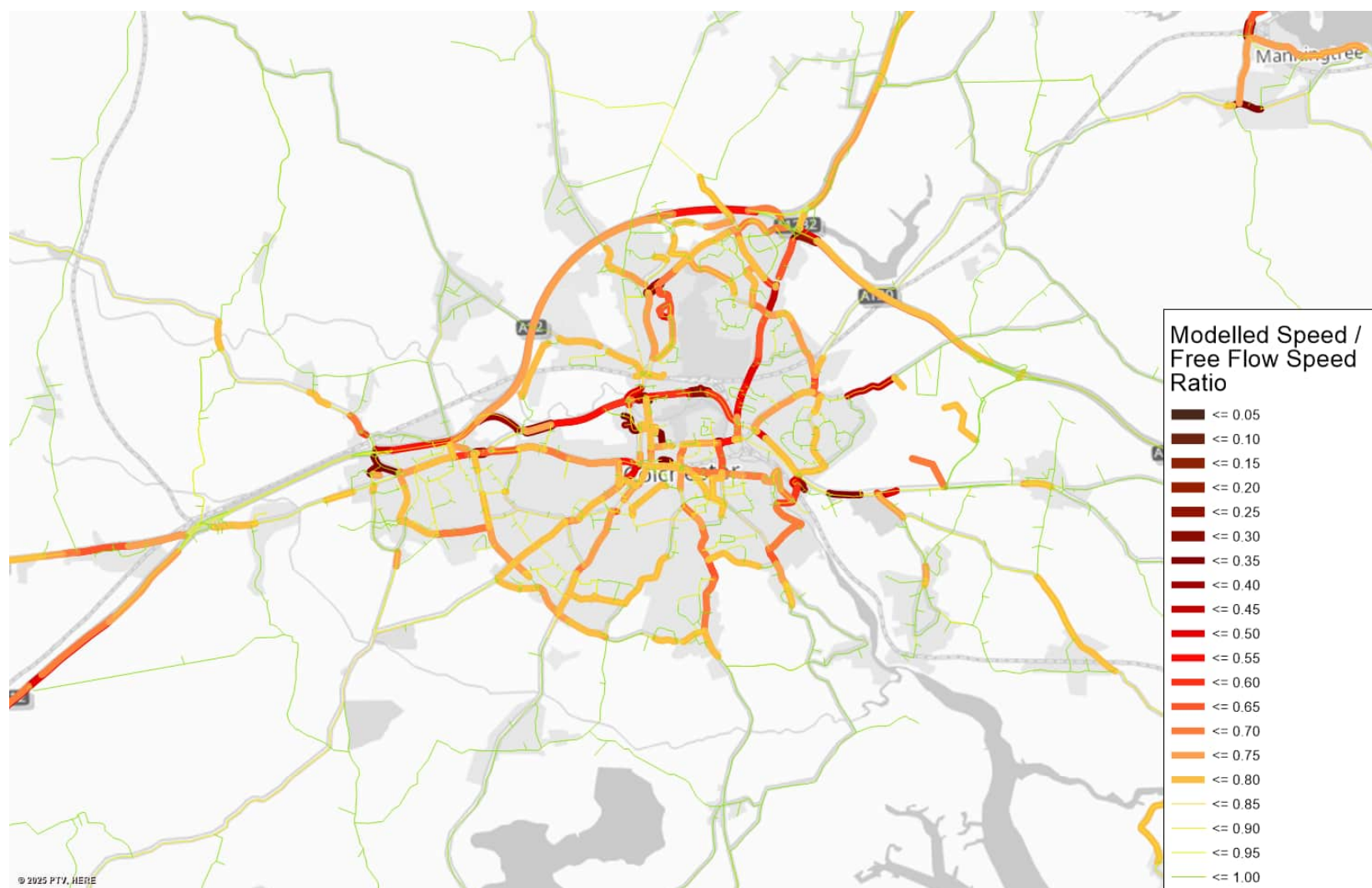


Figure D.17: Speed ratio – Scenario 0 without A12 widening and with A331 completion – PM

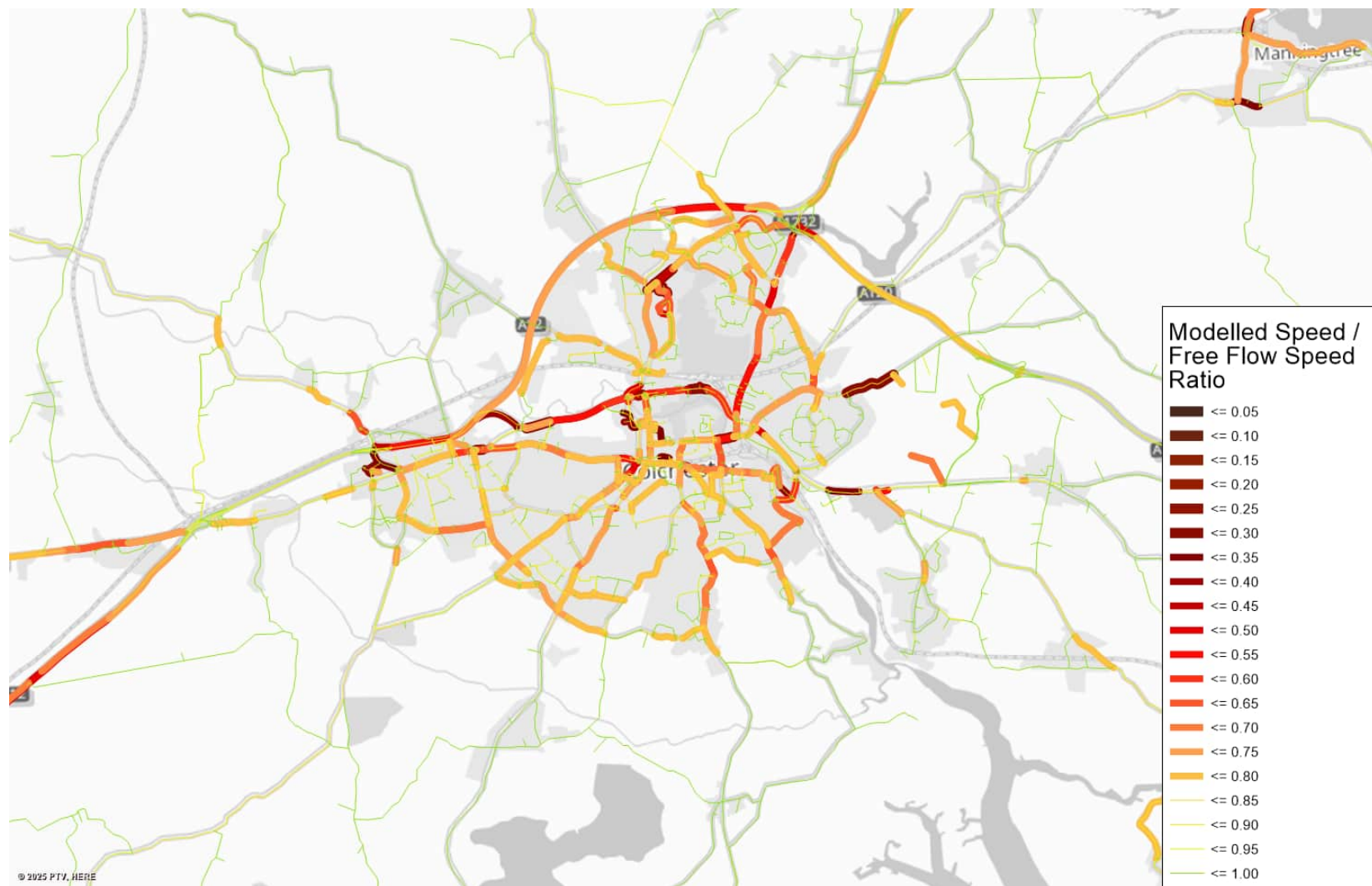


Figure D.18: Speed ratio – Scenario 1 without A12 widening and with A331 completion – PM

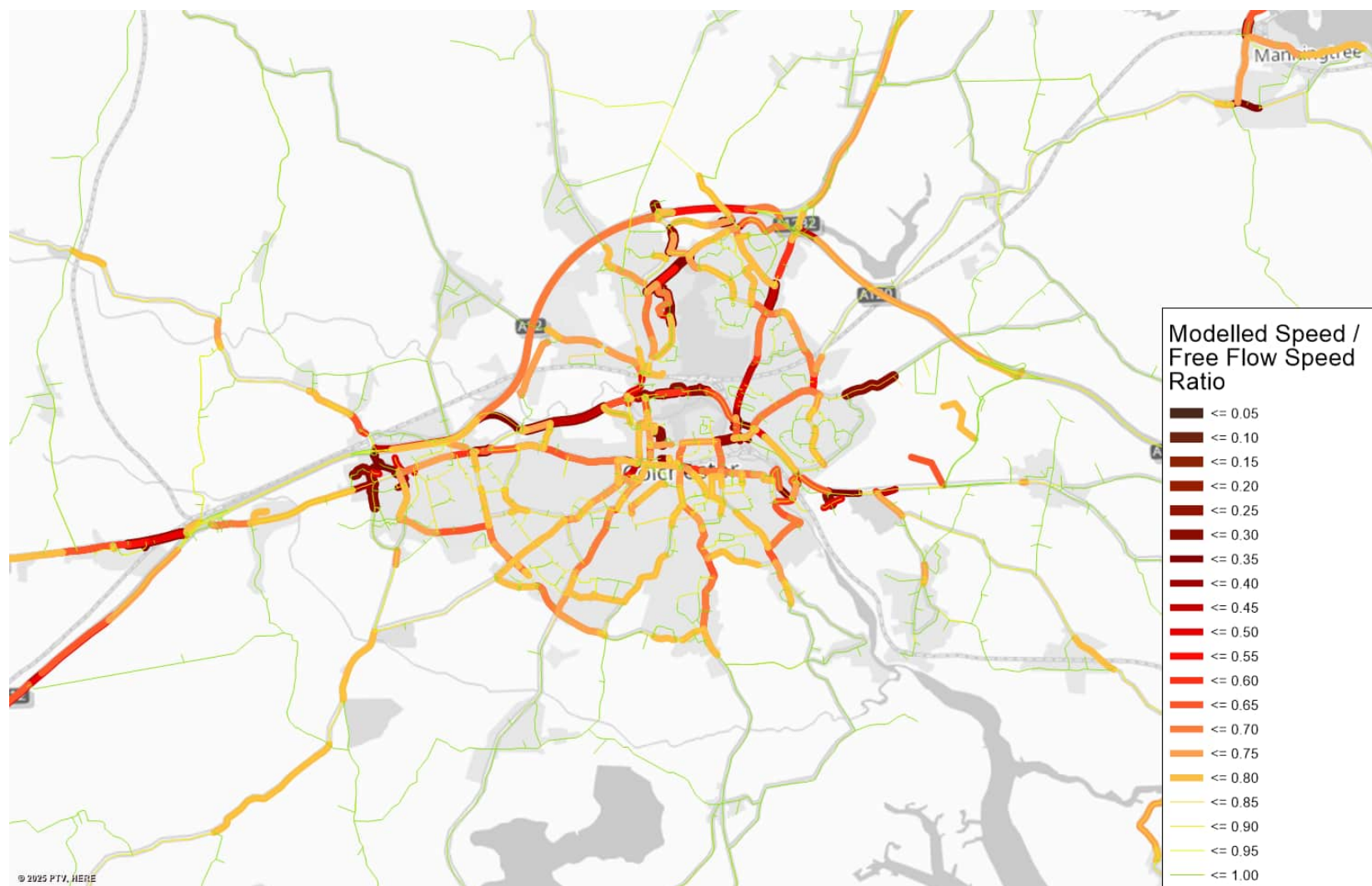


Figure D.19: Speed ratio – Scenario 2 without A12 widening and with A331 completion – PM



Figure D.20: Speed ratio – Scenario 3 without A12 widening and with A331 completion – PM

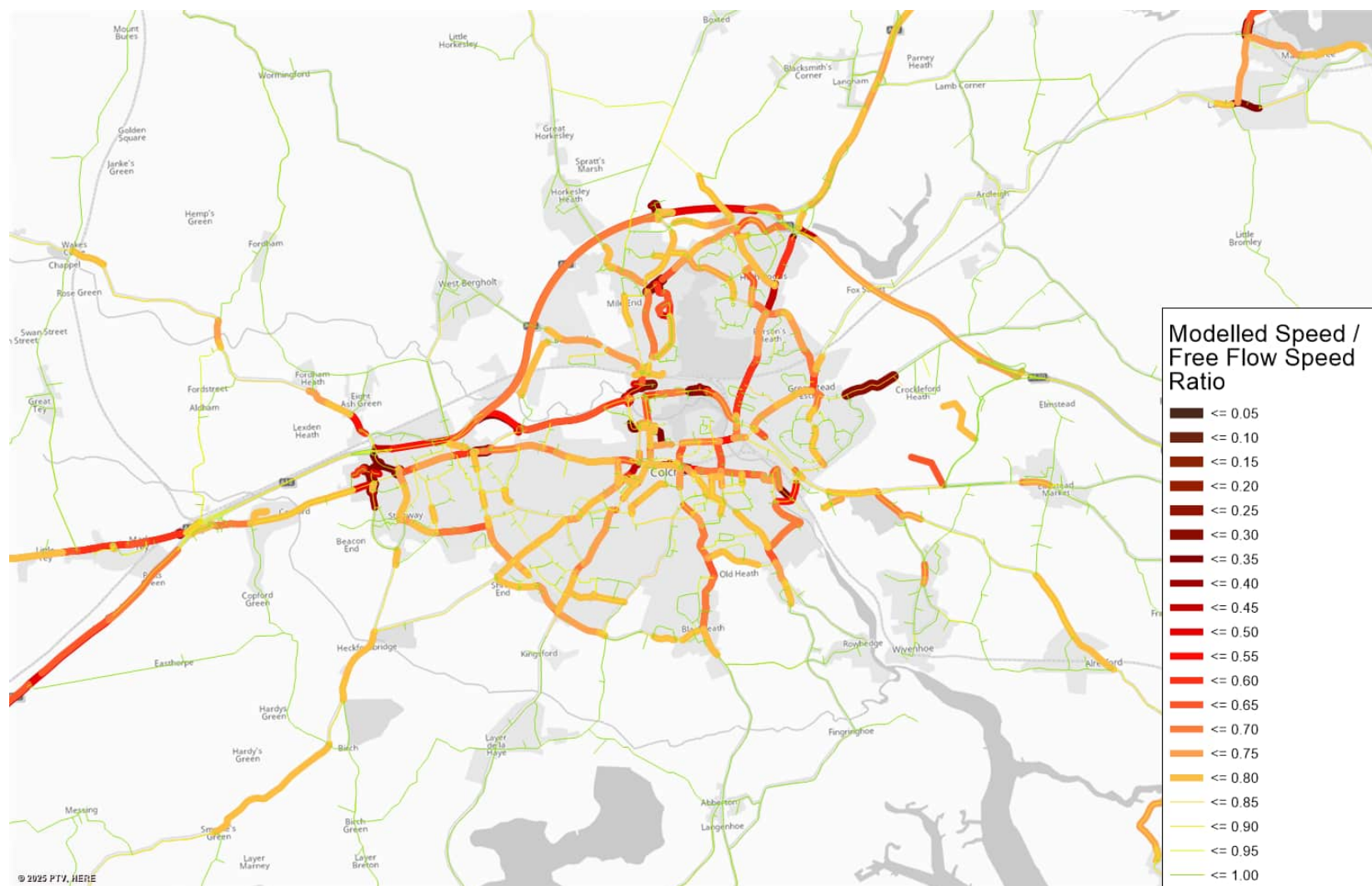


Figure D.21: Speed ratio – Scenario 4 without A12 widening and with A331 completion – PM

D.2.4 PM relative queue plots (100% queues on road links in the model)



Figure D.22: Relative queue – Scenario 0 without A12 widening and with A1331 completion – PM



Figure D.23: Relative queue – Scenario 1 without A12 widening and with A1331 completion – PM



Figure D.24: Relative queue – Scenario 2 without A12 widening and with A1331 completion – PM



Figure D.25: Relative queue – Scenario 3 without A12 widening and with A1331 completion – PM



Figure D.26: Relative queue – Scenario 4 with all mitigations, without A12 widening and with A1331 completion – PM

E Transport modelling outputs for scenarios with delayed A1331 link road completion (without A12 widening)

Introduction

This appendix provides flow difference, relative queue and speed plots from the 2041 NEMo reference and assessment cases in scenarios without A12 J19-25 widening and delayed completion of the A1331 link road. Hence, in a future without these schemes, it is possible to sequentially look at the impact of:

- 2041 reference case demand without all mitigations
- 2041 reference case demand with expected mitigations at A12 J29 and Greenstead roundabout (called the baseline with A12 widening and with the link road)
- 2041 BaU demand from preferred site allocations added on top of the baseline scenario
- 2041 ST demand from preferred site allocations added on top of the baseline scenario – which reduced car trips to reflect the impact of a shift to sustainable modes as a result of sustainable travel measures
- 2041 ST demand from preferred site allocations with highway mitigations added on top of the baseline scenario – which combines all mitigation measures that are considered as required to achieve acceptable performance of the transport network.

Parallel appendices show the above scenarios in future with the A12 widening and link road completions.

E.1 AM flow, speed queue plots

E.1.1 Summary of impact in the AM

Table E.1: AM peak summary impact assessment of scenarios without A12 widening and without link road completion

AM peak impacts		With A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	13	9	x	x	x
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	!	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	6	10	11	x	!	✓
	A12 J25 / A120 (western)	5	6	6	x	x	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	9	9	x	!	✓
	A12 J29 / A120 (eastern)	7	9	8	✓	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	6	8	8	✓	!	!
Overall assesement combining all areas		7	9	9	12	11	10

E.1.2 AM flow difference plots

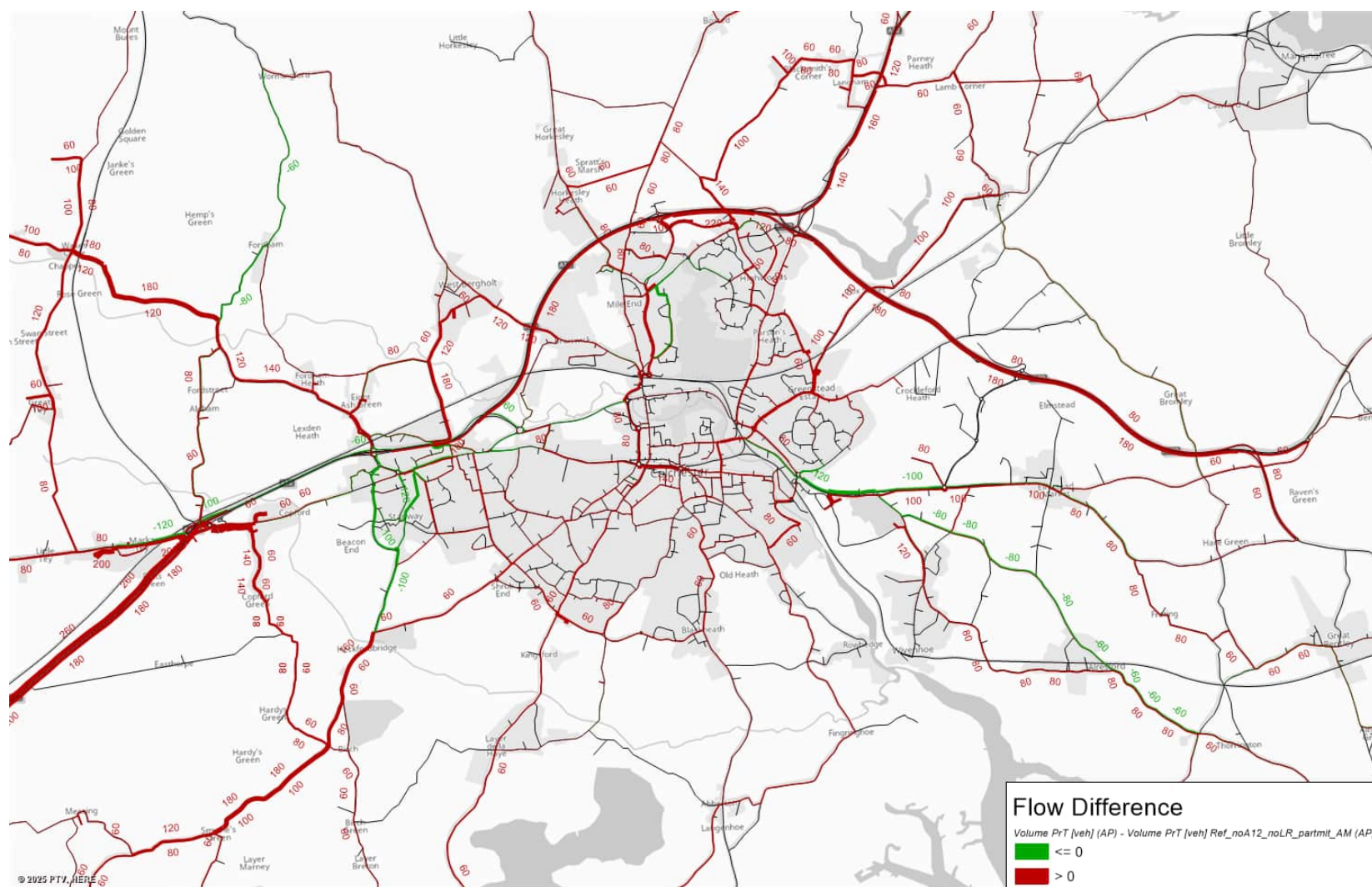


Figure E.1: Flow difference – Scenario 2 v. Scenario 1 (without A12 widening and delayed A1331)– AM

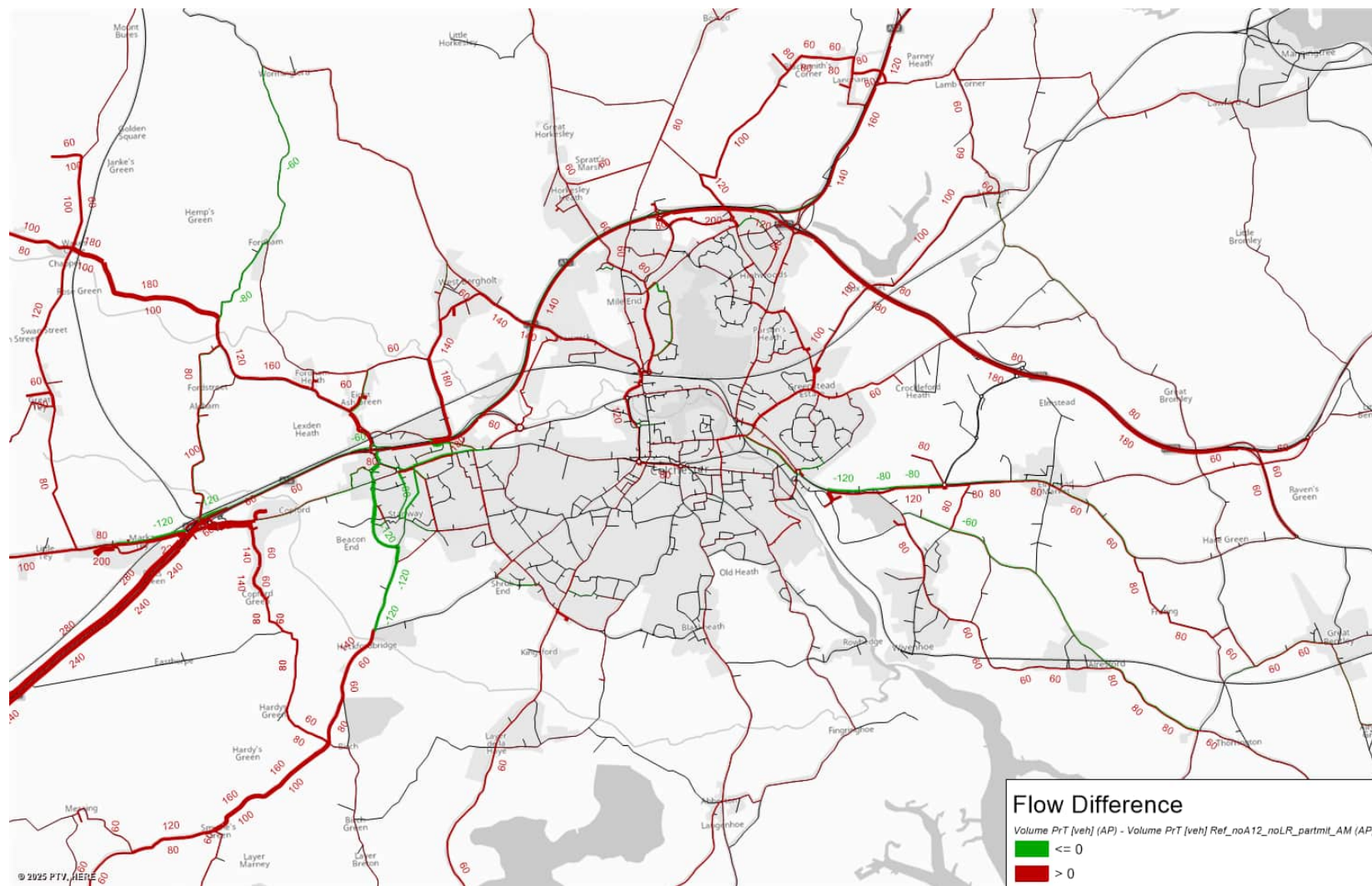


Figure E.2: Flow difference – Scenario 3 v. Scenario 1 (without A12 widening and delayed A1331)– AM

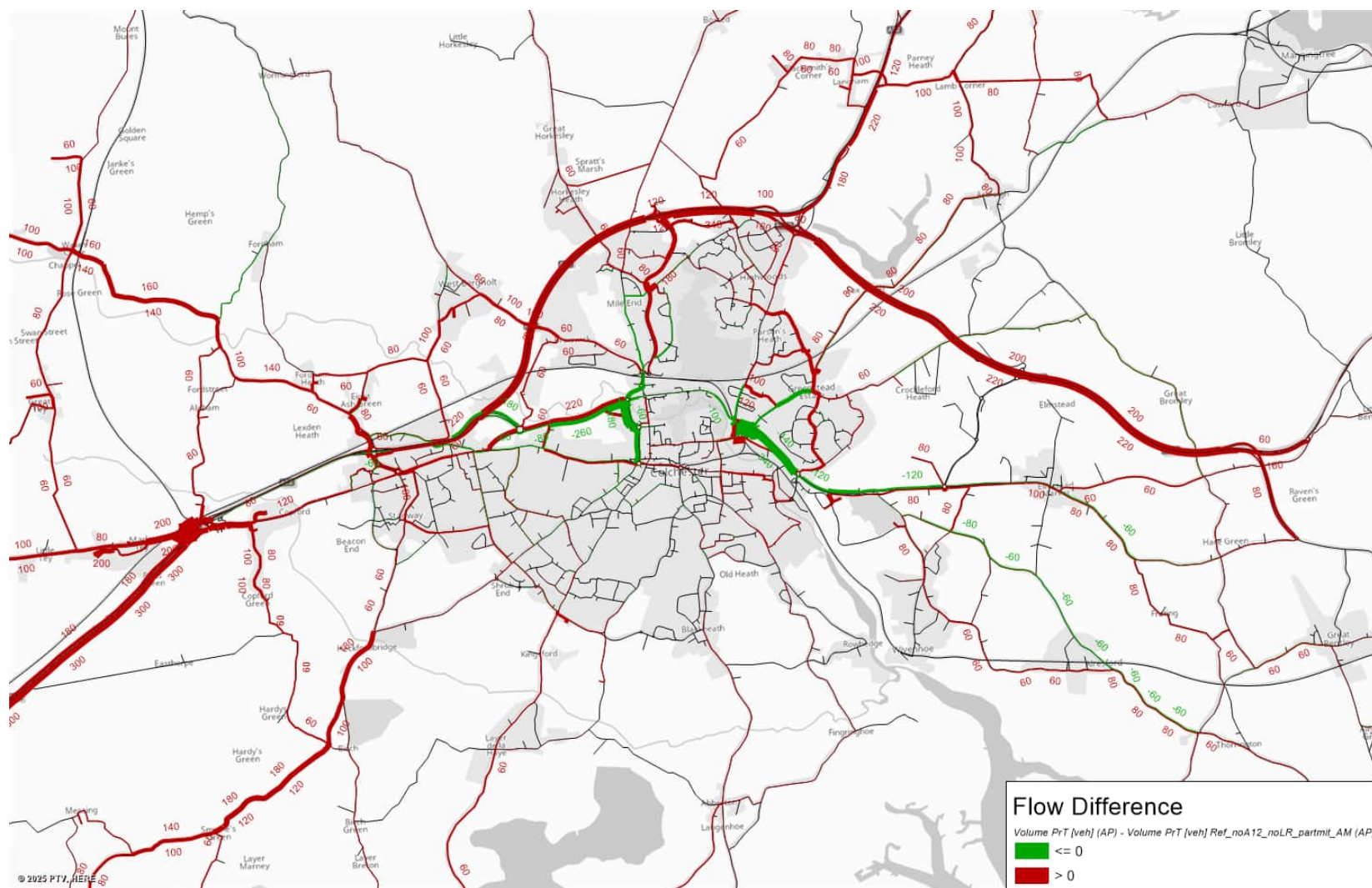


Figure E.3: Flow difference – Scenario 4 v. Scenario 1 (without A12 widening and delayed A1331)– AM

E.1.3 AM speed plots (modelled speed / free flow speed)



Figure E.4: Speed ratio – Scenario 0 without A12 widening and delayed A331 completion – AM

This plot is discussed in sections 3.4, 5.3, 6.3.

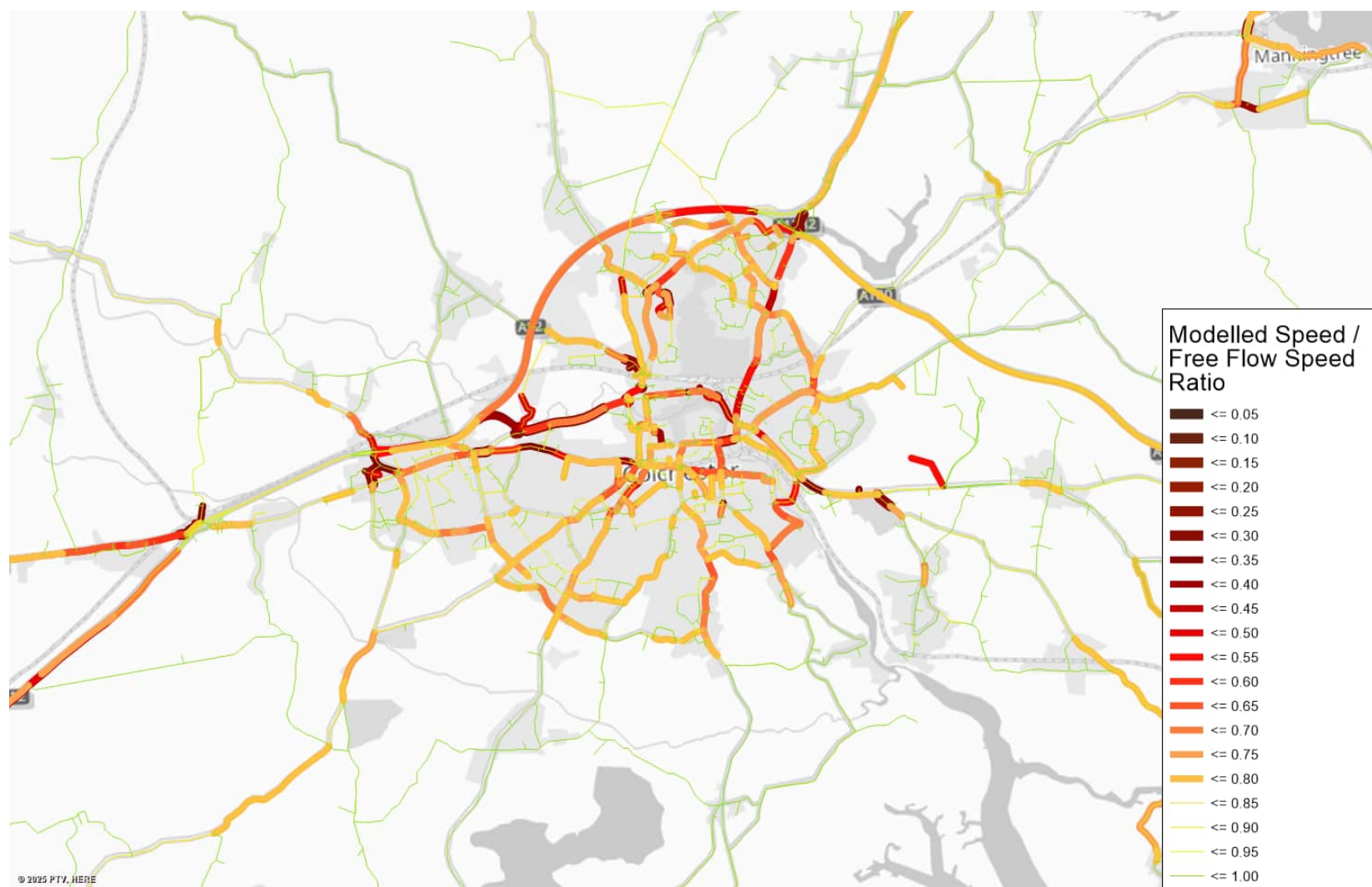


Figure E.5: Speed ratio – Scenario 1 without A12 widening and delayed A331 completion – AM

This plot is discussed in Section 3.4.

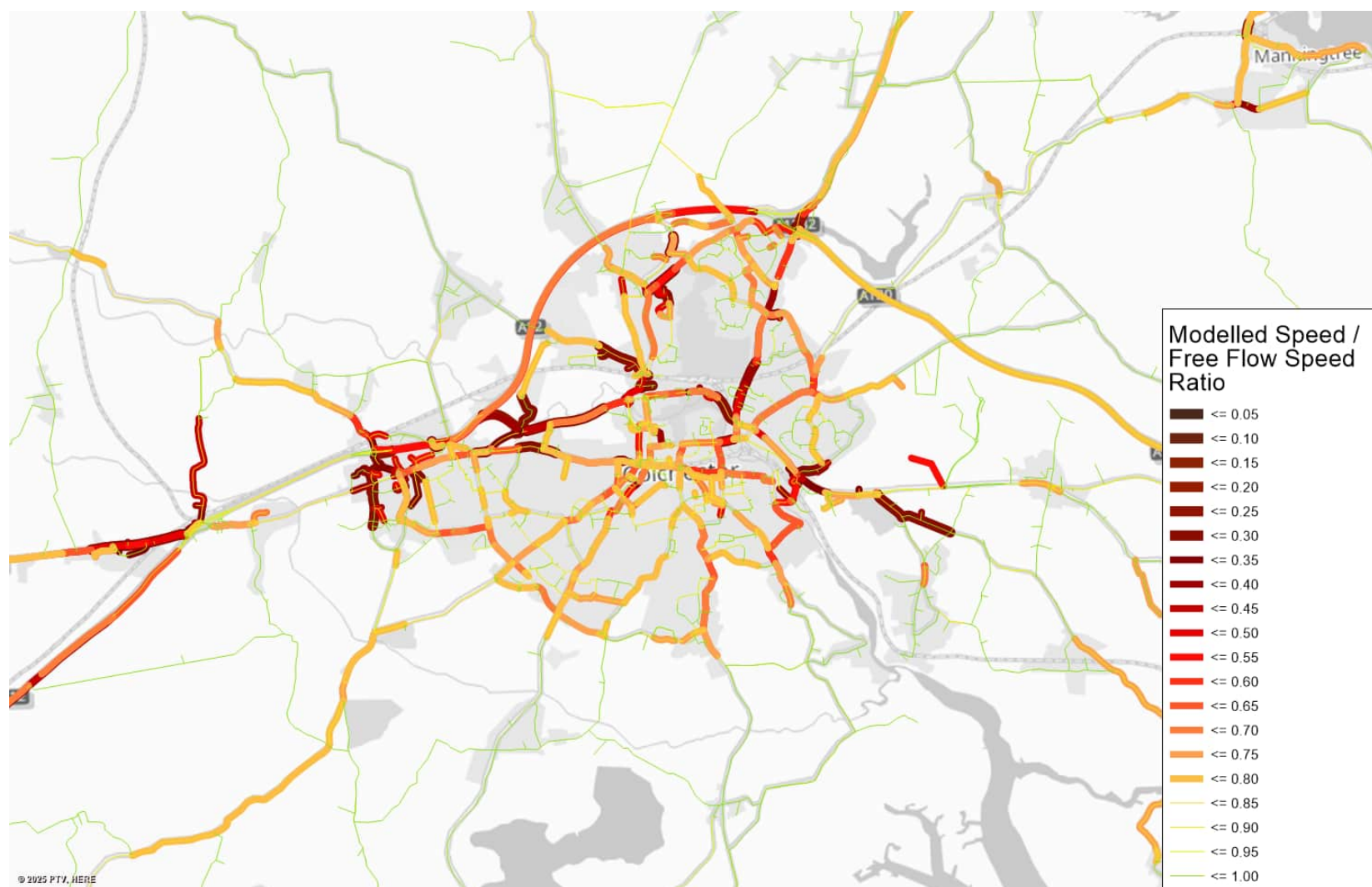


Figure E.6: Speed ratio – Scenario 2 without A12 widening and delayed A331 completion – AM

This plot is discussed in Section 5.3.

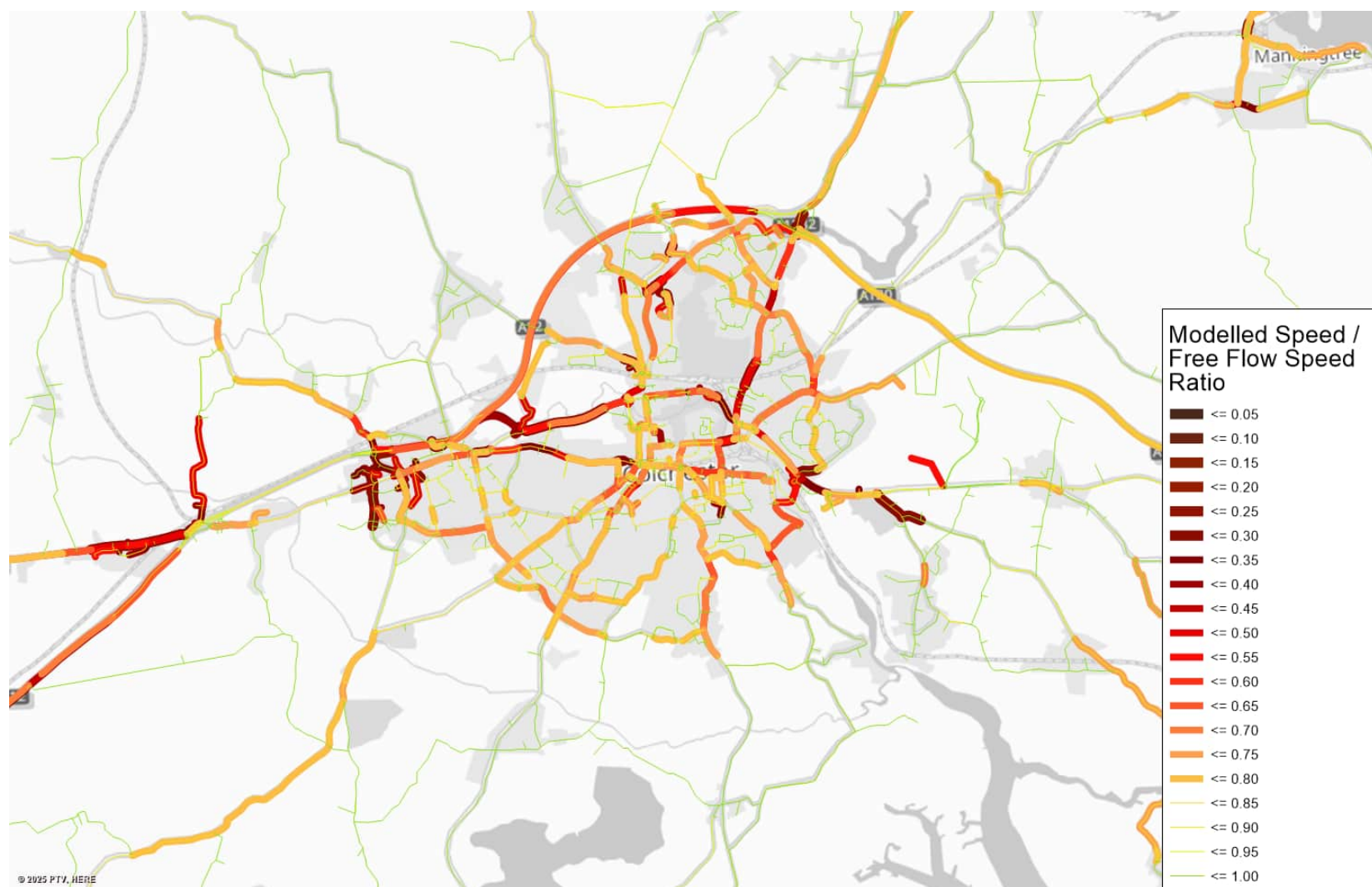


Figure E.7: Speed ratio – Scenario 3 without A12 widening and delayed A331 completion – AM

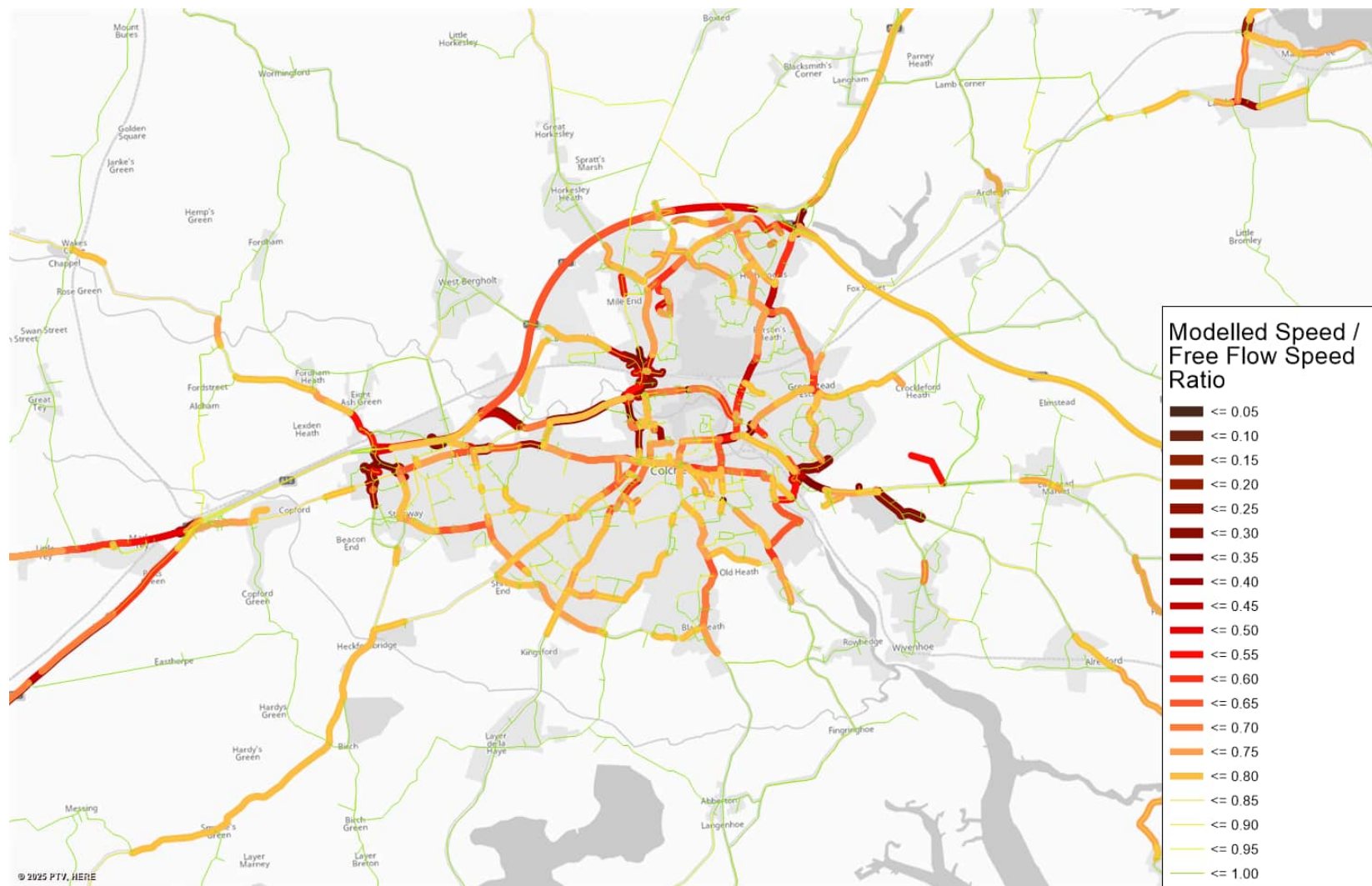


Figure E.8: Speed ratio – Scenario 4 without A12 widening and delayed A331 completion – AM

E.1.4 AM relative queue plots (100% queues on road links in the model)

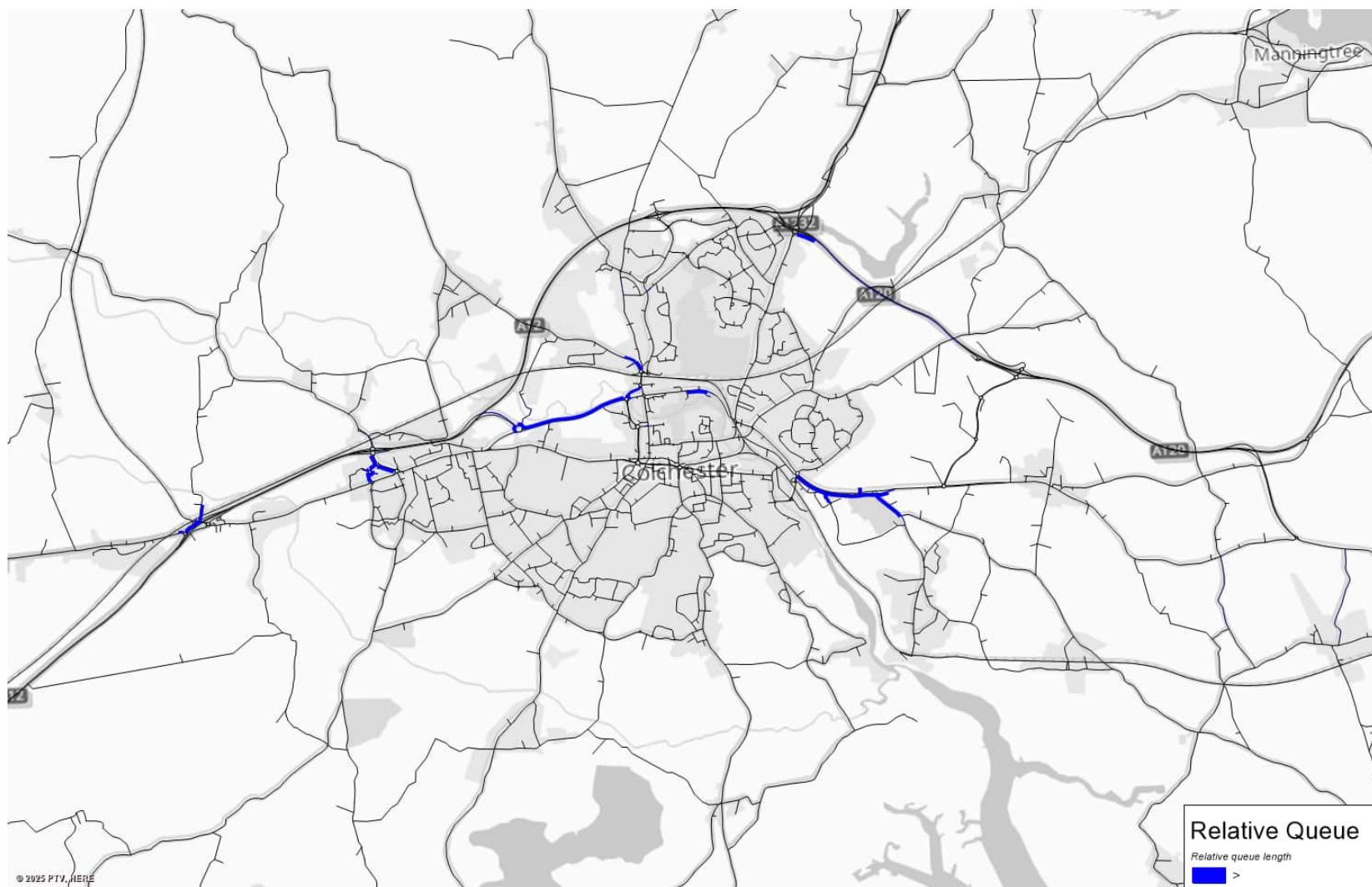


Figure E.9: Relative queue – Scenario 0 without A12 widening and delayed A1331 completion – AM



Figure E.10: Relative queue – Scenario 1 without A12 widening and delayed A1331 completion – AM



Figure E.11: Relative queue – Scenario 2 without A12 widening and delayed A1331 completion – AM



Figure E.12: Relative queue – Scenario 3 without A12 widening and delayed A1331 completion – AM

Figure E.13: Relative queue – Scenario 4 with all mitigations, delayed A12 widening and without A1331 completion – AM

E.2 PM speed and queue plots

E.2.1 Summary of impact in the PM

Table E.2: PM peak summary impact assessment of scenarios without A12 widening and without link road completion

PM peak impacts		Without A12 Widening and Without A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	11	14	10	X	X	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	X	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	5	8	8	!	!	!
	A12 J25 / A120 (western)	5	5	5	X	X	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	9	11	X	X	✓
	A12 J29 / A120 (eastern)	7	8	8	✓	✓	✓
Outer	Tiptree	3	4	4	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	5	7	7	✓	✓	✓
Overall assesement combining all areas		7	8	8	11	10	9

E.2.2 PM flow difference plots

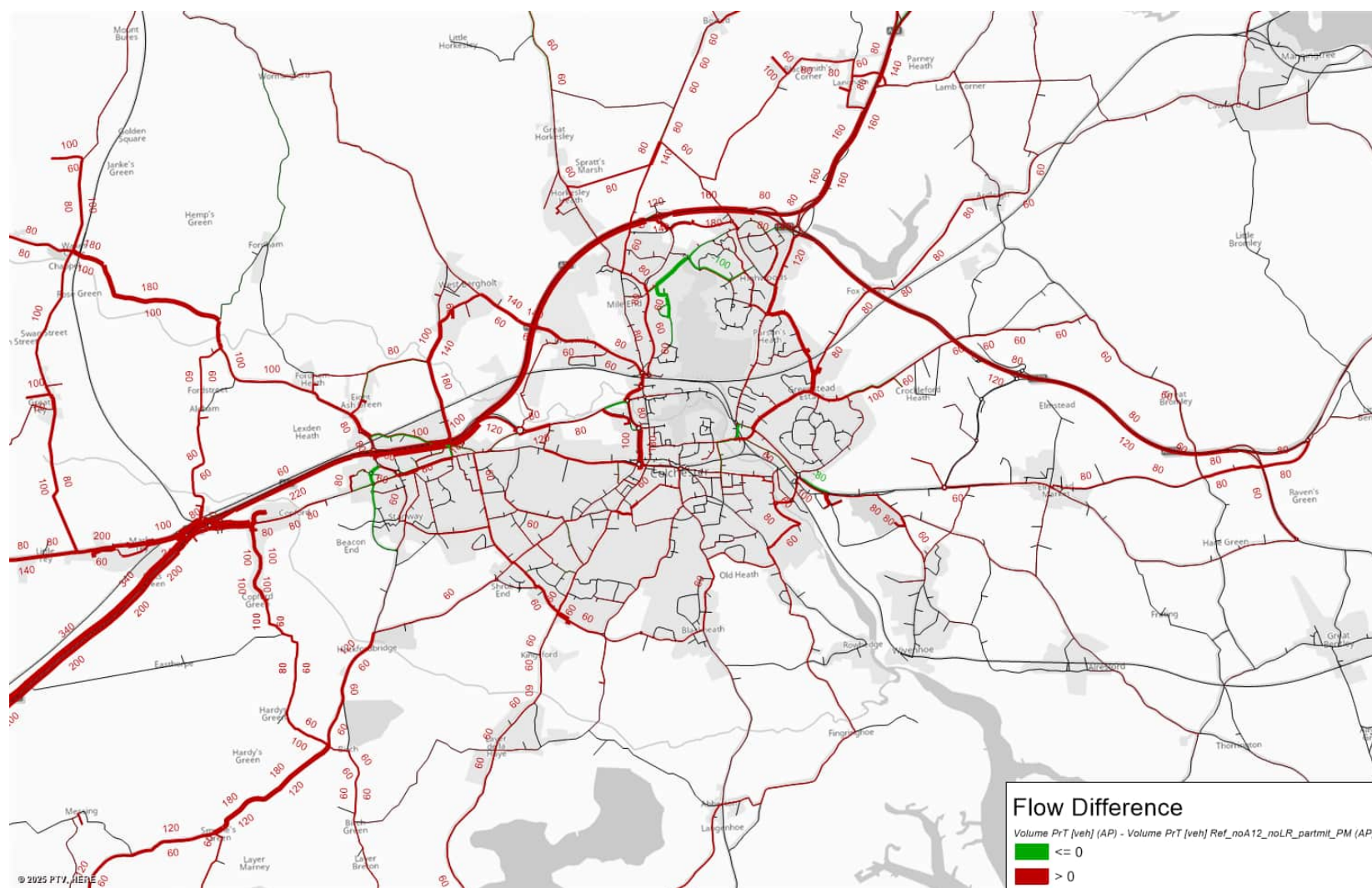


Figure E.14: Flow difference – Scenario 2 v. Scenario 1 (without A12 widening and delayed A1331)– PM

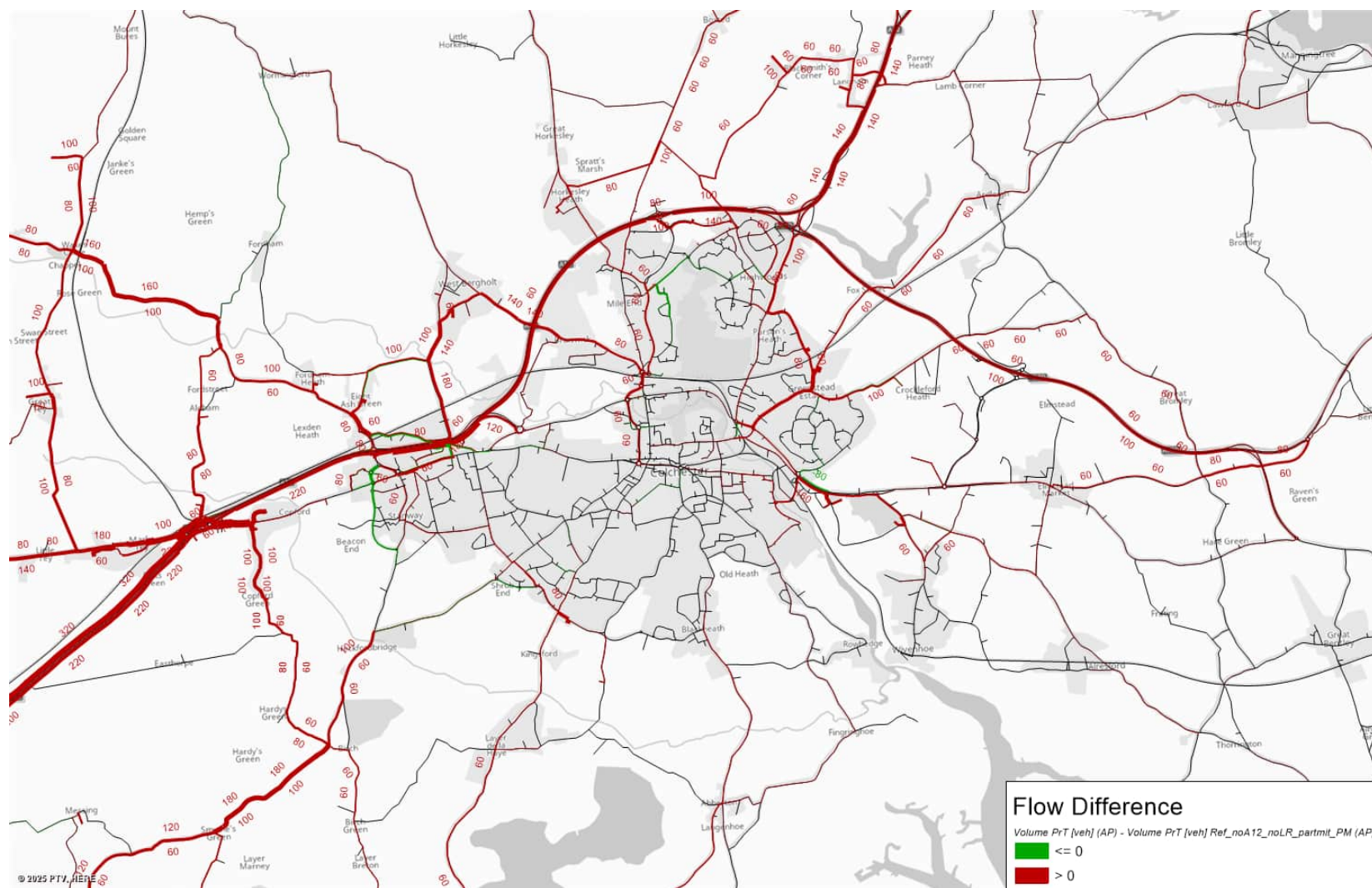


Figure E.15: Flow difference – Scenario 3 v. Scenario 1 (without A12 widening and delayed A1331)– PM

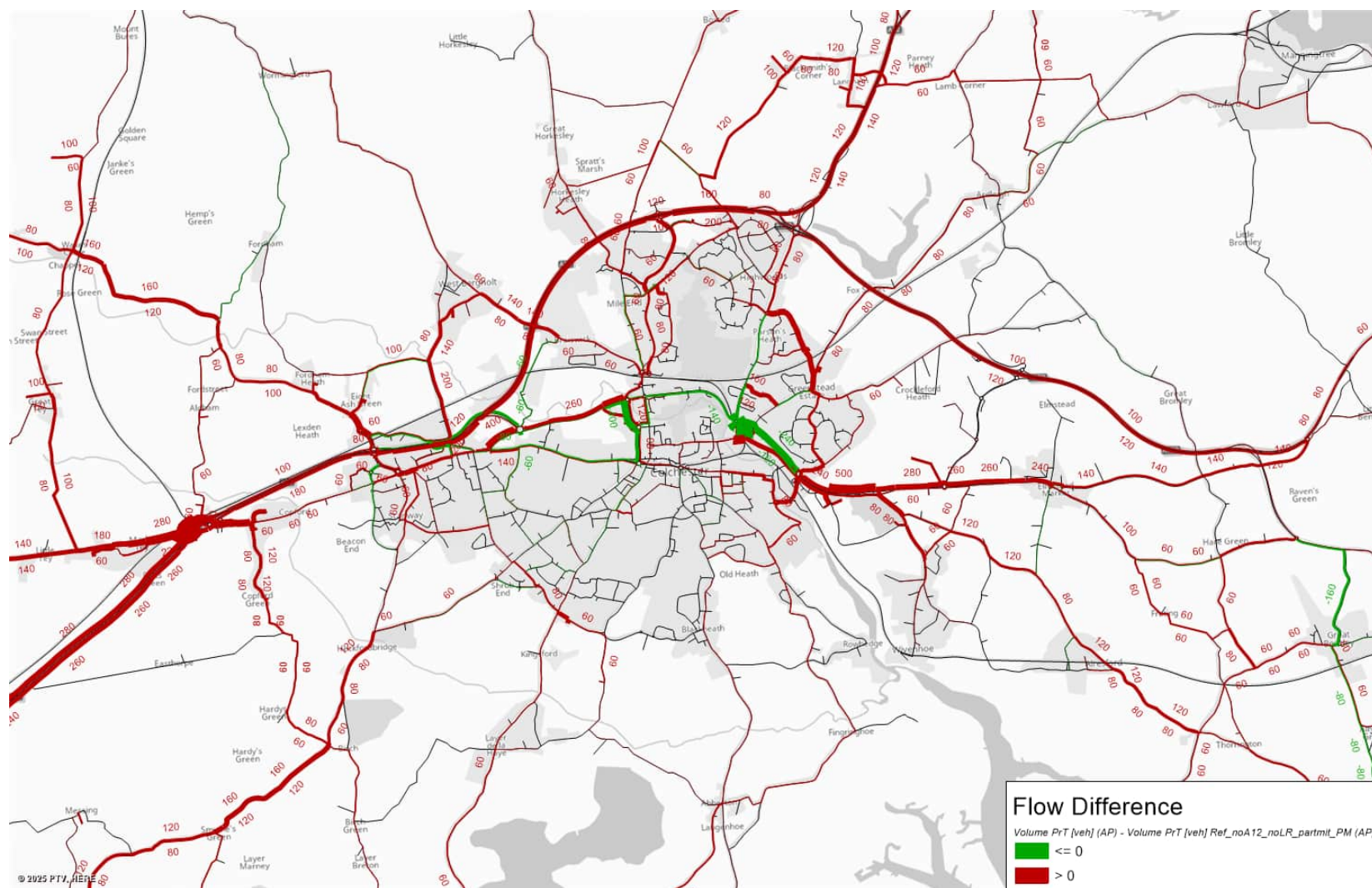


Figure E.16: Flow difference – Scenario 4 v. Scenario 1 (without A12 widening and delayed A1331)– PM

E.2.3 PM speed plots (modelled speed / free flow speed)

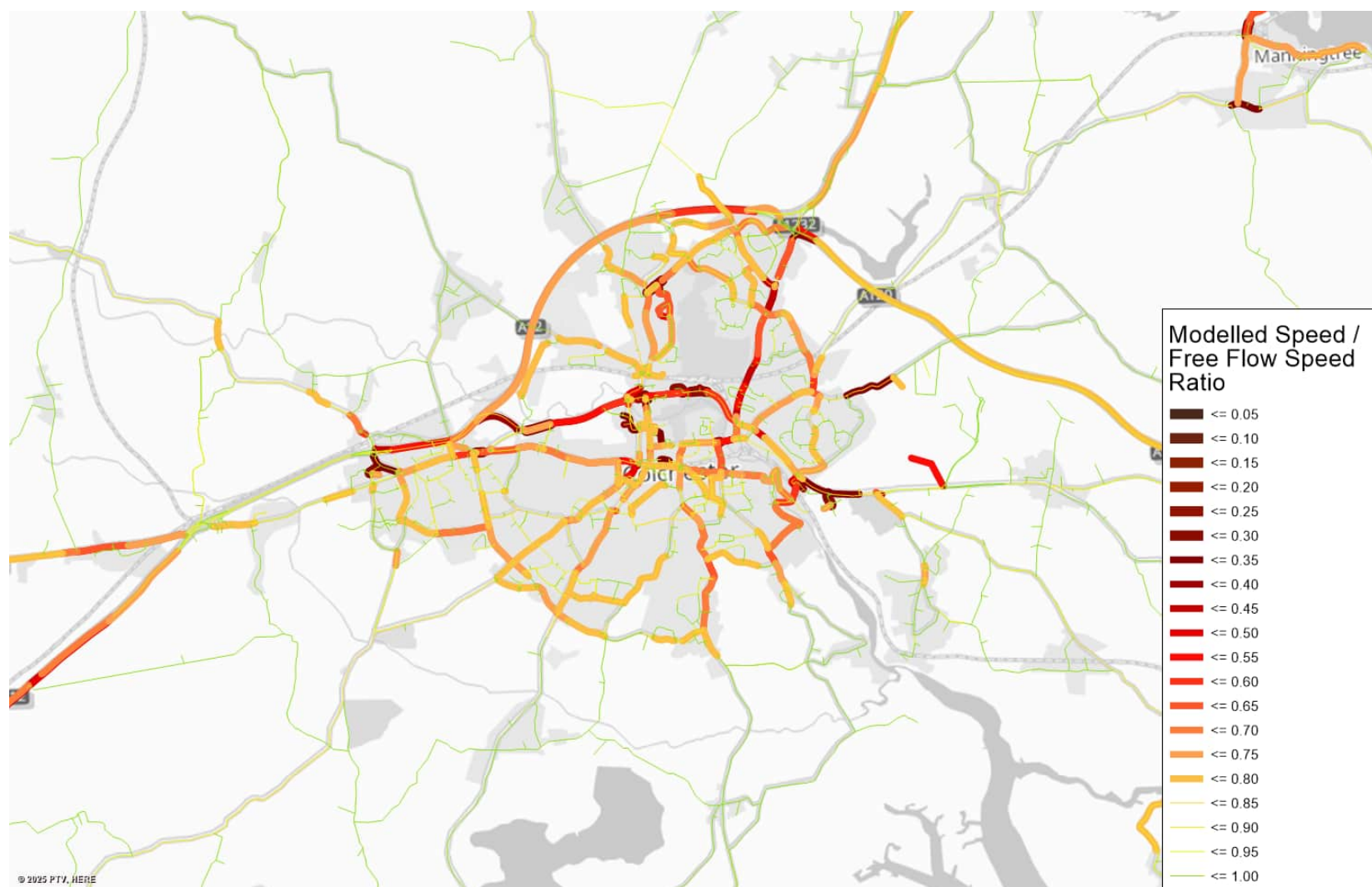


Figure E.17: Speed ratio – Scenario 0 without A12 widening and delayed A331 completion – PM

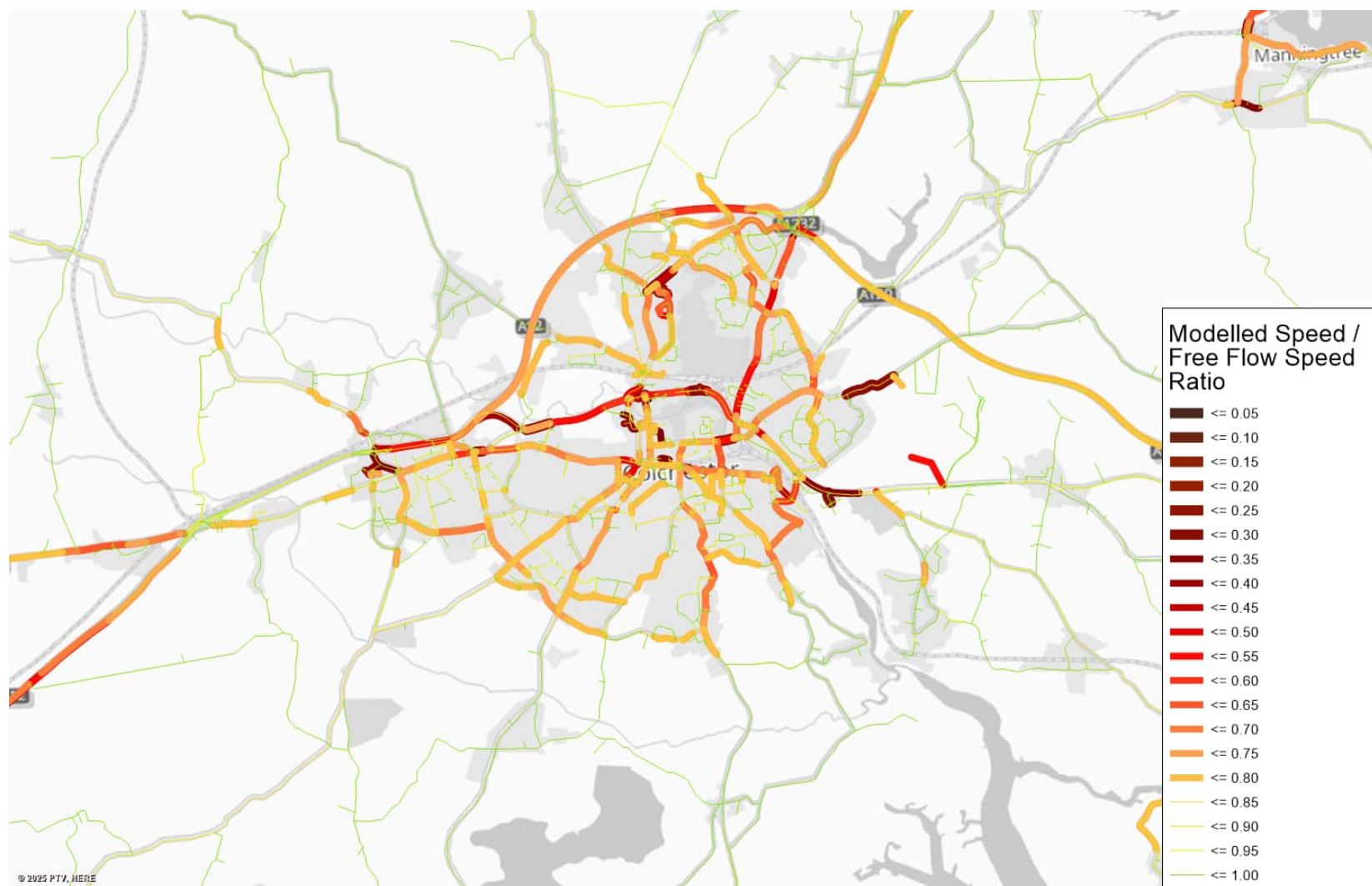


Figure E.18: Speed ratio – Scenario 1 without A12 widening and delayed A331 completion – PM

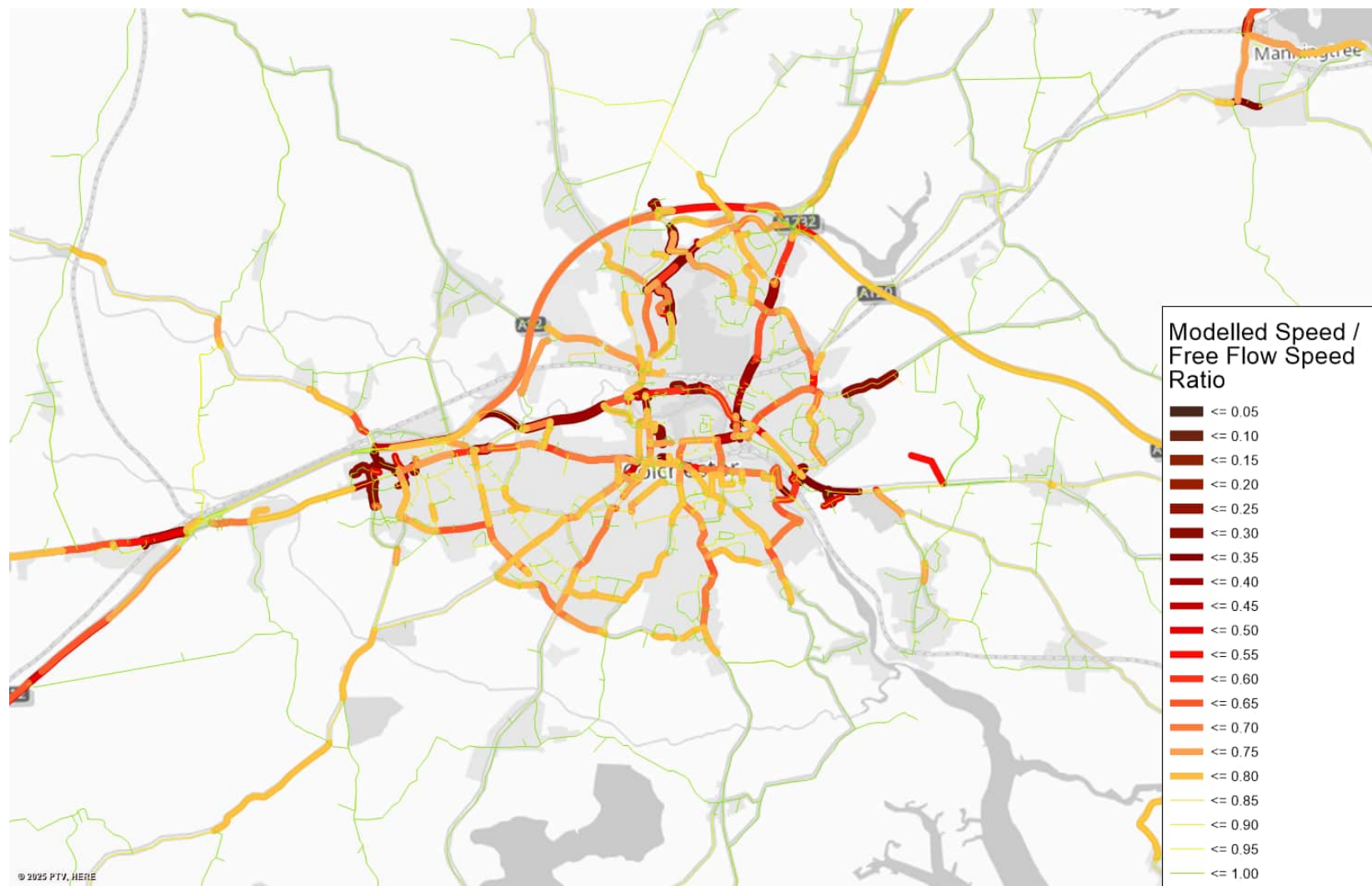


Figure E.19: Speed ratio – Scenario 2 without A12 widening and delayed A331 completion – PM

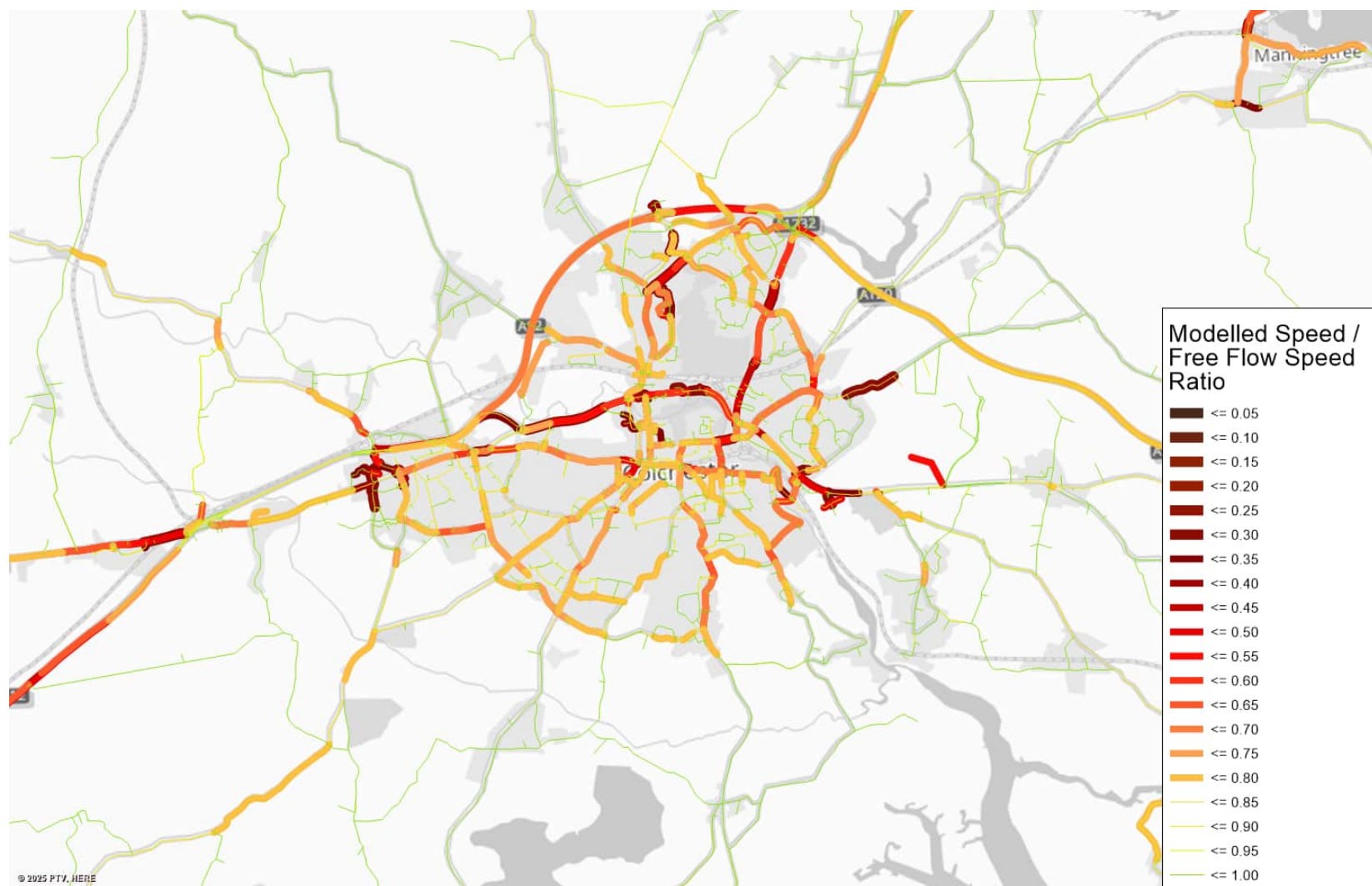


Figure E.20: Speed ratio – Scenario 3 without A12 widening and delayed A331 completion – PM

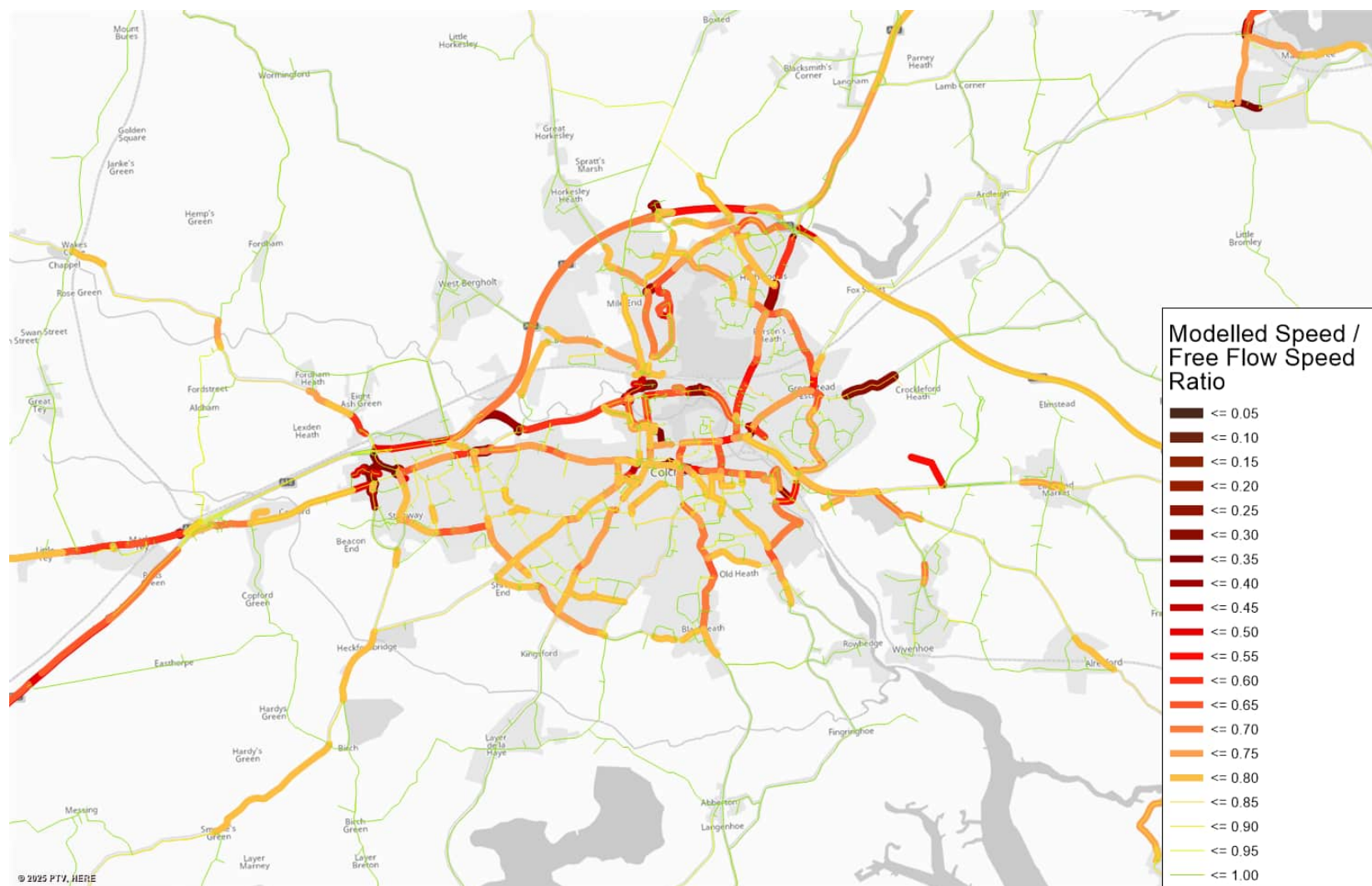


Figure E.21: Speed ratio – Scenario 4 without A12 widening and delayed A331 completion – PM

E.2.4 PM relative queue plots (100% queues on road links in the model)



Figure E.22: Relative queue – Scenario 0 without A12 widening and delayed A1331 completion – PM



Figure E.23: Relative queue – Scenario 1 without A12 widening and delayed A1331 completion – PM

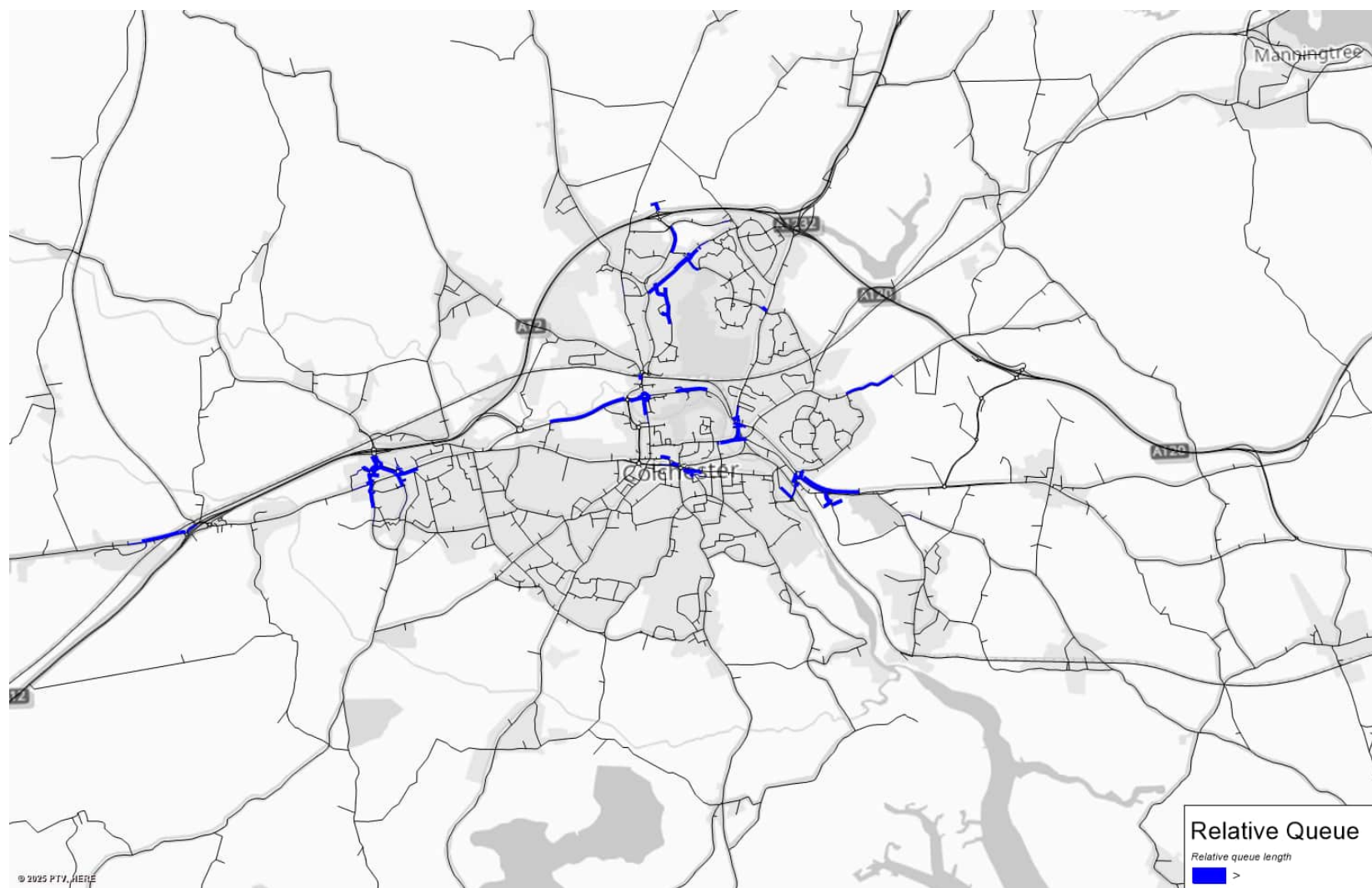


Figure E.24: Relative queue – Scenario 2 without A12 widening and delayed A1331 completion – PM

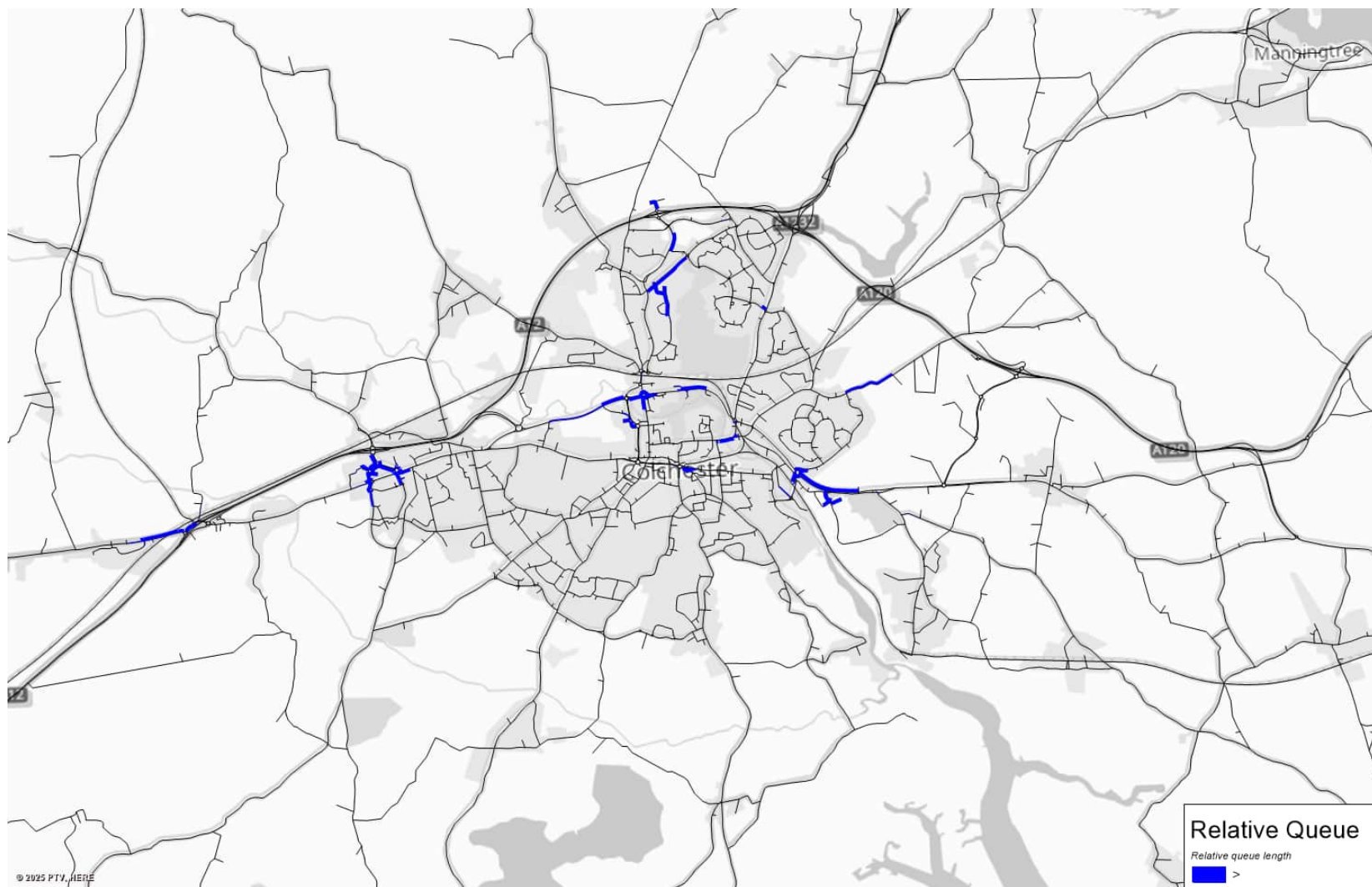


Figure E.25: Relative queue – Scenario 3 without A12 widening and delayed A1331 completion – PM

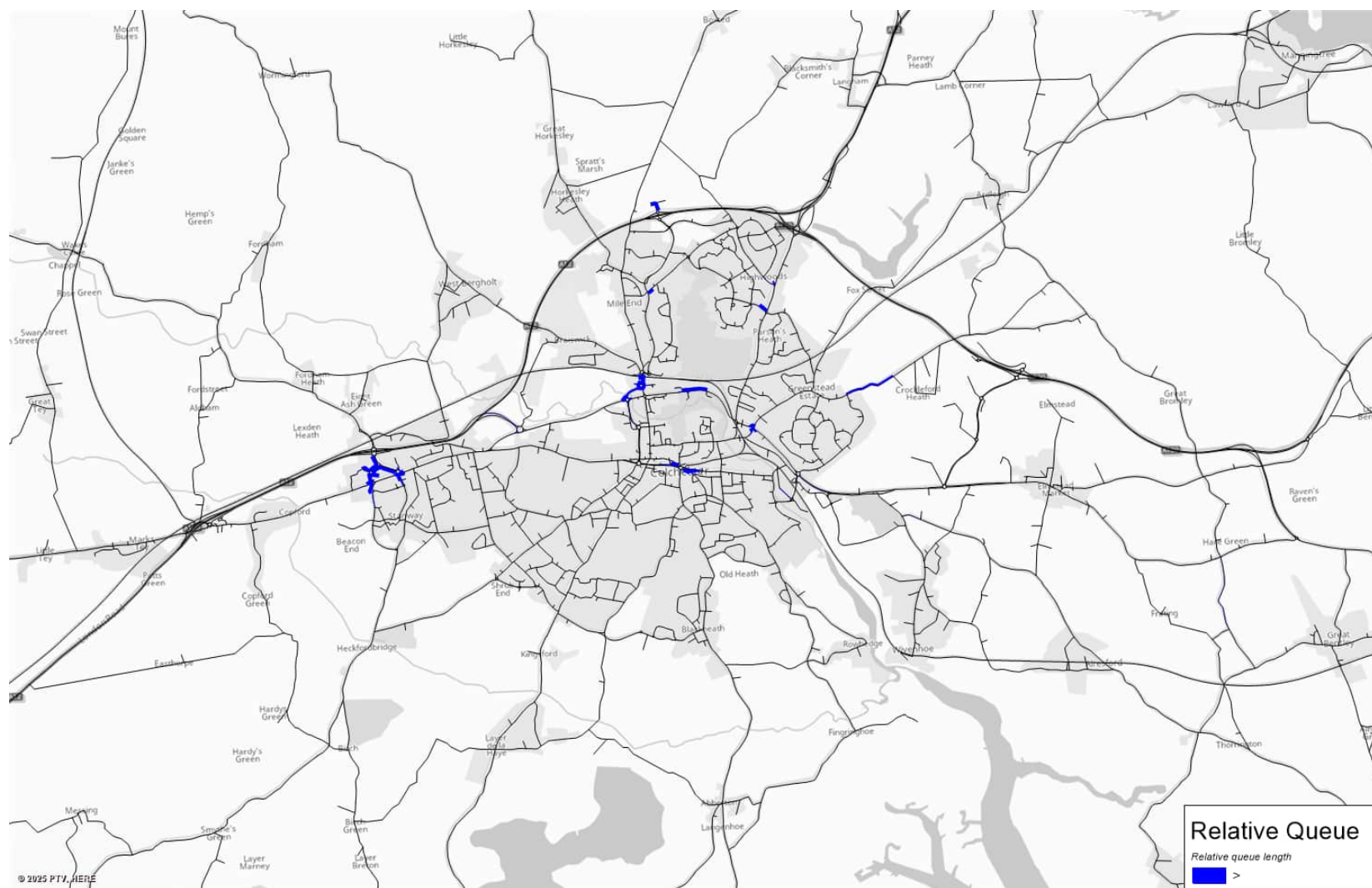


Figure E.26: Relative queue – Scenario 4 with A12 widening and delayed A1331 completion – PM

F Transport modelling outputs for scenarios with A1331 link road completion and with J19-25 A12 widening

Introduction

This appendix provides flow difference, relative queue and speed plots from the 2041 NEMo reference and assessment cases in scenarios with A12 J19-25 widening and completion of the A1331 link road. Hence, in a future with these schemes, it is possible to sequentially look at the impact of:

- 2041 reference case demand without all mitigations
- 2041 reference case demand with expected mitigations at A12 J29 and Greenstead roundabout (called the baseline with A12 widening and with the link road)
- 2041 BaU demand from preferred site allocations added on top of the baseline scenario
- 2041 ST demand from preferred site allocations added on top of the baseline scenario – which reduced car trips to reflect the impact of a shift to sustainable modes as a result of sustainable travel measures
- 2041 ST demand from preferred site allocations with highway mitigations added on top of the baseline scenario – which combines all mitigation measures that are considered as required to achieve acceptable performance of the transport network.

Parallel appendices show the above scenarios in future without the A12 widening and link road completions.

F.1 AM flow, speed queue plots

F.1.1 Summary of impact in the AM

Table F.1: AM peak summary impact assessment of scenarios

AM peak impacts		With A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	12	7	!	✓	✓
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	x	!	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	6	9	9	x	x	!
	A12 J25 / A120 (western)	5	5	5	✓	✓	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	8	9	x	!	✓
	A12 J29 / A120 (eastern)	7	10	7	!	✓	✓
Outer	Tiptree	3	3	3	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	6	3	3	✓	✓	✓
Overall assesement combining all areas		7	8	7	10	9	8

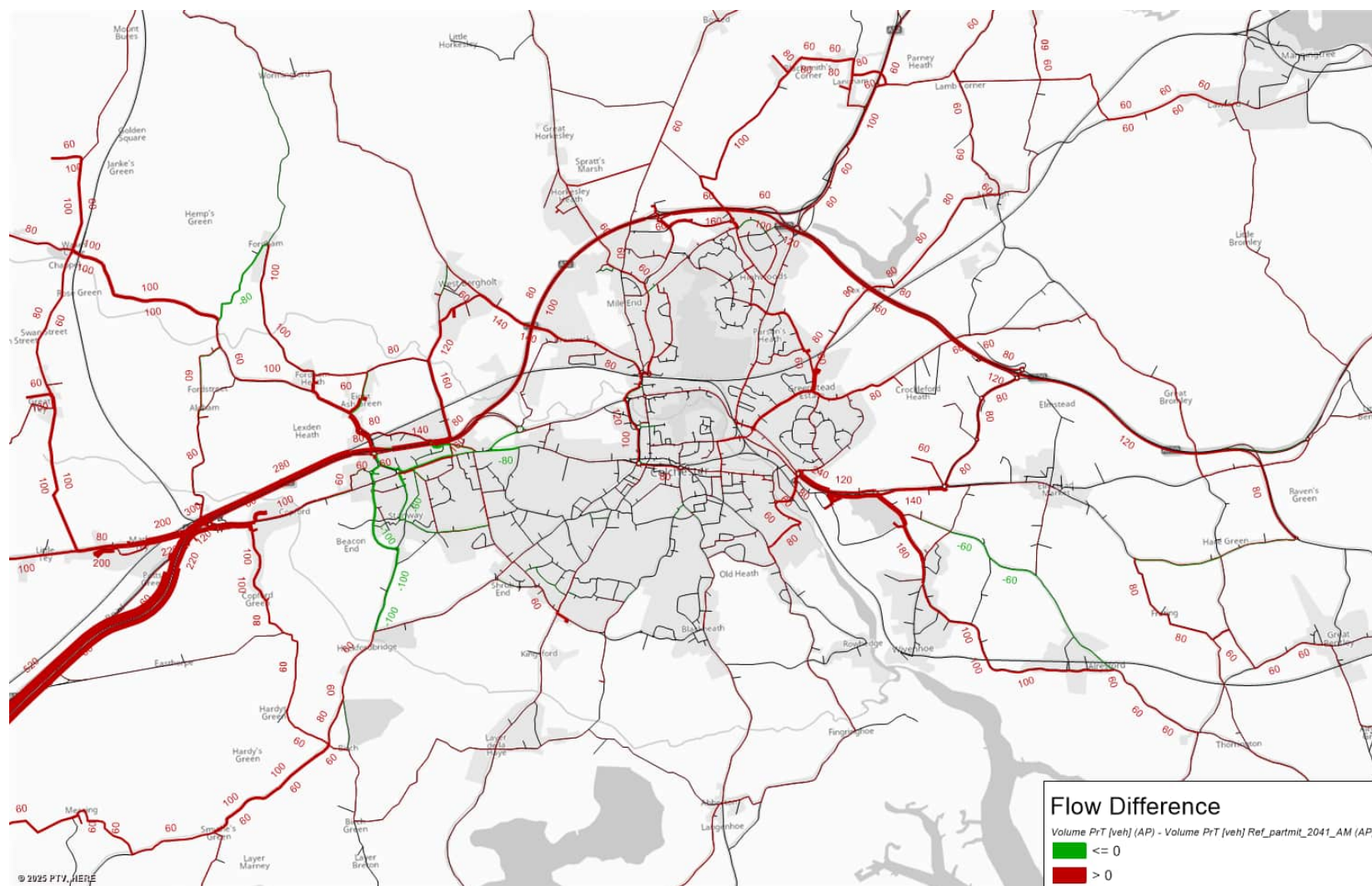


Figure F.2: Flow difference – Scenario 3 v. Scenario 1 (with A12 widening and with A1331)– AM

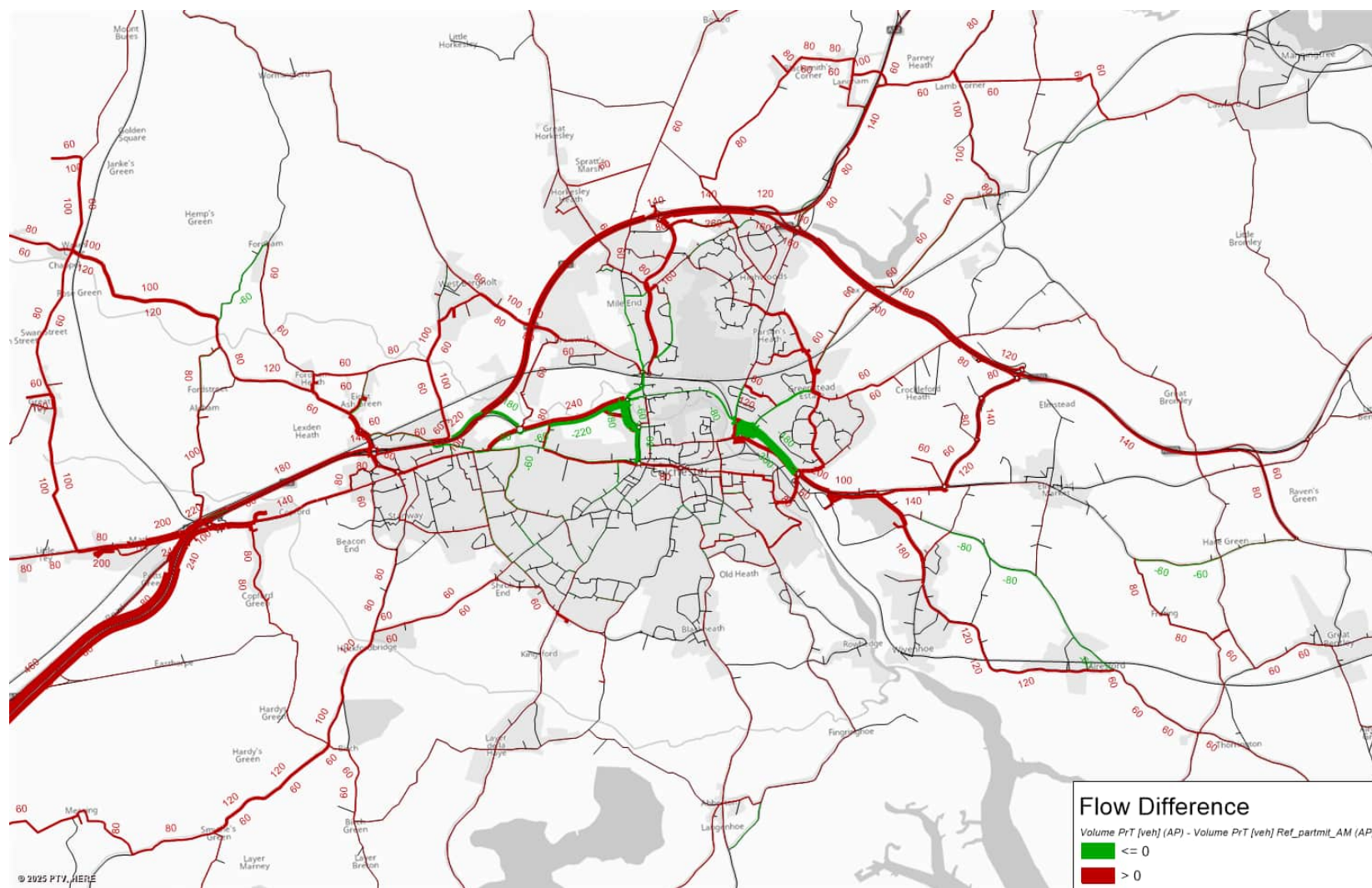


Figure F.3: Flow difference – Scenario 4 v. Scenario 1 (with A12 widening and with A1331)– AM

F.1.3 AM speed plots (modelled speed / free flow speed)**Figure F.4:** Speed ratio – Scenario 0 with A12 widening and A331 completion – AM



Figure F.5: Speed ratio – Scenario 1 with A12 widening and A331 completion – AM



Figure F.6: Speed ratio – Scenario 2 with A12 widening and with A331 completion – AM

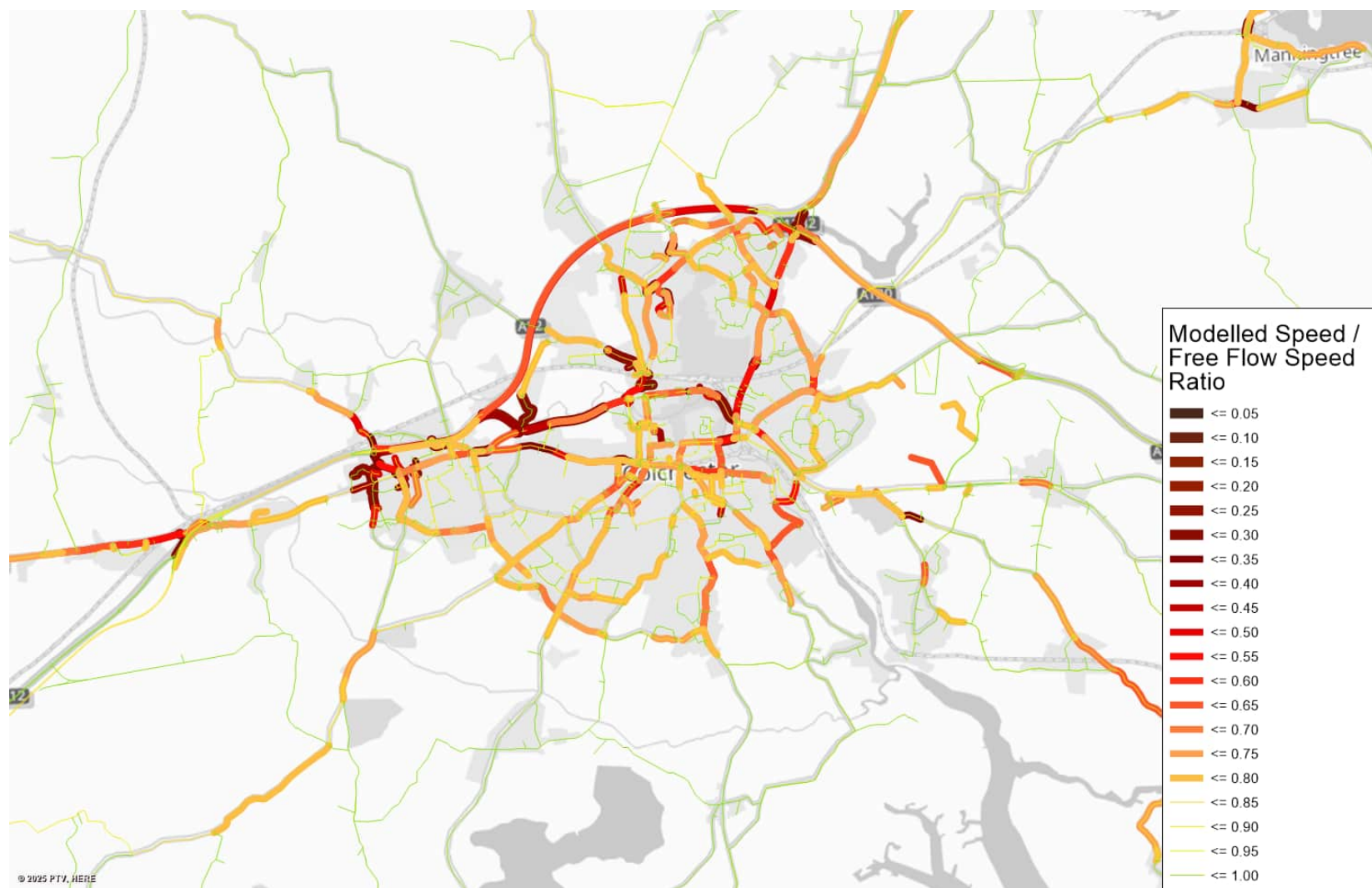


Figure F.7: Speed ratio – Scenario 3 with A12 widening and with A331 completion – AM

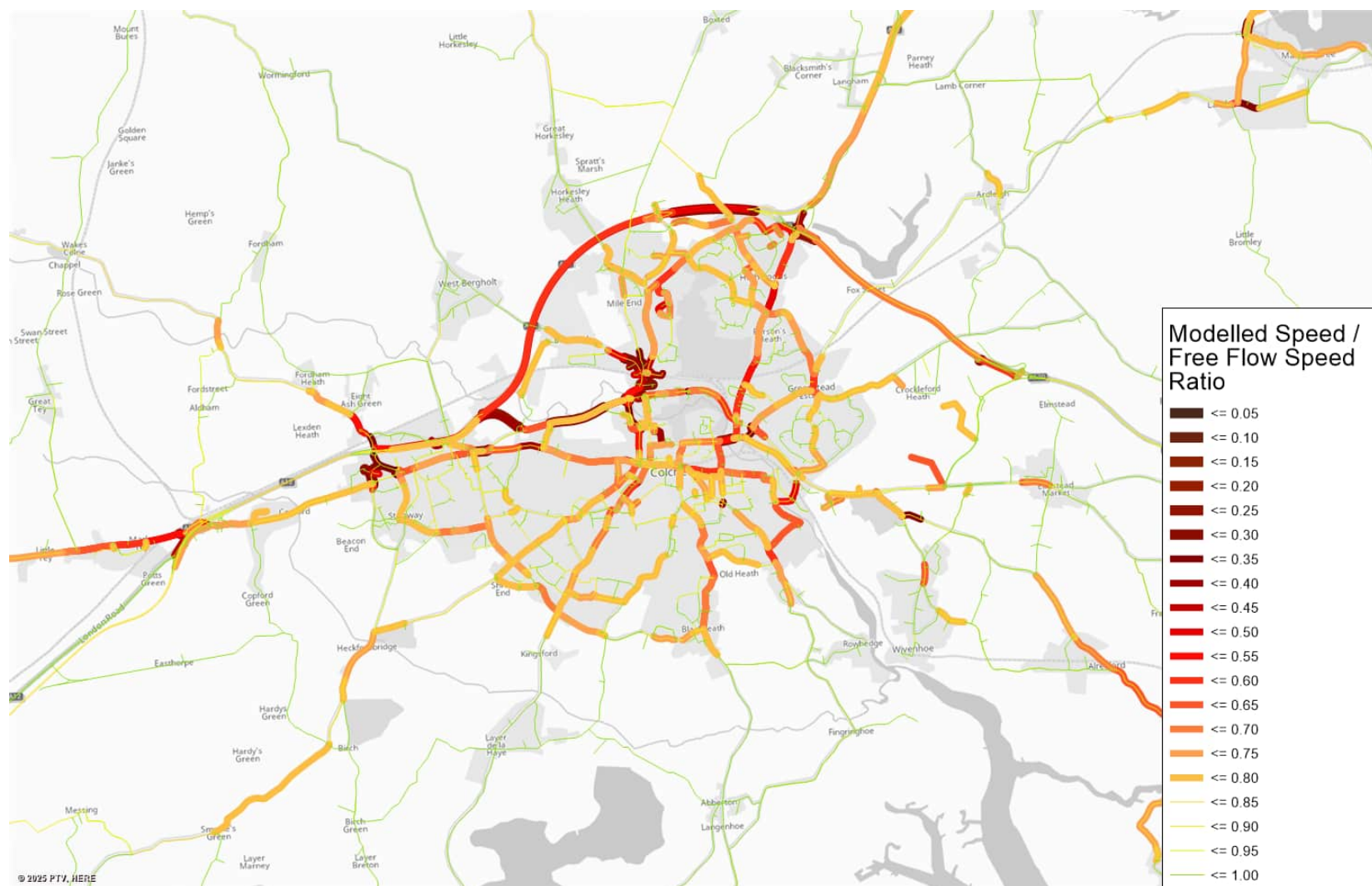


Figure F.8: Speed ratio – Scenario 4 with A12 widening and with A331 completion – AM

F.1.4 AM relative queue plots (100% queues on road links in the model)



Figure F.9: Relative queue – Scenario 0 with A12 widening and A1331 completion – AM



Figure F.10: Relative queue – Scenario 1 with A12 widening and A1331 completion – AM



Figure F.11: Relative queue – Scenario 2 with A12 widening and A1331 completion – AM



Figure F.12: Relative queue – Scenario 3 with A12 widening and A1331 completion – AM

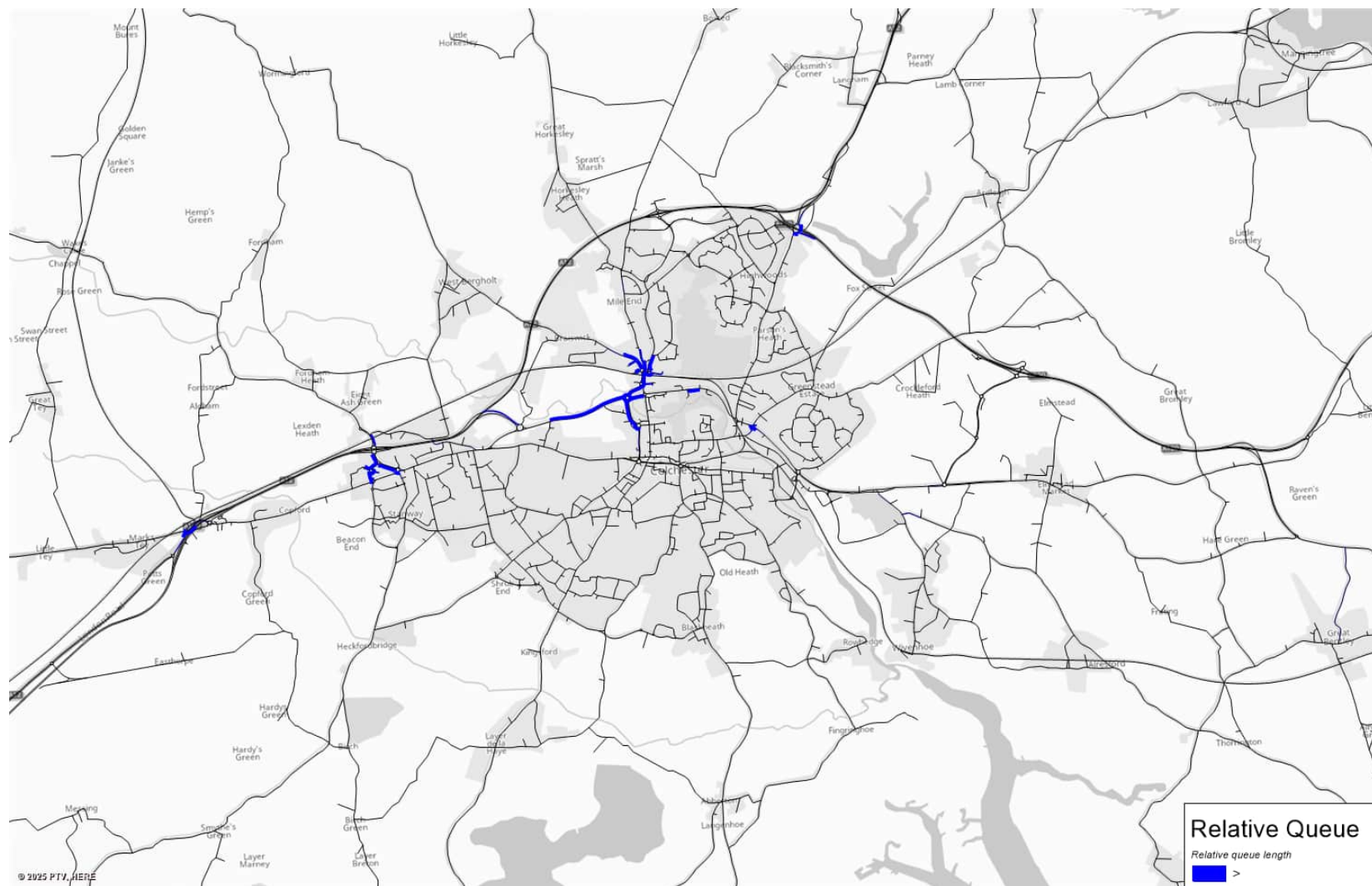


Figure F.13: Relative queue – Scenario 4 with A12 widening and A1331 completion – AM

F.2 PM flow, speed and queue plots

F.2.1 Summary of impact in the PM

Table F.2: PM peak summary impact assessment of scenarios

PM peak impacts		With A12 Widening and With A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	11	11	8	!	!	!
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	x	✓	!
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	5	7	7	!	!	✓
	A12 J25 / A120 (western)	5	5	5	✓	✓	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	10	11	x	x	✓
	A12 J29 / A120 (eastern)	7	8	8	✓	✓	✓
Outer	Tiptree	3	3	3	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	5	3	3	✓	✓	✓
Overall assesement combining all areas		7	8	7	10	9	8

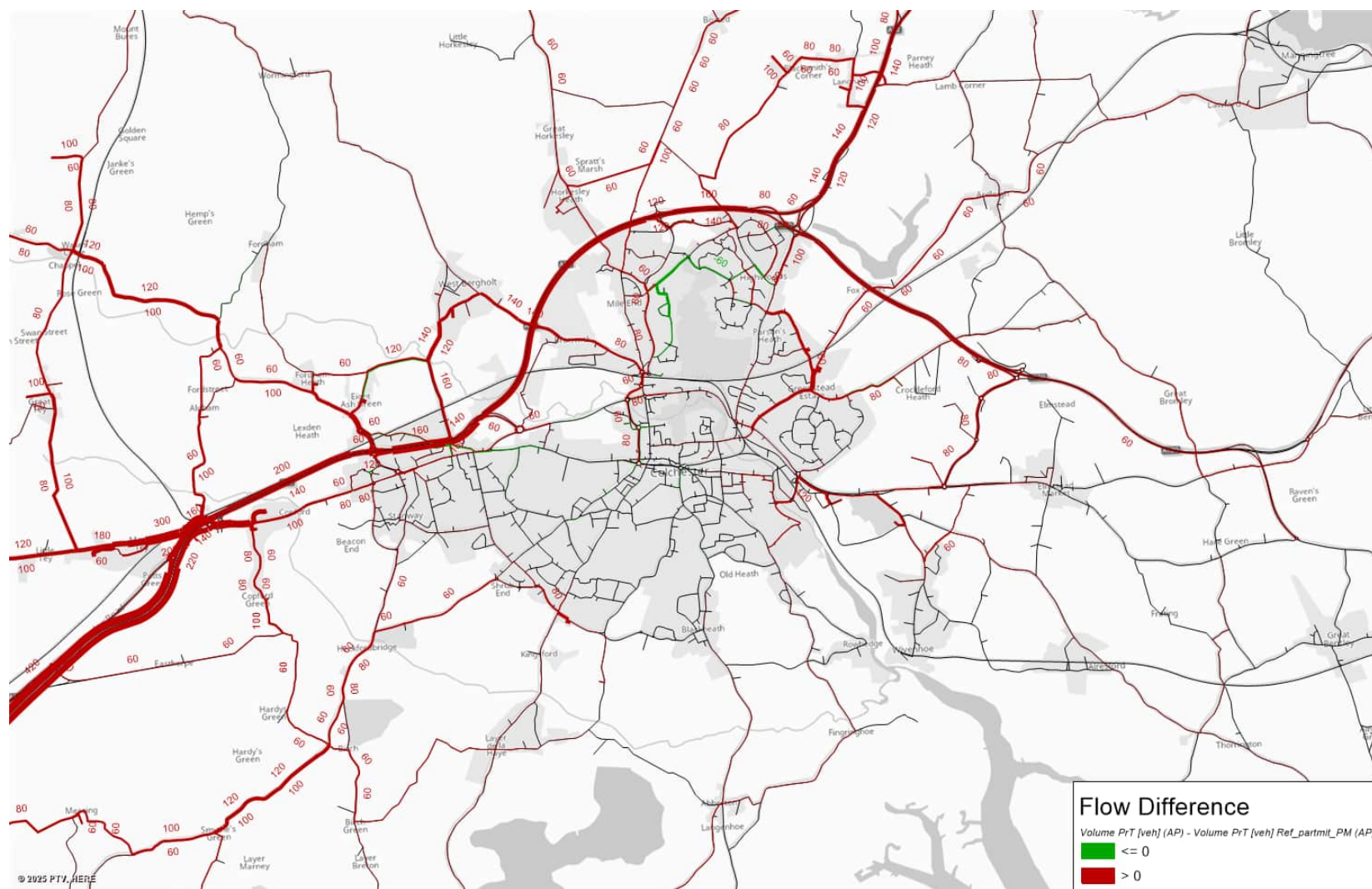


Figure F.15: Flow difference – Scenario 3 v. Scenario 1 (with A12 widening and with A1331)– PM

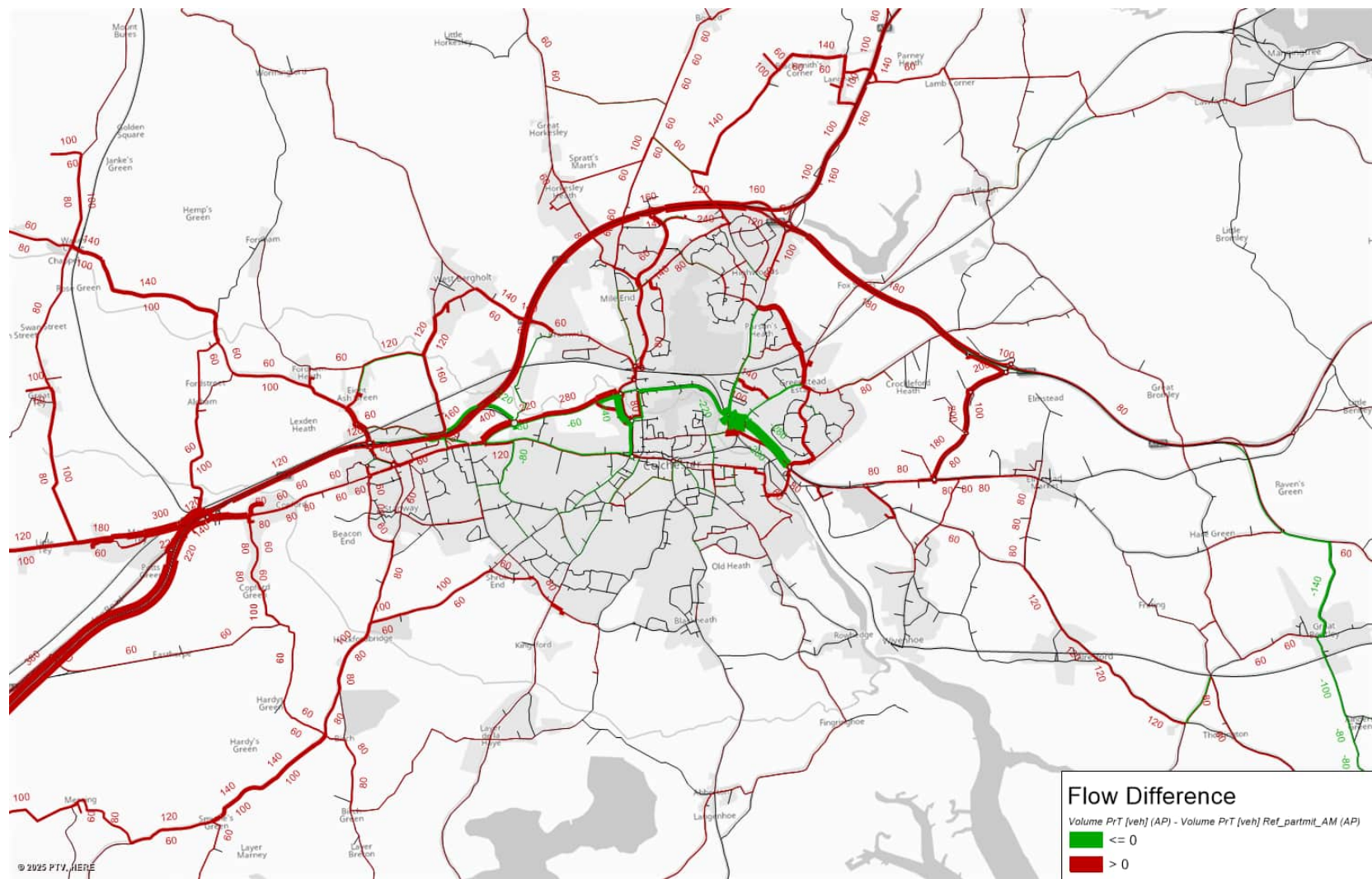
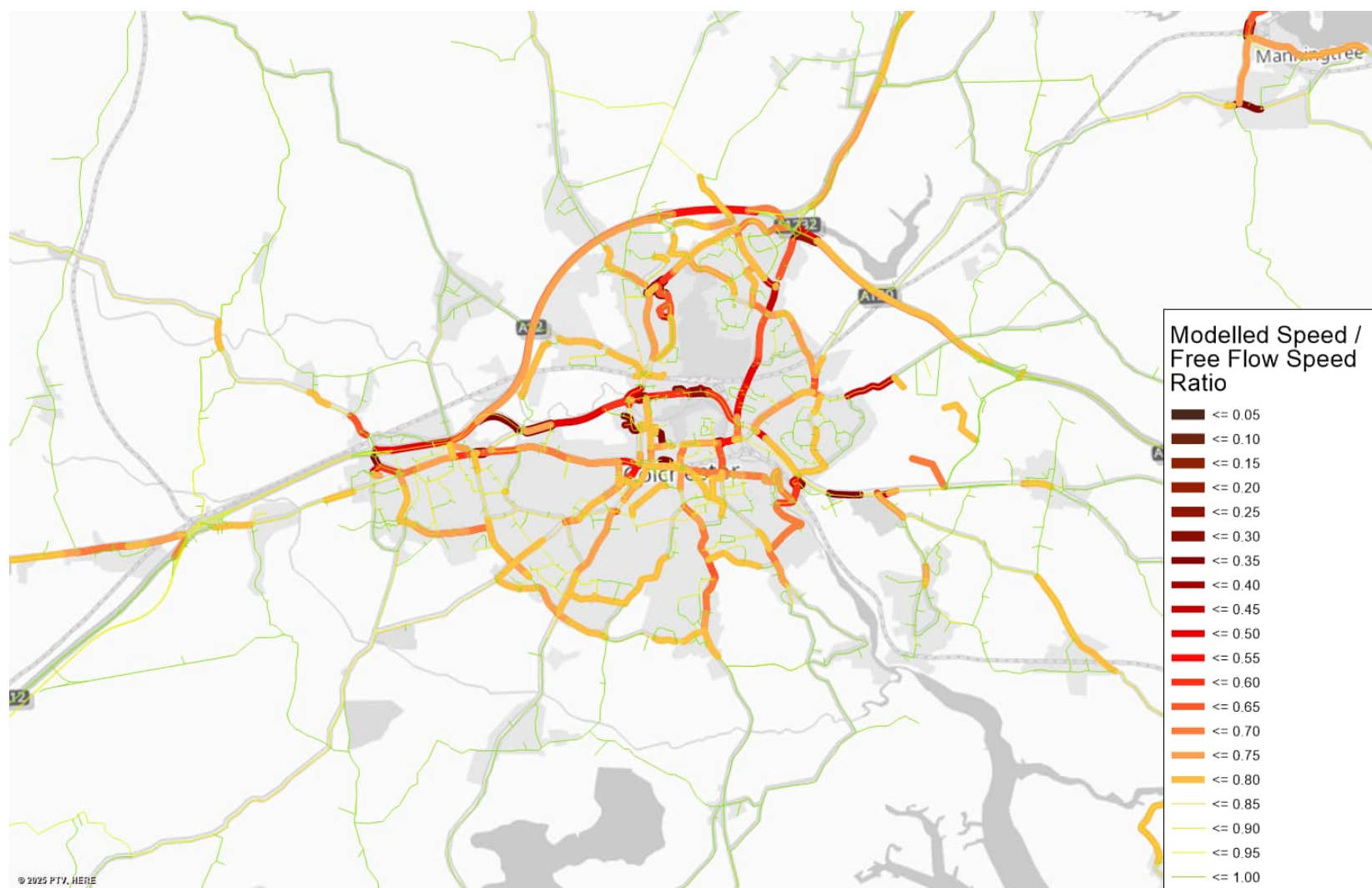


Figure F.16: Flow difference – Scenario 4 v. Scenario 1 (with A12 widening and with A1331)– PM

F.2.3 PM speed plots (modelled speed / free flow speed)**Figure F.17:** Speed ratio – Scenario 0 with A12 widening and A331 completion – PM

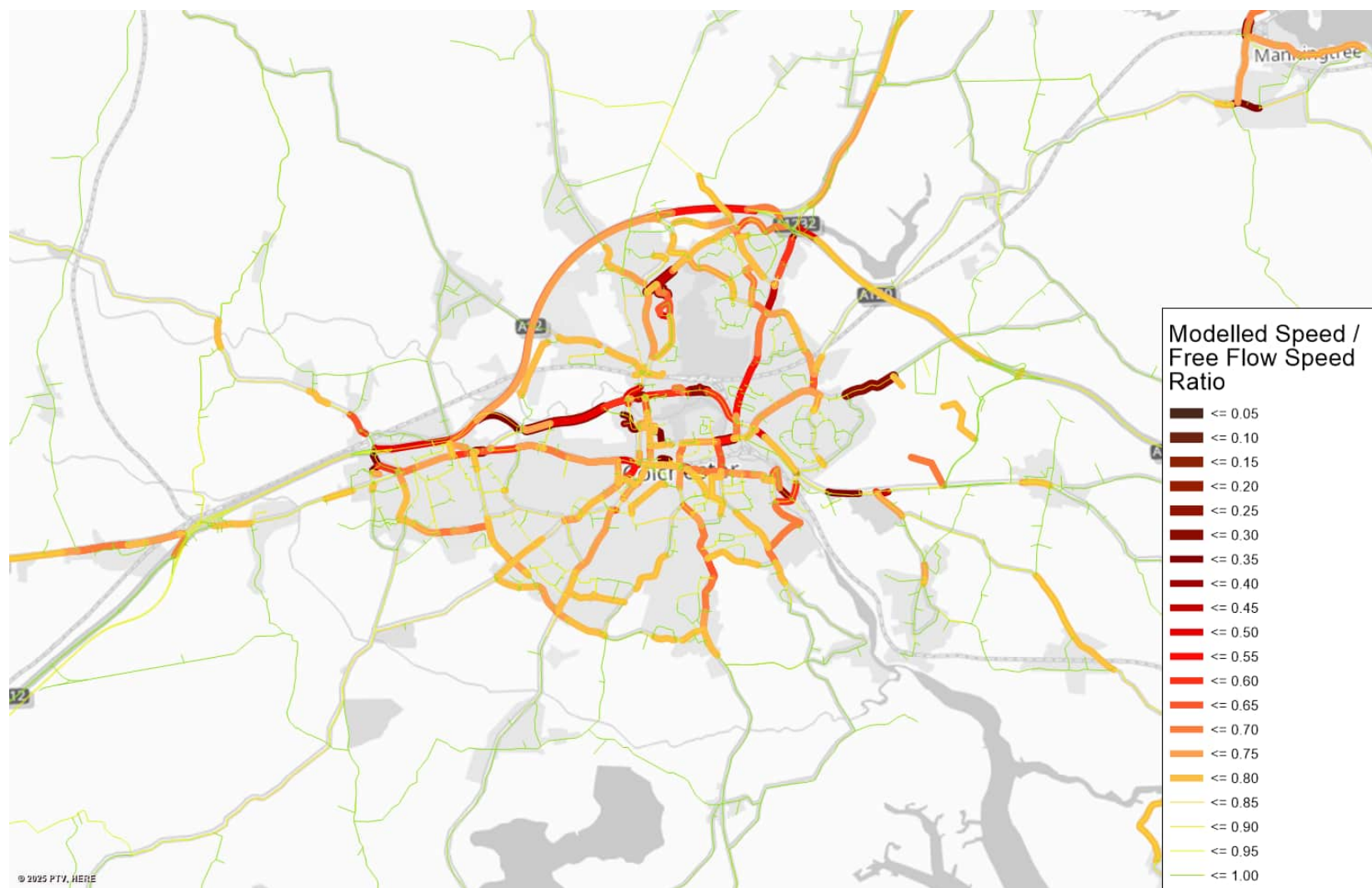


Figure F.18: Speed ratio – Scenario 1 with A12 widening and A331 completion – PM



Figure F.19: Speed ratio – Scenario 2 with A12 widening and with A331 completion – PM



Figure F.20: Speed ratio – Scenario 3 with A12 widening and with A331 completion – PM

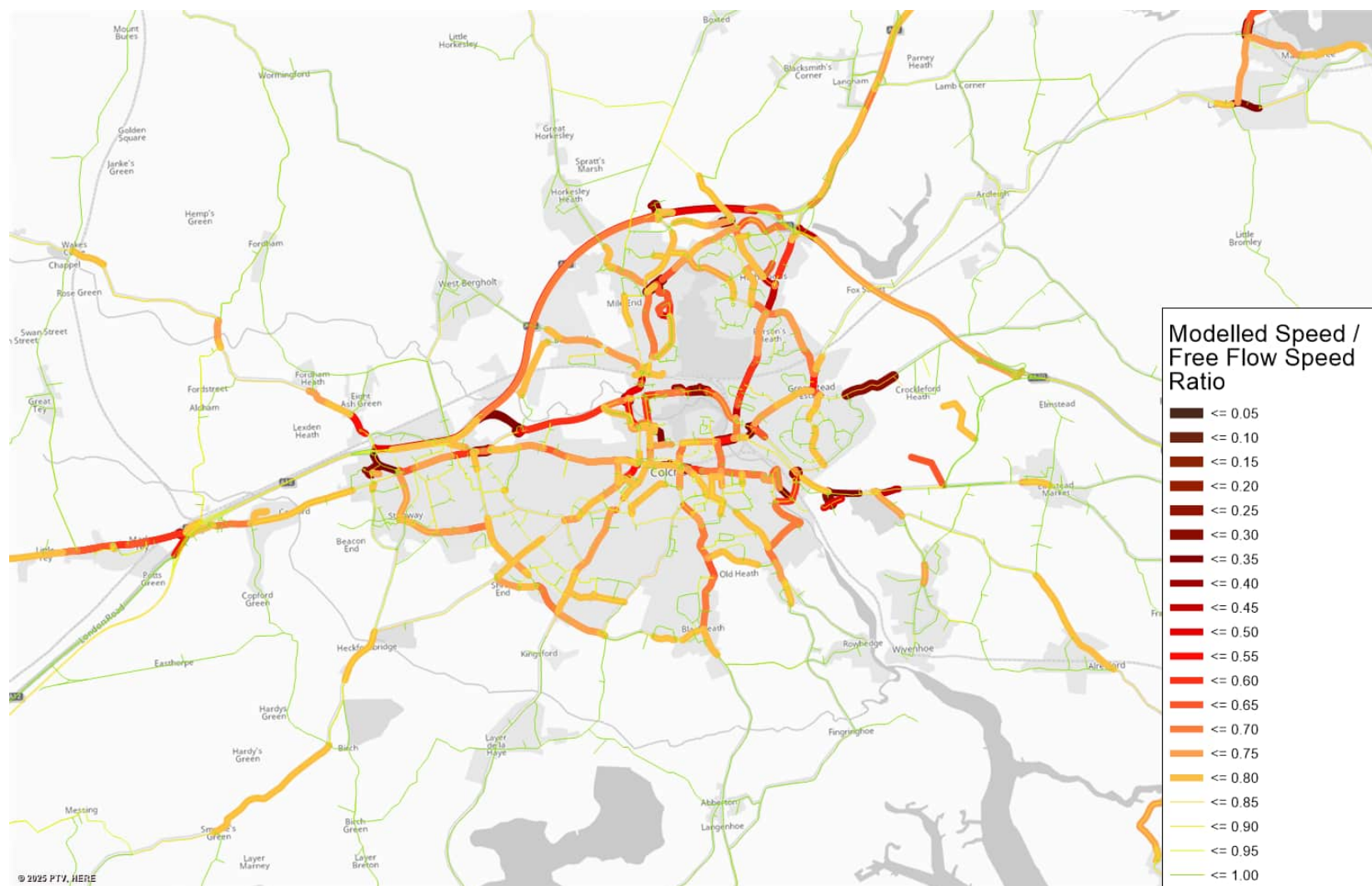


Figure F.21: Speed ratio – Scenario 4 with A12 widening and with A331 completion – PM

F.2.4 PM relative queue plots (100% queues on road links in the model)



Figure F.22: Relative queue – Scenario 0 with A12 widening and A1331 completion – PM



Figure F.23: Relative queue – Scenario 1 with A12 widening and A1331 completion – PM



Figure F.24: Relative queue – Scenario 2 with A12 widening and A1331 completion – PM



Figure F.25: Relative queue – Scenario 3 with A12 widening and A1331 completion – PM

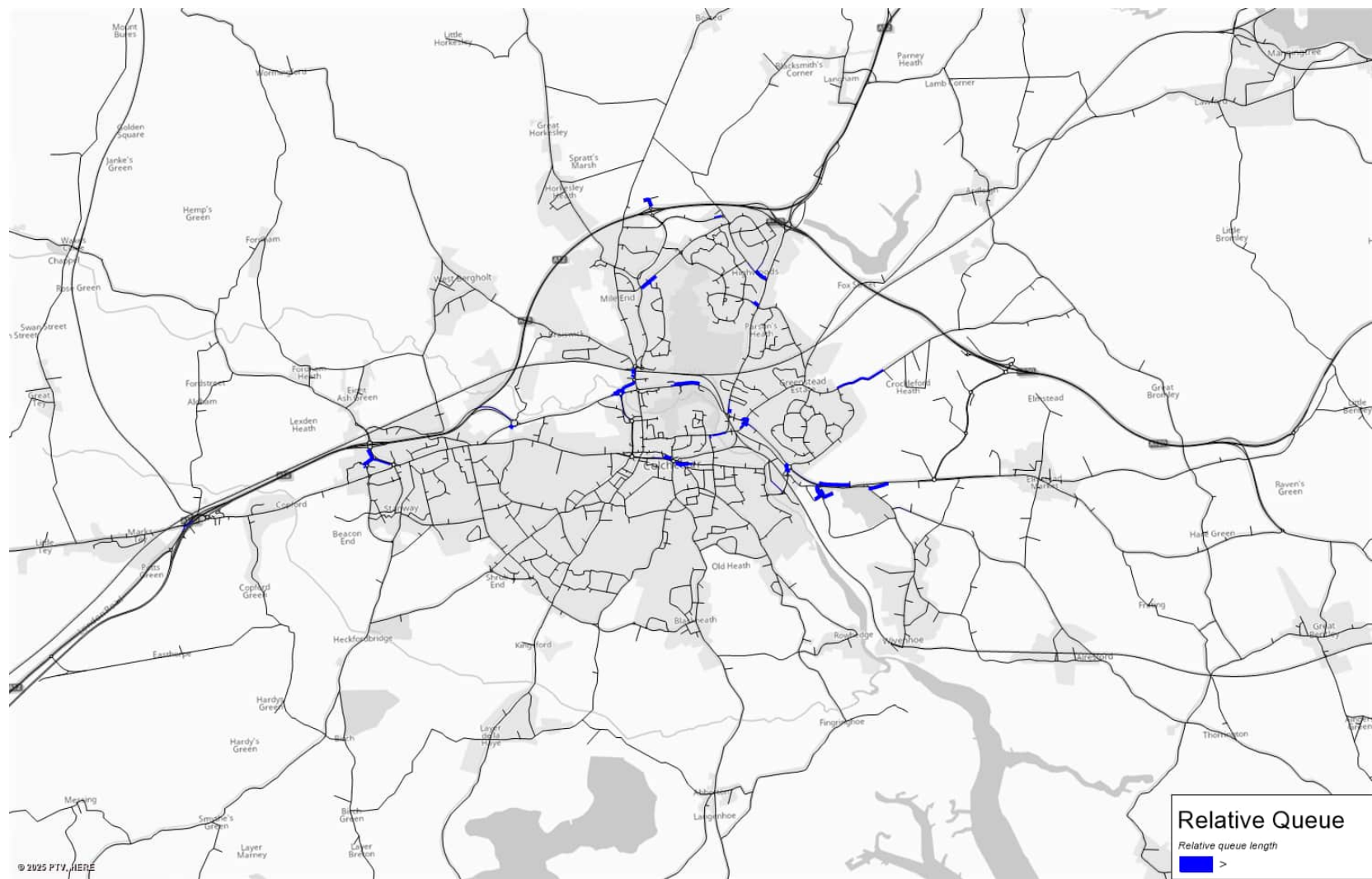


Figure F.26: Relative queue – Scenario 4 with A12 widening and A1331 completion – PM

G Transport modelling outputs for scenarios with delayed A1331 link road completion and with J19-25 A12 widening

Introduction

This appendix provides flow difference, relative queue and speed plots from the 2041 NEMo reference and assessment cases in scenarios with A12 J19-25 widening and with delayed completion of the A1331 link road. Hence, in a future with these schemes, it is possible to sequentially look at the impact of:

- 2041 reference case demand without all mitigations
- 2041 reference case demand with expected mitigations at A12 J29 and Greenstead roundabout (called the baseline with A12 widening and with the link road)
- 2041 BaU demand from preferred site allocations added on top of the baseline scenario
- 2041 ST demand from preferred site allocations added on top of the baseline scenario – which reduced car trips to reflect the impact of a shift to sustainable modes as a result of sustainable travel measures
- 2041 ST demand from preferred site allocations with highway mitigations added on top of the baseline scenario – which combines all mitigation measures that are considered as required to achieve acceptable performance of the transport network.

G.1 AM flow, speed queue plots

G.1.1 Summary of impact in the AM

Table G.1: AM peak summary impact assessment of scenarios

AM peak impacts		With A12 Widening and Without A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	8	13	9	x	x	x
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	11	!	✓	✓
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	6	10	10	x	x	✓
	A12 J25 / A120 (western)	5	5	5	✓	✓	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	9	9	9	x	!	✓
	A12 J29 / A120 (eastern)	7	9	8	✓	✓	✓
Outer	Tiptree	3	3	3	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	6	3	3	✓	✓	✓
Overall assesement combining all areas		7	8	8	11	10	9



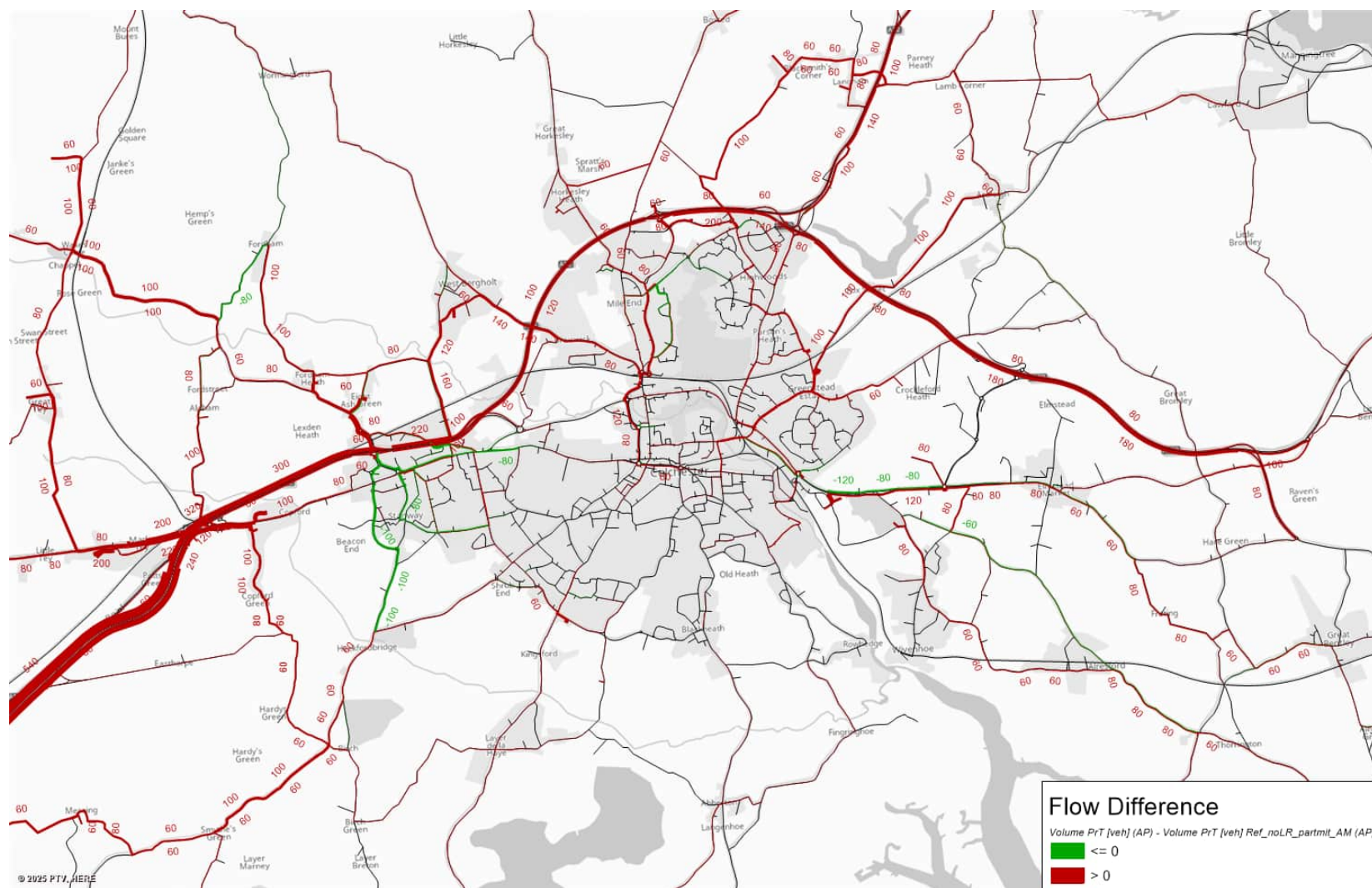


Figure G.2: Flow difference – Scenario 3 v. Scenario 1 (with A12 widening and delayed A1331)– AM

Figure G.3: Flow difference – Scenario 4 v. Scenario 1 (with A12 widening and delayed A1331)– AM

G.1.3 AM speed plots (modelled speed / free flow speed)



Figure G.4: Speed ratio – Scenario 0 with A12 widening and delayed A331 completion – AM

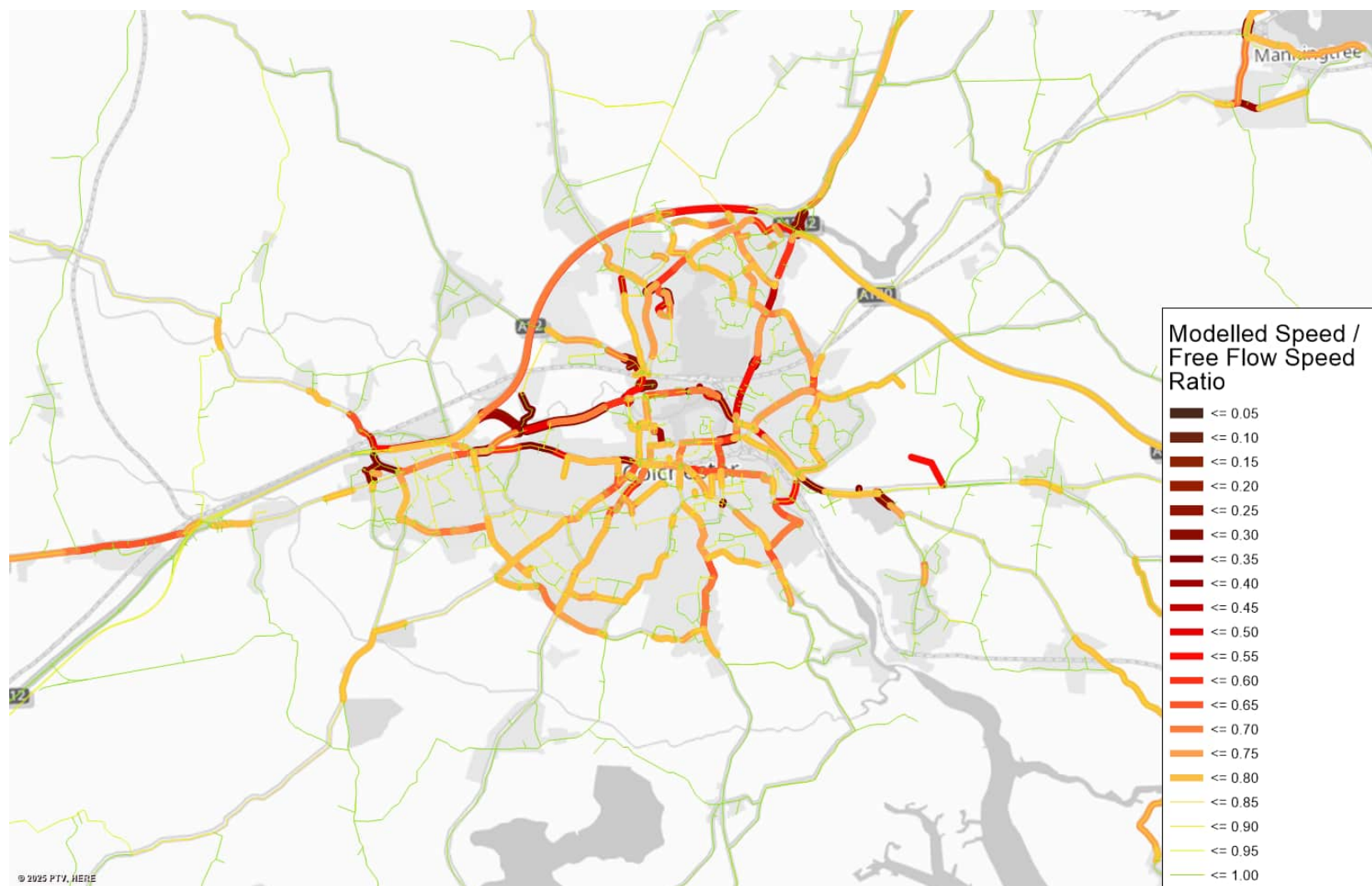


Figure G.5: Speed ratio – Scenario 1 with A12 widening and delayed A331 completion – AM



Figure G.6: Speed ratio – Scenario 2 with A12 widening and delayed A331 completion – AM



Figure G.7: Speed ratio – Scenario 3 with A12 widening and delayed A331 completion – AM

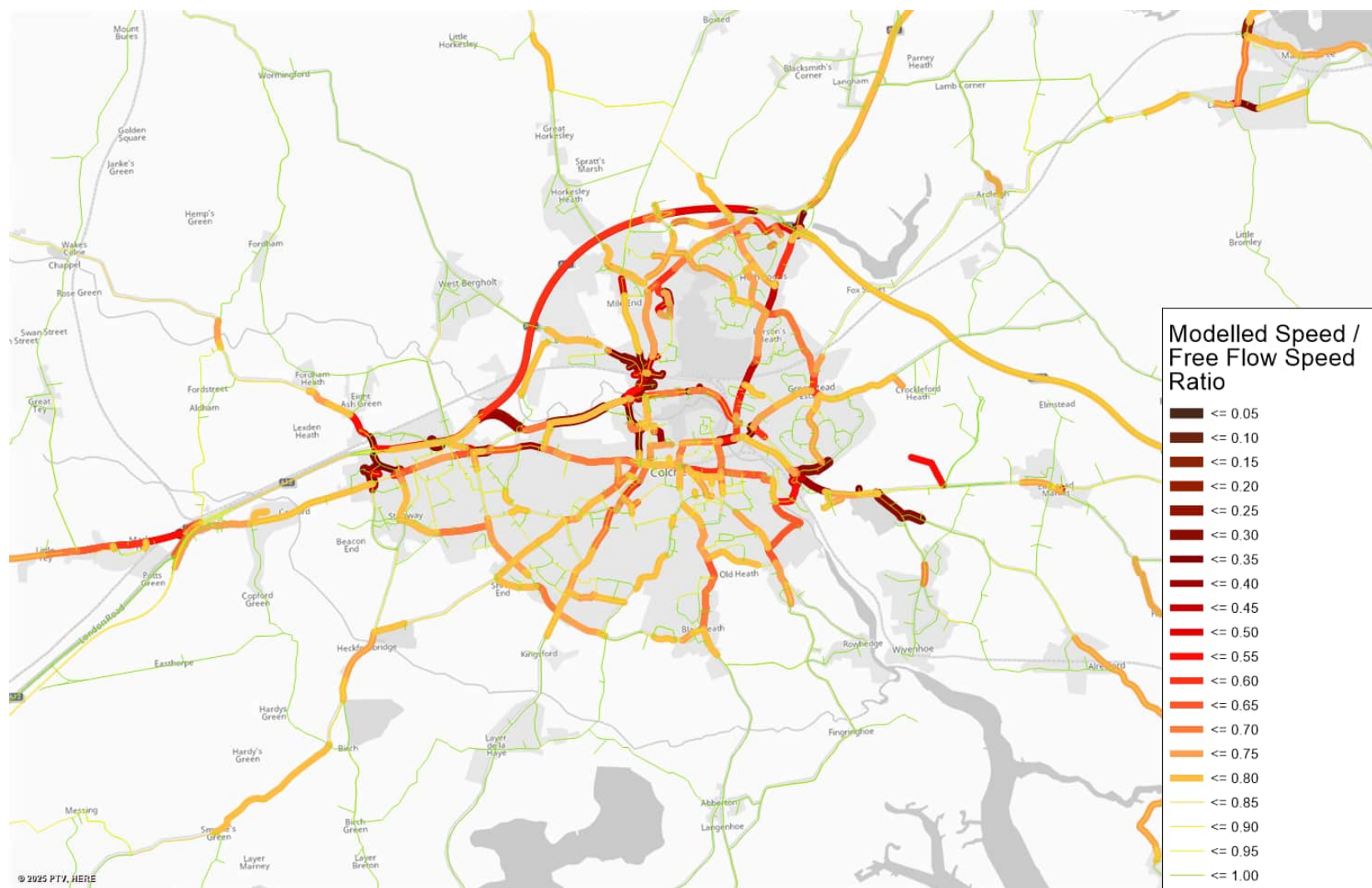


Figure G.8: Speed ratio – Scenario 4 with A12 widening and delayed A331 completion – AM

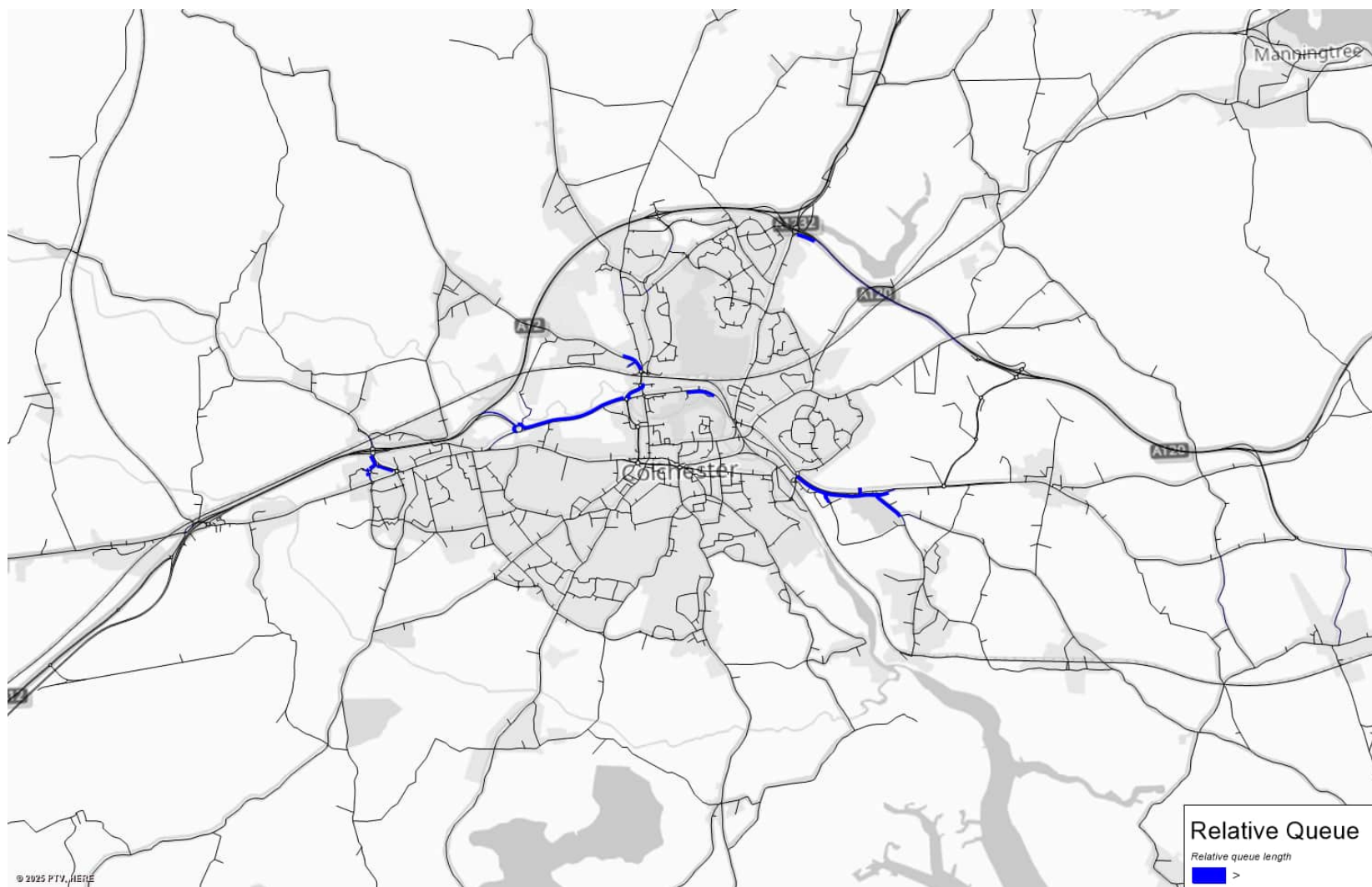
G.1.4 AM relative queue plots (100% queues on road links in the model)**Figure G.9:** Relative queue – Scenario 0 with A12 widening and delayed A1331 completion – AM



Figure G.10: Relative queue – Scenario 1 with A12 widening and delayed A1331 completion – AM

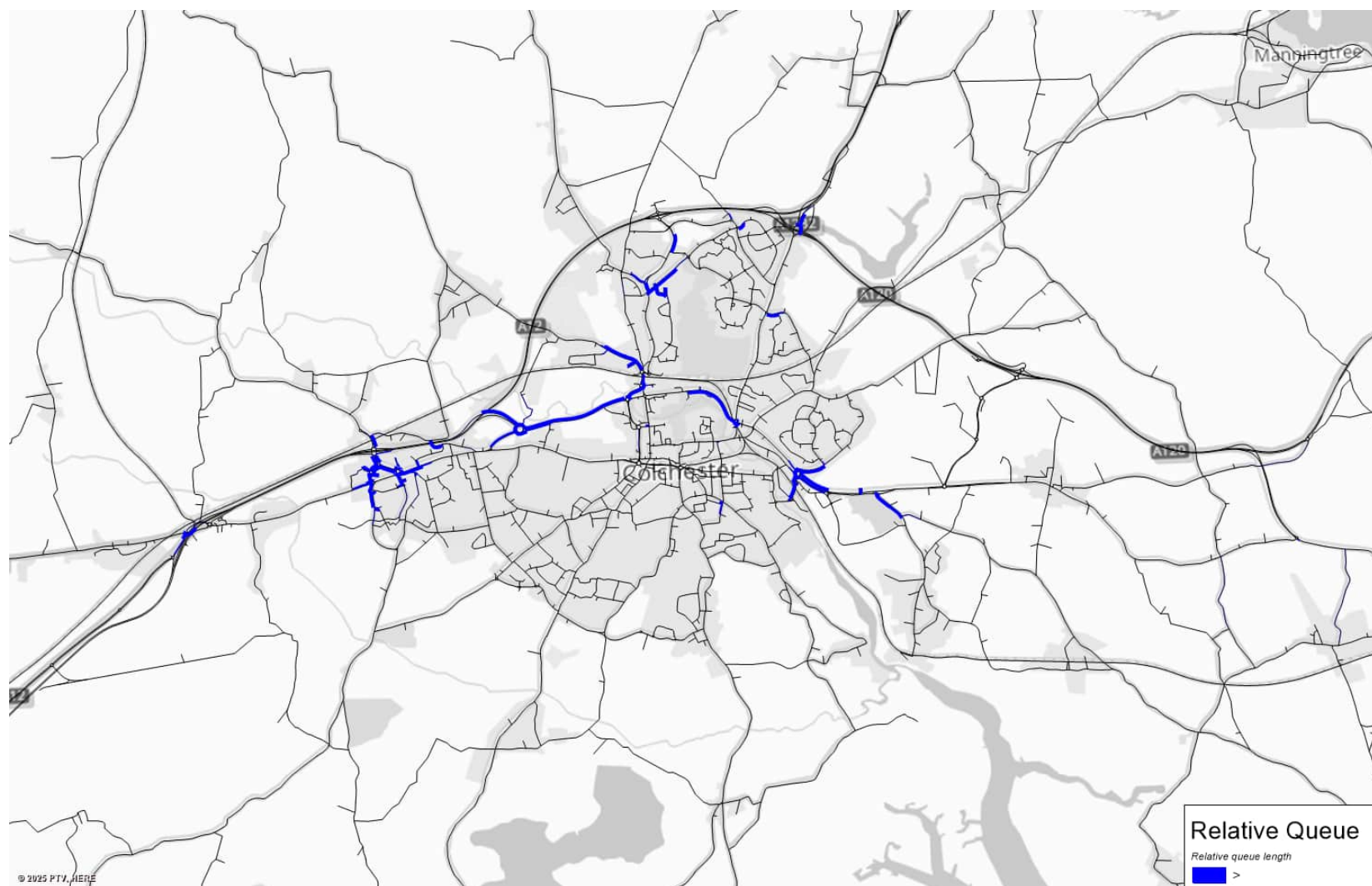


Figure G.11: Relative queue – Scenario 2 with A12 widening and delayed A1331 completion – AM



Figure G.12: Relative queue – Scenario 3 with A12 widening and delayed A1331 completion – AM



Figure G.13: Relative queue – Scenario 4 with A12 widening and delayed A1331 completion – AM

G.2 PM speed and queue plots

G.2.1 Summary of impact in the PM

Table G.2: PM peak summary impact assessment of scenarios

PM peak impacts		With A12 Widening and Without A1331 Link Road					
Sector	Location	2023 Base	2041 S0 Unmit. ref.	2041 S1 Mit. ref.	2041 S2 Unmit. BaU	2041 S3 Unmit. ST	2041 S4 Mit. ST
East	Greenstead Roundabout, Colne Causeway & Clingoe Hill	11	13	10	x	✓	x
	Ipswich Road, East Street, East Hill & Harwich Road	10	10	10	x	✓	!
West	Lexden Road, Cymbeline Way, Colne Bank Rbt, London Rd, A12 J27, A12 J26	5	7	7	!	!	✓
	A12 J25 / A120 (western)	5	5	5	✓	✓	✓
North	Northern Approach Road, Via Urbis Romane, Mill Road & A12 J28	8	11	11	x	x	✓
	A12 J29 / A120 (eastern)	7	8	8	✓	✓	✓
Outer	Tiptree	3	3	3	✓	✓	✓
	Aldham	3	3	3	✓	✓	✓
	A12 J20-25	5	3	3	✓	✓	✓
Overall assesement combining all areas		7	8	8	10	9	9

G.2.2 PM flow difference plots

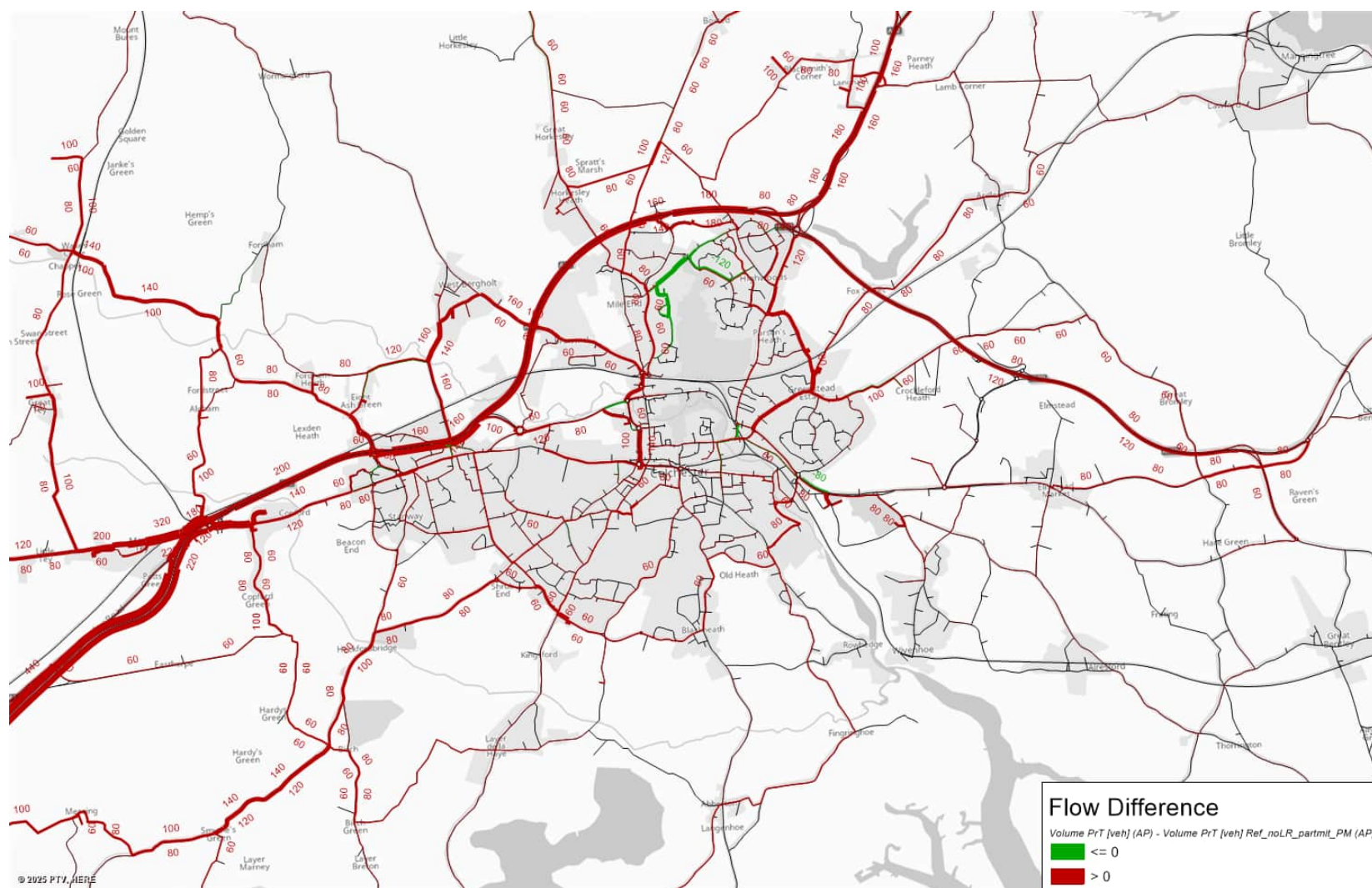


Figure G.14: Flow difference – Scenario 2 v. Scenario 1 (with A12 widening and delayed A1331)– PM

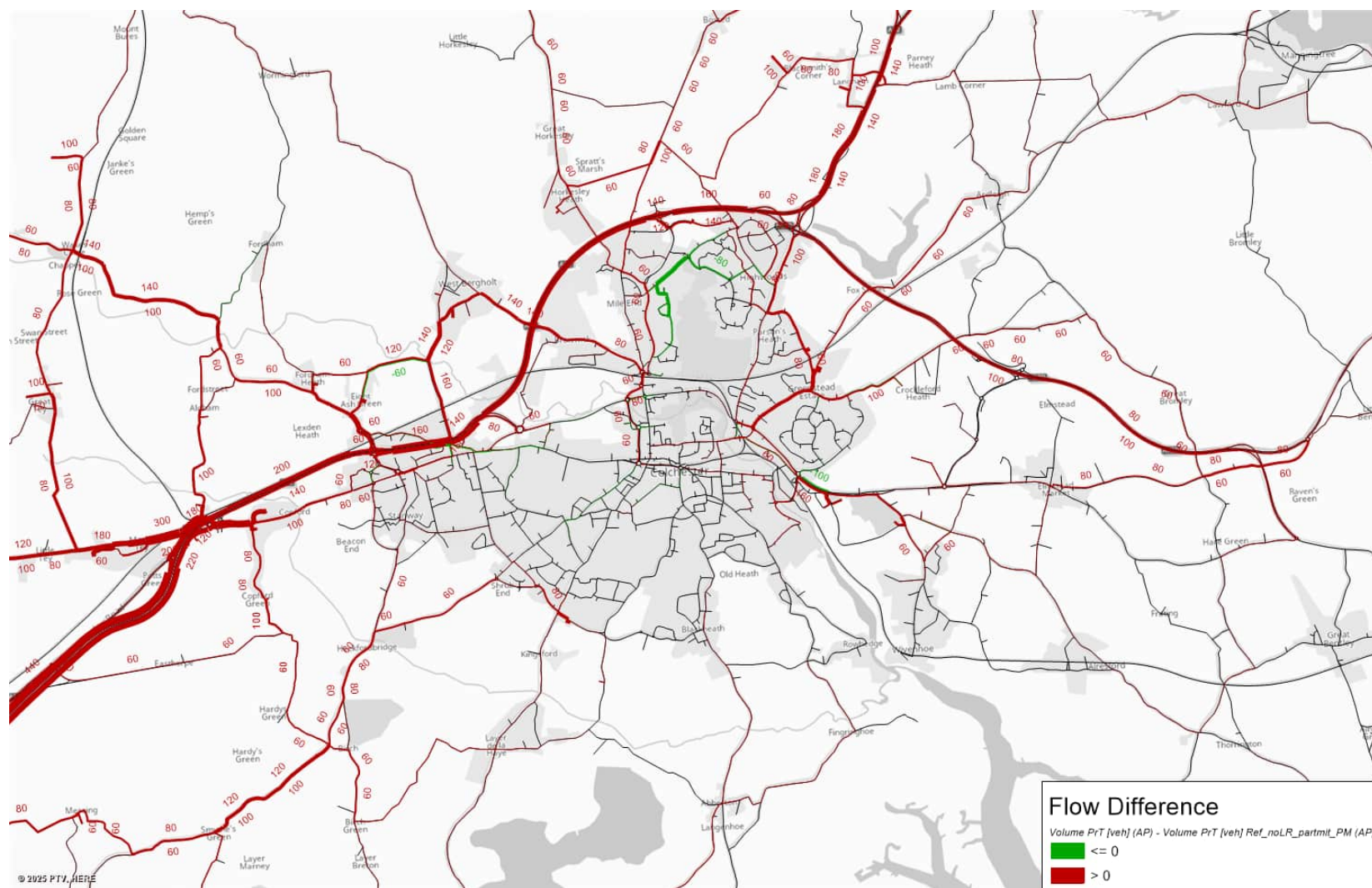


Figure G.15: Flow difference – Scenario 3 v. Scenario 1 (with A12 widening and delayed A1331)– PM

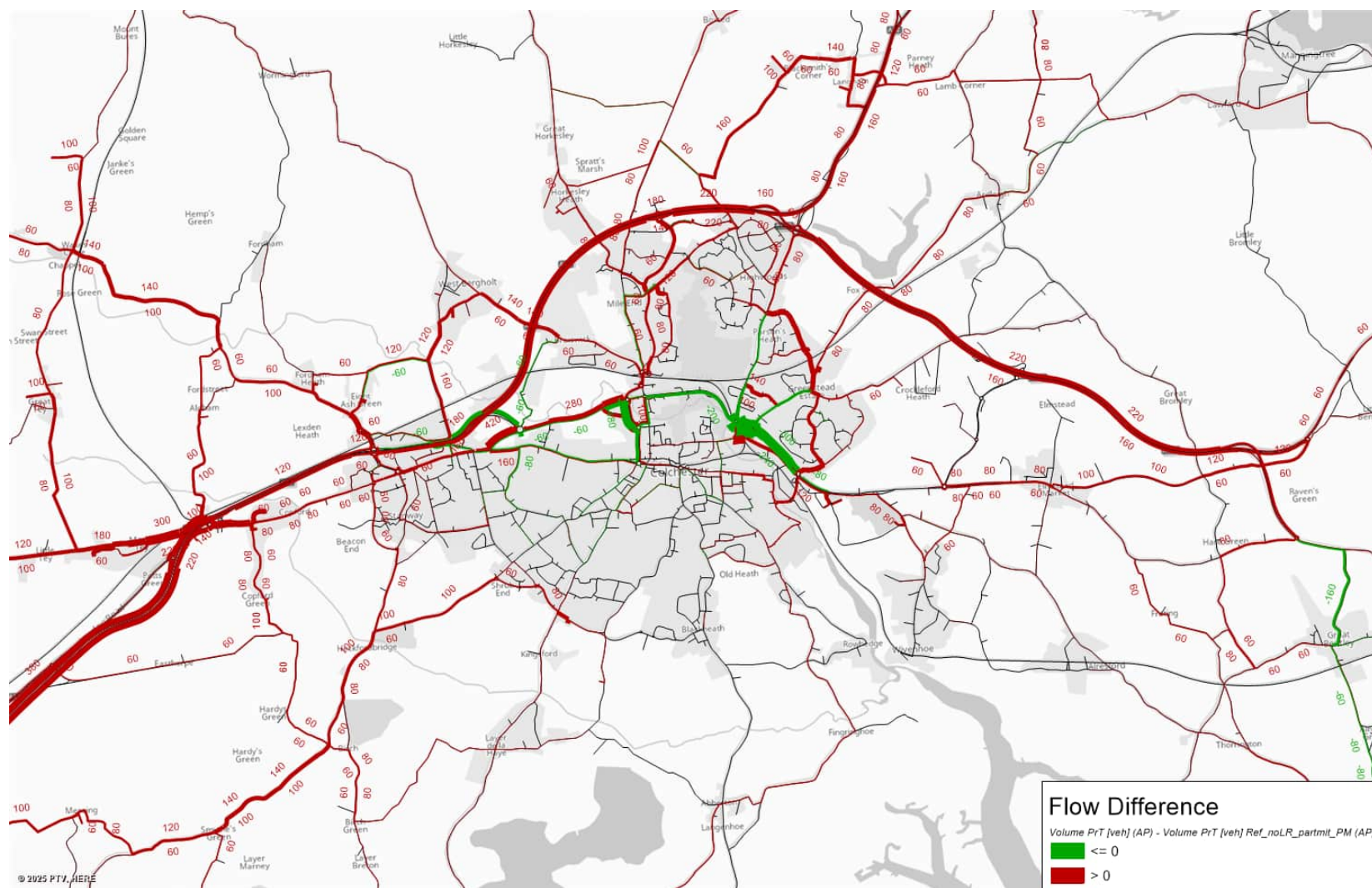


Figure G.16: Flow difference – Scenario 4 v. Scenario 1 (with A12 widening and delayed A1331)– PM

G.2.3 PM speed plots (modelled speed / free flow speed)

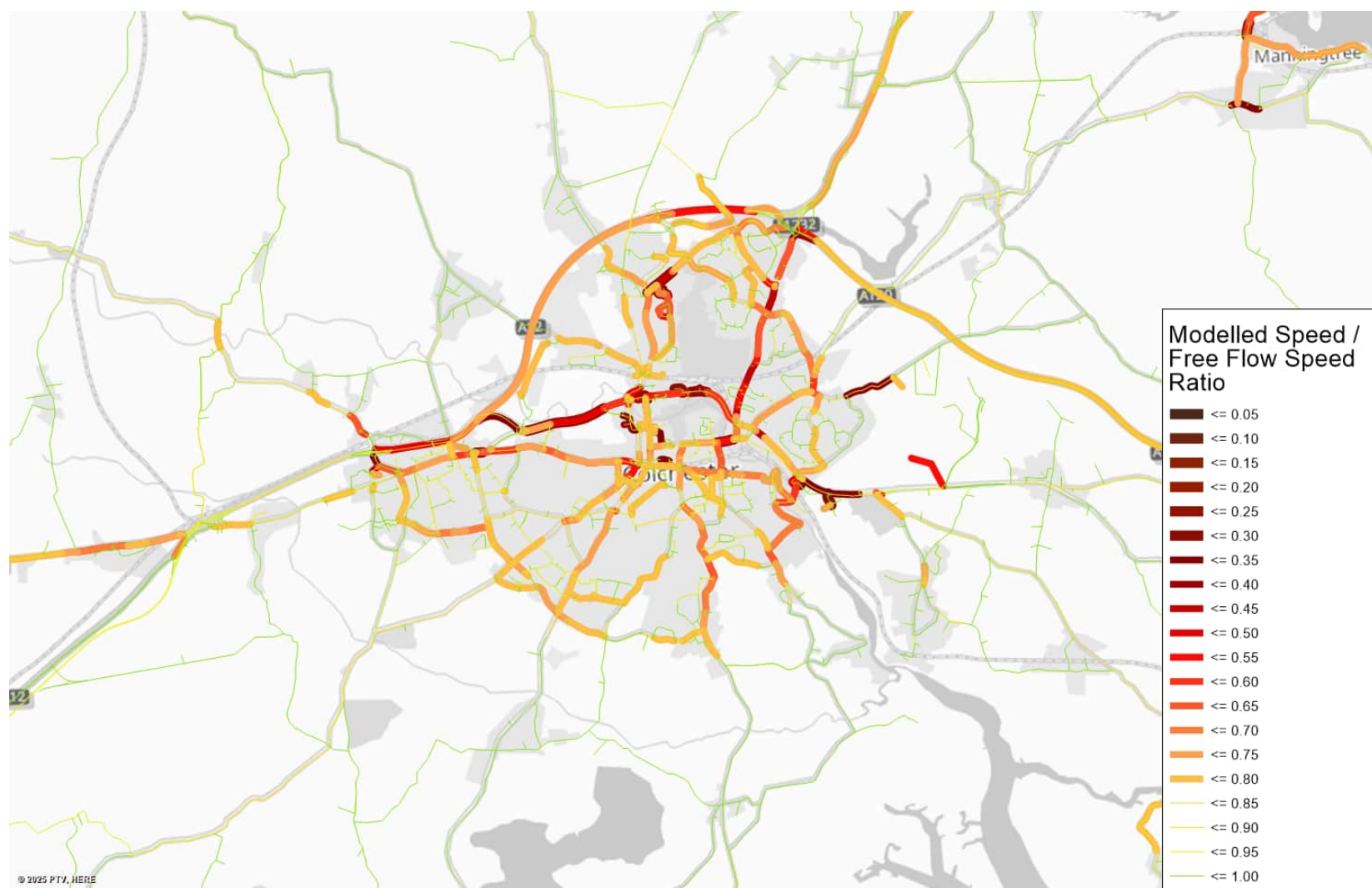


Figure G.17: Speed ratio – Scenario 0 with A12 widening and delayed A331 completion – PM

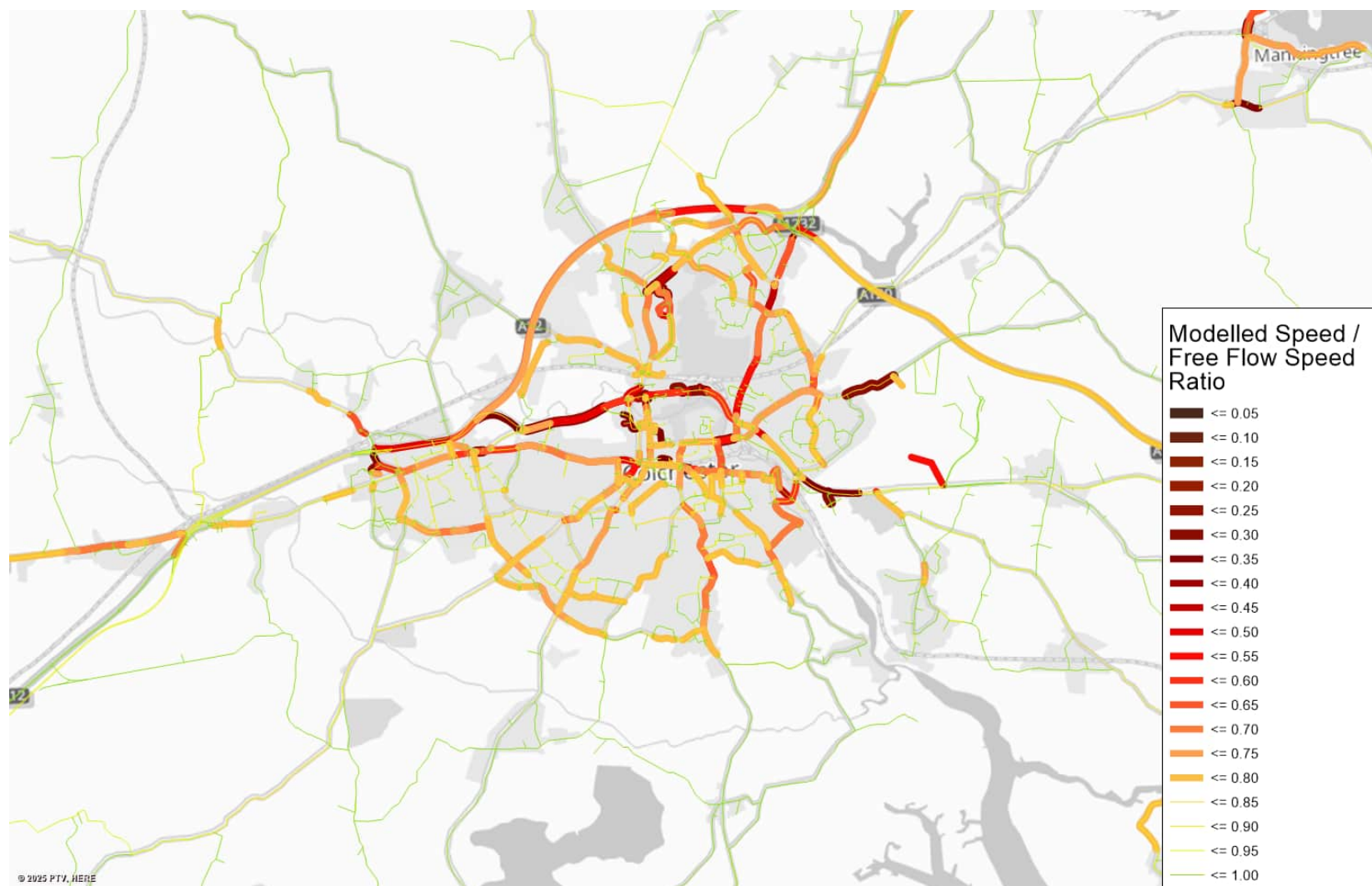


Figure G.18: Speed ratio – Scenario 1 with A12 widening and delayed A331 completion – PM

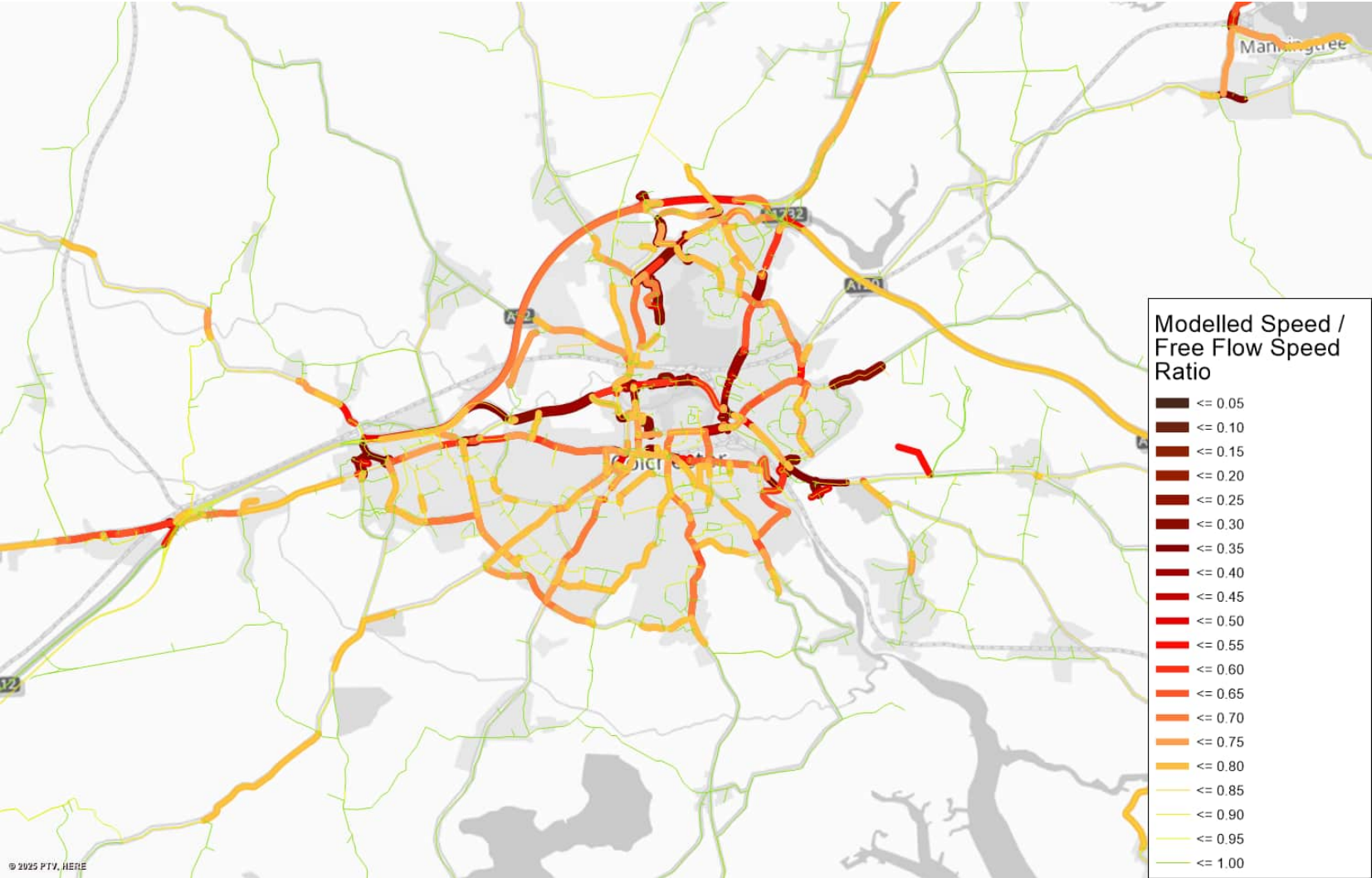


Figure G.19: Speed ratio – Scenario 2 with A12 widening and delayed A331 completion – PM

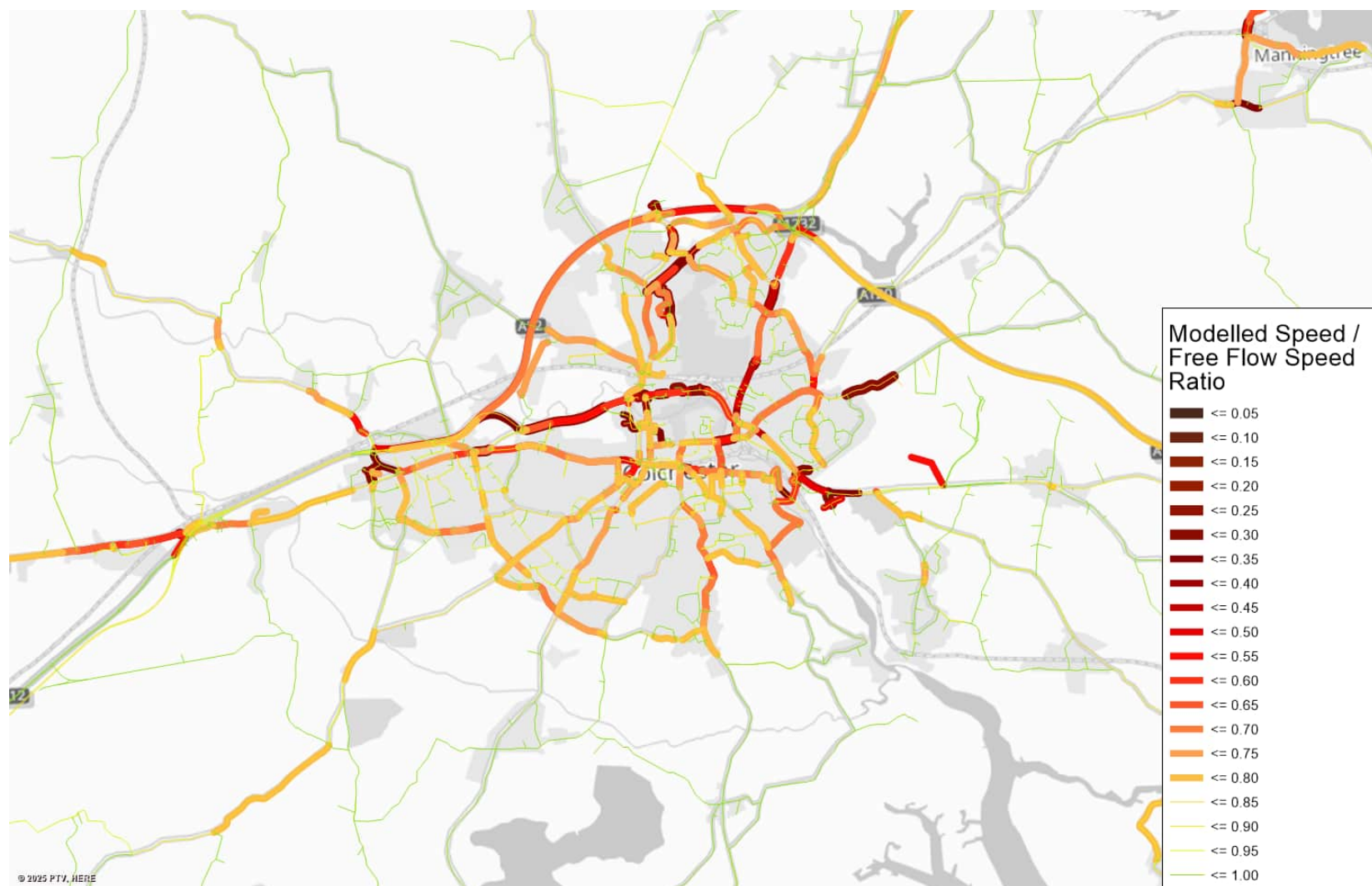


Figure G.20: Speed ratio – Scenario 3 with A12 widening and delayed A331 completion – PM

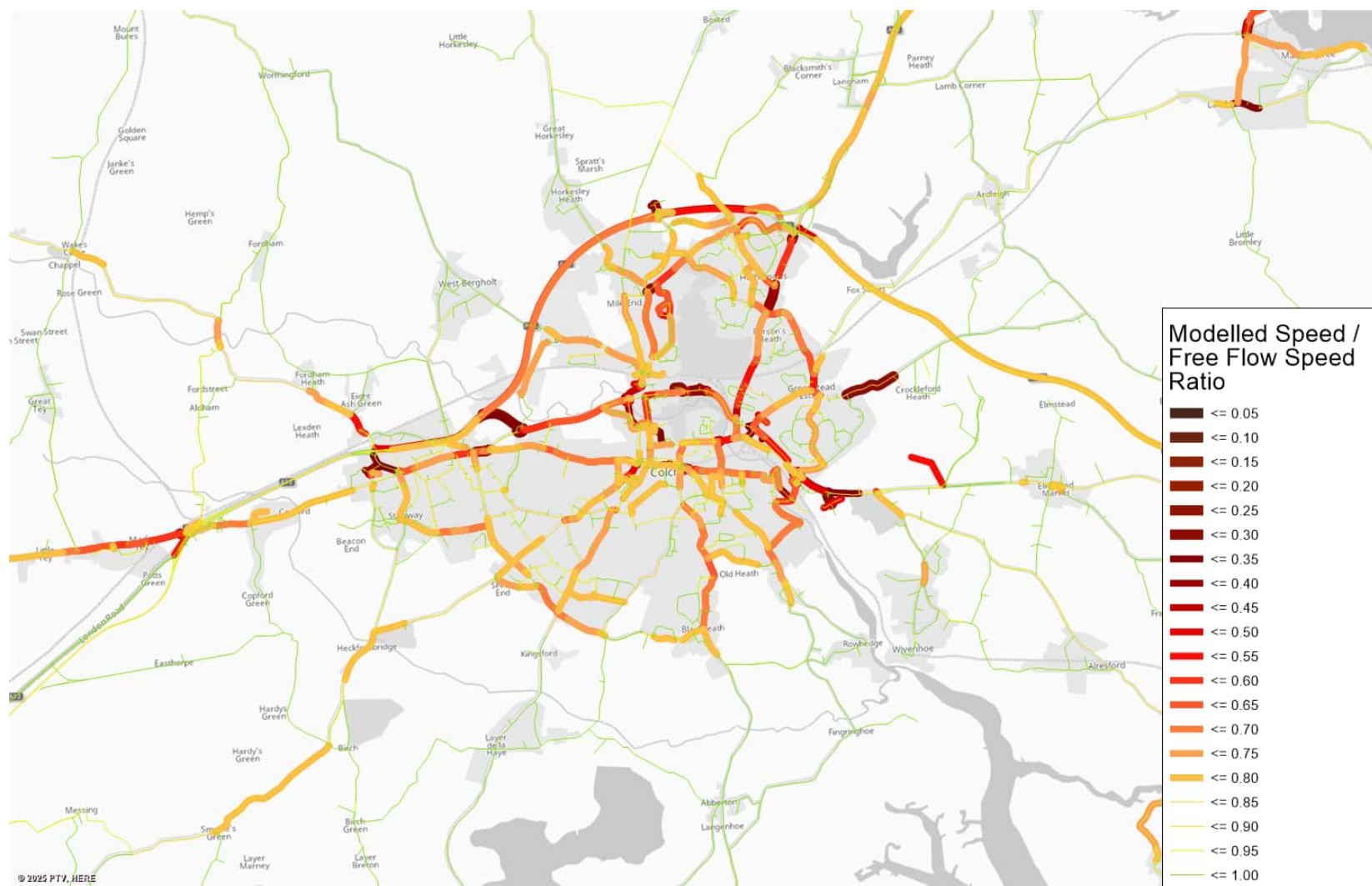


Figure G.21: Speed ratio – Scenario 4 with A12 widening and delayed A331 completion – PM

G.2.4 PM relative queue plots (100% queues on road links in the model)



Figure G.22: Relative queue – Scenario 0 with A12 widening and delayed A1331 completion – PM



Figure G.23: Relative queue – Scenario 1 with A12 widening and delayed A1331 completion – PM

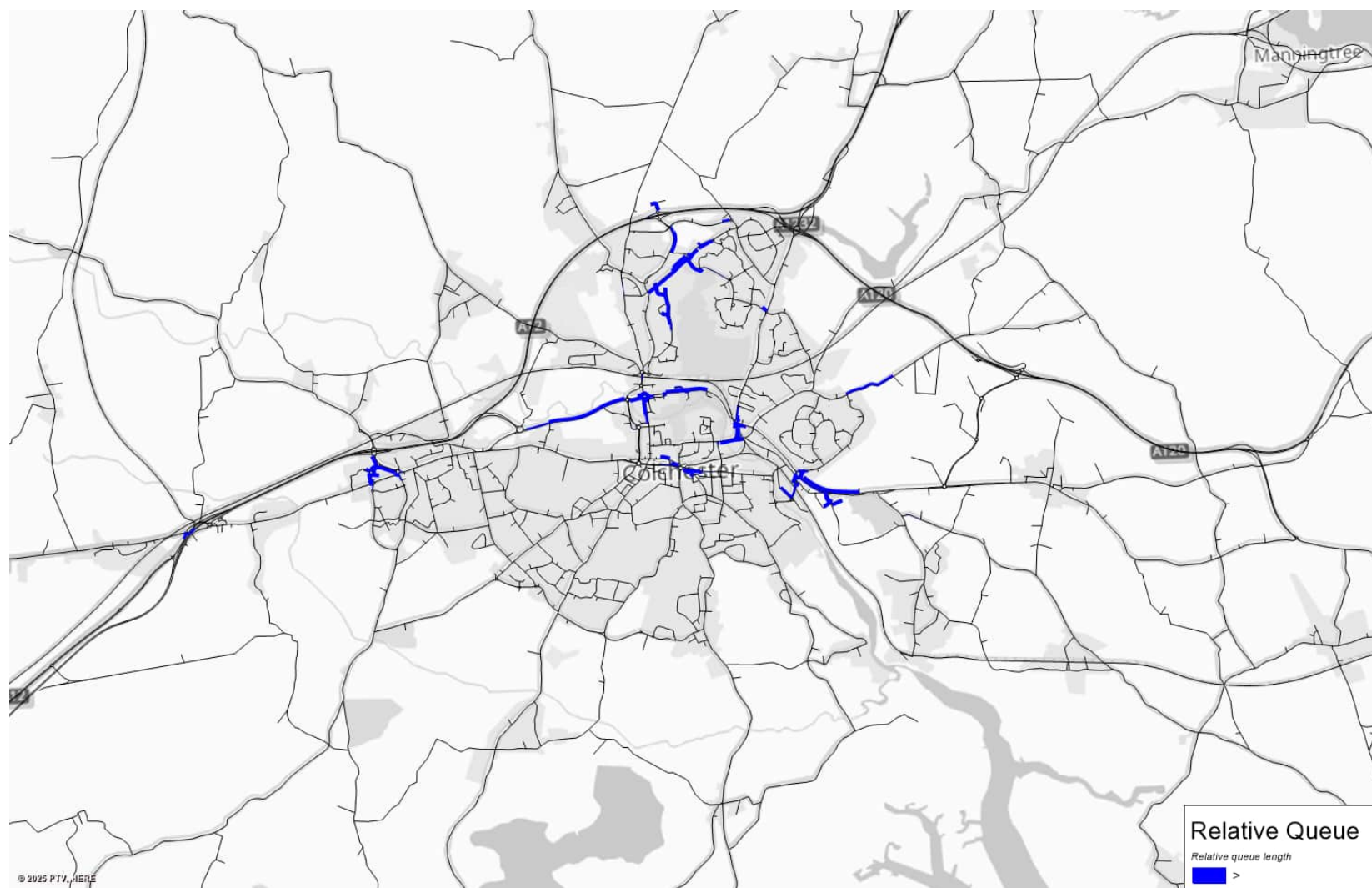


Figure G.24: Relative queue – Scenario 2 with A12 widening and delayed A1331 completion – PM



Figure G.25: Relative queue – Scenario 3 with A12 widening and delayed A1331 completion – PM



Figure G.26: Relative queue – Scenario 4 with A12 widening and delayed A1331 completion – PM

H Vision-led mitigation

H.1 Introduction

This appendix sets out tables of proposed measures to mitigate the impact of preferred site allocations. The measures are informing the IADP, in which costs are shown.

The measures include baseline mitigation – namely, schemes at Greenstead and Colne Causeway, and A12 J29 – which were identified as required to manage reference case growth in addition to committed schemes for which designs are known.

The IADP provides information on the costs of the interventions, which, in turn, informs the viability assessment of the local plan. Since the many of the measures benefit reference case developments in Colchester but also in surrounding areas, the IADP identifies reasonable contributions from reference case developments and government grants, which reduces the contribution required from preferred site allocations.

Chapter 4 introduced categories of interventions: walking; cycling; rapid transit and bus, mobility hubs and interchanges; travel planning; and highways and networks. Accordingly and to assist digestibility of a large number of schemes, the tables have been grouped along the line of these categories.

In addition, each proposed measure has a reference number. Maps have been included with the location of schemes labelled with the reference numbers. Occasionally, a proposed measure may not be associated with a specific place or route so is missed from the maps (e.g. travel planning or dynamic traffic management).

H.2 Sustainable transport measures

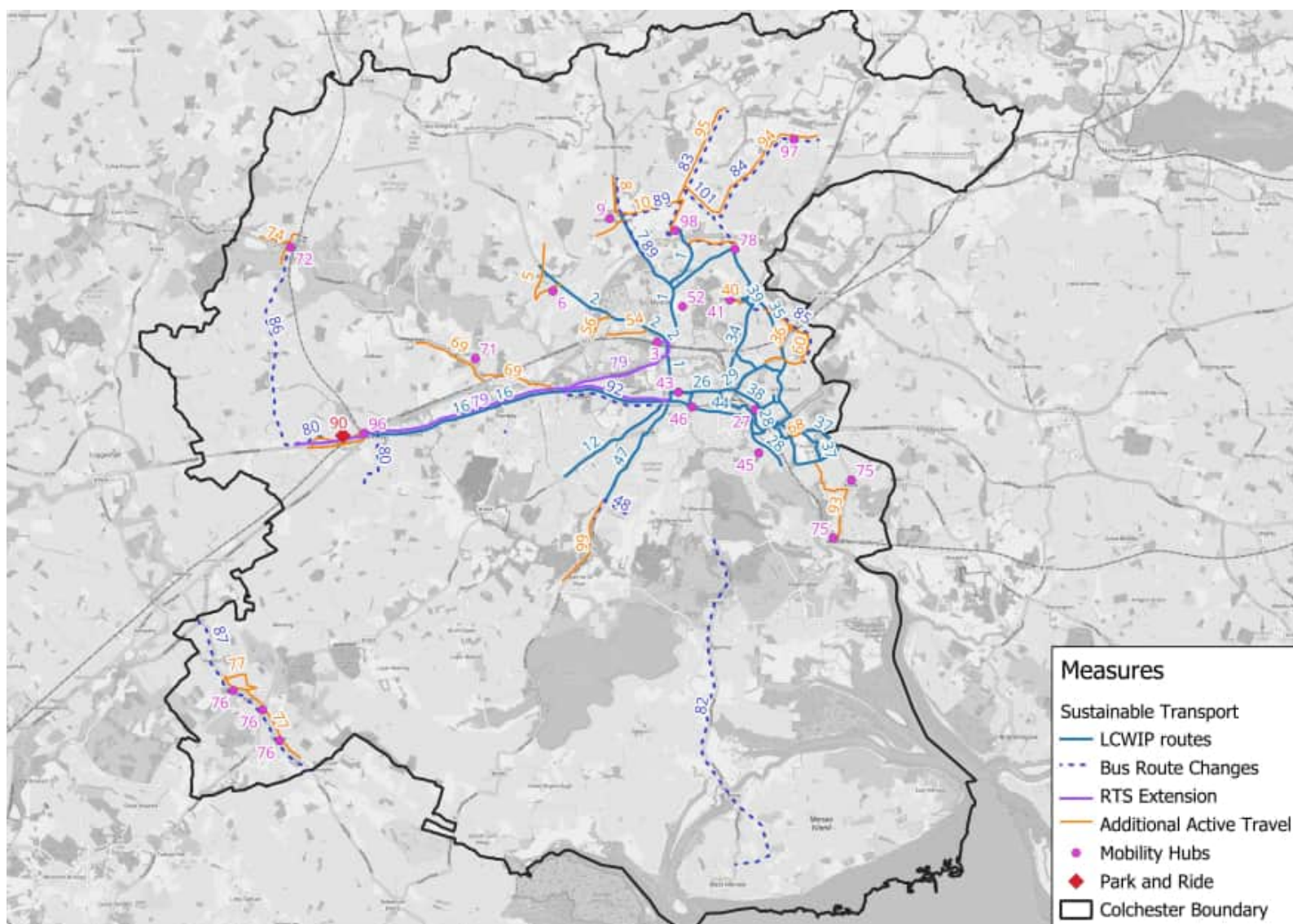


Figure H.1: Map of vision-led ST mitigation

Table H.1: Walking related measures

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
20	Footpath widening along Station Rd to accommodate increased footfall	Central	7	RefCase12, RefCase13, RefCase19
53	LCWIP Walking Route 1	Not mapped	4	n/a
54	Formalise secondary route branching from walking route 1 - off road walk and cycle access to station and through residential area	Inner NW	4	n/a
55	Formalise secondary walking route from Horkesley Heath to route 1	Outer NW	2	n/a
56	Walking route access to bus stop along Bakers Lane	Inner NW	4	n/a
57	LCWIP Walking Route 2	Not mapped	10,11	n/a
58	LCWIP Walking Route 3	Not mapped	12	n/a
59	LCWIP Walking Route 4	Not mapped	20	n/a
60	Extend walking route to access and service development	Outer NE	20	n/a
61	LCWIP Walking Route 6	Not mapped	10	n/a
62	LCWIP Walking Route 7	Not mapped	3,13,20	n/a
63	LCWIP Walking Route 8	Not mapped	10	n/a
64	LCWIP Walking Route 9	Not mapped	10,11,12	n/a
65	LCWIP Walking Route 10	Not mapped	9	n/a
66	LCWIP Walking Route 11	Not mapped	10	n/a
67	LCWIP Walking Route 12	Not mapped	n/a	n/a
68	Formalise secondary walking route connecting routes 2, 3 and 12	Outer SE	13	n/a
69	LCWIP Walking Route 5	Outer W	6	RefCase16
70	Walking Route Eight Ash Green to Stanway - Connecting to new RTS	Not mapped	6	n/a
96	Marks Tey Mobility Hub	Outer W	7	n/a

Table H.2: Cycling related measures

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
1	LCWIP Cycle Route 1	Central	3,10	RefCase12, RefCase13, RefCase19, RefCase20
2	Extend LCWIP 1 to continue along secondary route through the business park	Outer N	3	RefCase1, RefCase20
4	LCWIP Cycle Route 1a	Inner NW	4	n/a
5	West Bergholt secondary cycle route	Outer NW	4	RefCase1
7	LCWIP Cycle Route 1b	Outer NW	2	RefCase4, RefCase21, RefCase22
8	Extension of LCWIP Cycle Route 1b	Outer NW	2	n/a
10	Formalise secondary route between LCWIP 1B and the P&R route 1 - for access to RTS	Outer NW	2	RefCase22
11	LCWIP Cycle Route 1c	Inner NE	4,13	RefCase19, RefCase20
12	LCWIP Cycle Route 2	Inner SW	9	RefCase6, RefCase13, RefCase14
14	LCWIP Cycle Route 2a	Inner SW	n/a	RefCase6
15	LCWIP Cycle Route 2b	Outer SW	9	RefCase6, RefCase14, RefCase15
16	LCWIP Cycle Route 3	Outer SW	7	RefCase3, RefCase5, RefCase13, RefCase17
17	Extension of LCWIP Cycle Route 3	Outer SW	7	n/a
18	Walking/Cycling Structure over A12	Outer W	7	n/a
19	Secure cycle hub at rail station - Marks Tey	Outer W	7	RefCase12, RefCase13, RefCase19
21	Remove on street parking on Station Rd and replace with dedicated 2-way cycle track to accommodate increased cycle demand	Outer W	7	RefCase12, RefCase13, RefCase19
22	LCWIP Cycle Route 3a	Inner NW	4	n/a

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Table H.2: Cycling related measures (*continued*)

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
23	LCWIP Cycle Route 3b	Central	n/a	RefCase12, RefCase13, RefCase19
24	LCWIP Cycle Route 3c	Inner SW	n/a	n/a
25	LCWIP Cycle Route 3d	Outer SW	n/a	n/a
26	LCWIP Cycle Route 4	Central	12	RefCase12, RefCase13, RefCase19
28	LCWIP Cycle Route 4a	Outer SE	11, 12	RefCase7, RefCase18
29	LCWIP Cycle Route 4b	Inner E	20	n/a
30	LCWIP Cycle Route 5	Inner S	10	n/a
31	LCWIP Cycle Route 5a	Outer SE	9	n/a
32	LCWIP Cycle Route 6	Central	10	RefCase12, RefCase13, RefCase19
33	LCWIP Cycle Route 6a	Outer NE	n/a	n/a
34	LCWIP Cycle Route 7	Outer NE	3, 20	RefCase23
35	LCWIP Cycle Route 7a	Outer NE	20	n/a
36	Extend cycling route to access and service development	Outer NE	20	n/a
37	LCWIP Cycle Route 7b	Outer SE	13	RefCase23
38	LCWIP Cycle Route 7c	Outer E	n/a	n/a
39	LCWIP Cycle Route 7d	Outer NE	20	n/a
40	Extend LCWIP route to access Highwoods Square Interchange	Outer NE	20	n/a
42	LCWIP Cycle Route 8	Central	10	RefCase12, RefCase13, RefCase19
44	LCWIP Cycle Route 9	Outer S	10,11	RefCase12, RefCase18
47	LCWIP Cycle Route 10	Inner SW	9	RefCase6
49	LCWIP Cycle Route 11	Inner S	10	RefCase2
50	LCWIP Cycle Route 12	Inner W	n/a	n/a
51	LCWIP Cycle Route 13	Outer N	4	n/a

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Table H.2: Cycling related measures (*continued*)

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
73	Secure cycle hub at rail station - Chappel & Wakes Colne	Outer NW	5	n/a
74	Cycle route between station/mobility hub and employment site - Wakes Colne	Outer NW	5	n/a
77	Cycle route along B1023 to Tiptree and connecting with spatial options on the other side of town	Outer SW	8	n/a
93	Formalise secondary cycle route connecting LCWIP 7b to Wivenhoe	Outer SE	13	n/a
94	Formalise secondary cycle route connecting Langham to P&R site and access to RTS	Outer NE	1	RefCase8
95	Formalise secondary cycle route connecting Boxted to P&R site and access to RTS	Outer NE	1	n/a
99	Formalise secondary LCWIP route to Layer-De-La-Haye	Outer SW	9	Refcase9, RefCase14, RefCase15

Table H.3: Bus rapid transit

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
79	RTS extension City Centre to Marks Tey	Outer W	4,7,10	n/a

Table H.4: Bus related measures

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
48	Provision of bus stop at development site - Berechurch Hall Road / Layer Road dependant on site access arrangements	Outer SW	9	n/a
80	Marks Tey new bus route (low cost alternative to item 79) Option 1 – extend existing route(s) into developments Option 2 – new bus route connecting developments and key amenities	Outer W	7	n/a

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Table H.4: Bus related measures (*continued*)

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
81	Bus Gate on Tollgate Road close to the junction with Church Lane	Outer SW	16	n/a
82	West Mersea bus frequency upgrades	Outer S	23	RefCase 10, RefCase11
83	Boxted bus frequency upgrades	Outer N	1	n/a
84	Langham bus frequency upgrades	Outer NW	1	RefCase8
85	East Colchester - Land north of Bromley Road new bus route Option 1 – extend existing routes into development Option 2 – create orbital route connecting either end of the RTS through the site	Inner NE	20	n/a
86	Great Horkesley / Wakes Colne new bus route	Outer W	5	n/a
87	Tiptree bus frequency upgrade	Outer SW	8	n/a
88	Axial Way / Colchester Business Park New Route	Inner NE	3	n/a
89	Increase the frequency of Colchester-Sudbury routes interacting with Horkesley Heat, or introduce Horkesley Heat-P&R shuttle to connect with RTS	Outer NW	2, 3	RefCase20, RefCase21, RefCase22
92	Lexden Road Sustainable Travel Corridor - Associated bus priority measures and infrastructure	Inner W	4	n/a
100	Bus Gate for bus access to P&R from Boxted Road	Outer N	n/a	n/a
101	Bus connection from Langham to connect to P&R at Boxted Road bus gate	Outer N	1	RefCase8
102	Bus Subsidy	Not Mapped	All	n/a
144	Bus station and interchange	Inner S	tbc	

Table H.5: Mobility hub related measures

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
3	Colchester North Station Mobility Hub Central	3	RefCase12, RefCase13, RefCase19	

Continued on next page

Table H.5: Mobility hub related measures (*continued*)

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
6	West Bergholt Mobility Hub Outer W	4	RefCase1	
9	Horkesley Heath Mobility Hub Outer NW	2	n/a	
27	Hythe Station Mobility Hub Outer SE	12	n/a	
41	Highwoods Mobility Hub Inner NE	20	RefCase20	
43	High Street Mobility Hub Outer S	10	n/a	
45	Whitehall Road Mobility Hub Outer SE	11	n/a	
46	Colchester Town Mobility Hub Outer S	10	RefCase12	
52	Colchester Hospital Mobility Hub Inner NW	4	n/a	
71	Eight Ash Green Mobility Hub Outer W	6	RefCase16	
72	Wakes Colne Mobility Hub Outer NW	5	n/a	
75	Wivenhoe Mobility Hub Outer SE	13	n/a	
76	Tiptree Mobility Hub Outer SW	8	n/a	
78	Severalls Mobility Hub Outer NE	3	RefCase20	
97	Langham Mobility Hub Outer NE	1	RefCase8	
98	P&R North Mobility Hub Outer N	3	RefCase22	

Table H.6: P&R measures

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
90	Colchester West Park and Choose	Outer W	All	n/a

Table H.7: Travel planning

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
91	Development travel planning and behaviour incentives	Not mapped	All	All

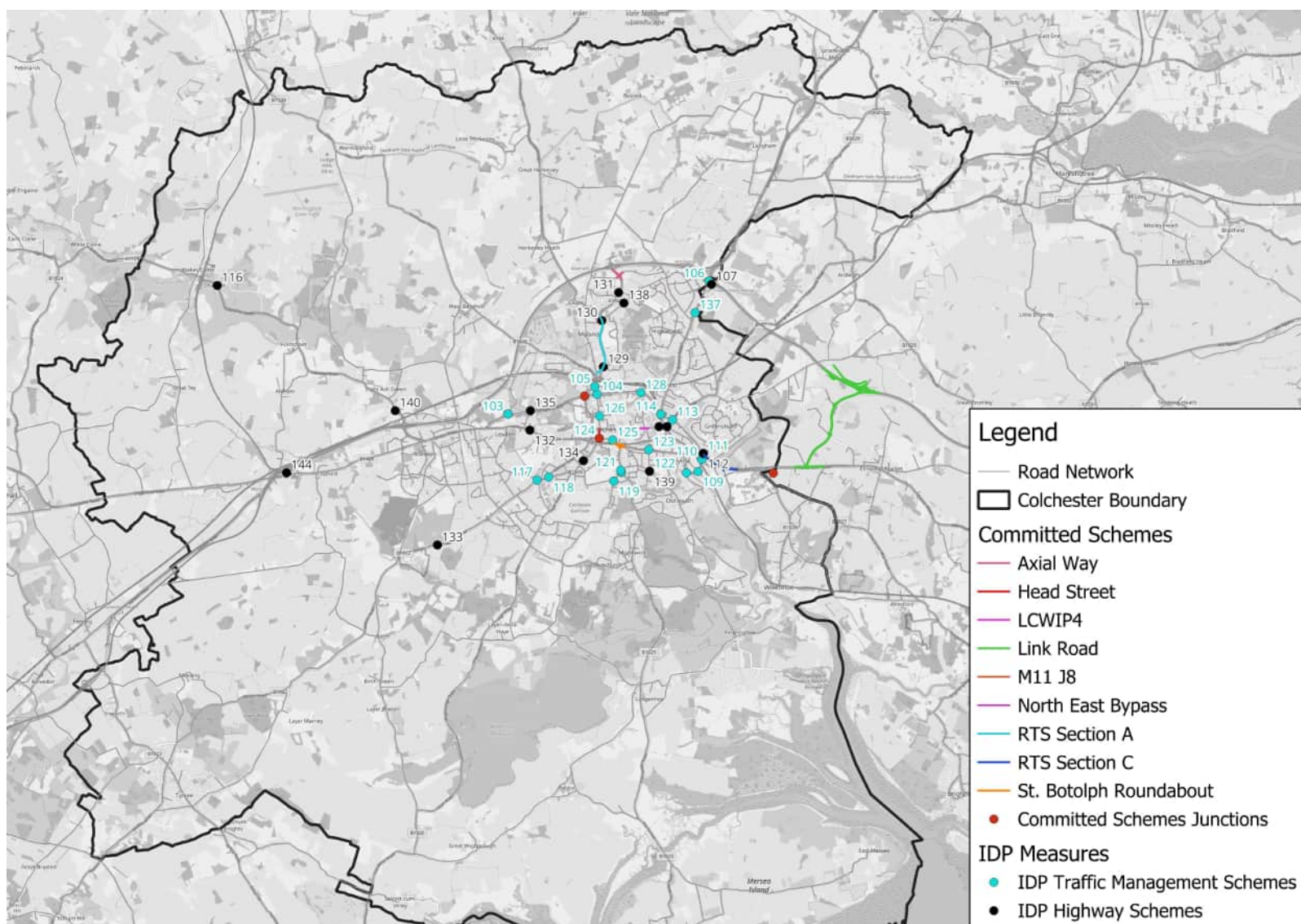


Table H.8: Highway schemes

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
107	A12 J29 A120 off slip widening	Outer NE	3	RefCase20
112	A134./A133 Greenstead rbt full realignment to standard rbt	Outer SE	11, 12, 13	RefCase7, RefCase18, RefCase23
123	A134 Magdalen St/Brook St/Wimpole Rd	Inner SE	10	RefCase12
127	Greenstead Rd/East St/Harwich Rd/railway junction improvements	Inner E	10, 12	RefCase12, RefCase23
129	A134 Northern Approach Rd/Turner Rd	Outer N	4	RefCase19
130	A134 Northern Approach Rd/Mill Rd	Outer N	2, 3, 4	RefCase4, RefCase20, RefCase21, RefCase22
131	Via Urbis Romanae/Olympic Blvd	Outer N	3	RefCase20
138	Mill Road widening	Outer N	3,4	RefCase20
139	Old Heath Road junction improvements	Inner SE	10, 11	RefCase12, RefCase18
140	Halstead Road junction improvements	Outer NW	6	RefCase16, RefCase17
142	Warren Lane/ Maldon Road junction	Outer SW	7,8,9,21	
143	Westway/Balkerne Hill (south of Colne Bank roundabout)	Inner S	tbc	
144	A12 J25 integrated highway and sustainable travel	Outer W	n/a	7

Table H.9: Traffic management schemes

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
103	A12 J27 Spring Lane rbt signalisation	Inner NW	4	RefCase16
104	Albert rbt signalisation	Central	4	Refcase19
105	Essex Hall full signalisation	Central	4	Refcase19
106	A12 J29 A120 rbt full signalisation	Outer NE	3	RefCase20
108	A134 Colne Causeway / Haven Road signalisation	Inner SE	11	RefCase18
109	A134 Colne Causeway / Hawkins Road signalisation	Inner SE	11, 12, 13	RefCase7, RefCase23

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Table H.9: Traffic management schemes (*continued*)

Scheme ID	Scheme name	Location	Links to preferred allocations	Links to reference case developments
110	A134 Colne Causeway / Elmstead Road signalisation	Inner SE	11, 12, 13	RefCase7, RefCase23
111	A134./A133 Greenstead rbt full signalisation	Outer SE	11, 12, 13	RefCase7, RefCase23
113	A133/A137 St Andrews Av / Harwich Rd signalisation	Inner NE	11, 12, 13, 20	RefCase7, RefCase23
114	A133/A137 St Andrews Av / Ipswich Rd signalisation	Inner NE	11, 12, 13, 20	RefCase7, RefCase23
115	Dynamic movement management	Not mapped	All	n/a
119	Circular Rd S/Berechurch Rd/Pownall Cres	Inner S	n/a	n/a
120	Berechurch Rd/B1025 Mersea Rd	Inner S	10	n/a
121	B1025 Mersea Rd/Roberts Rd	Inner S	10	n/a
122	Military Rd/Wimpole Rd/Old Heath Rd/Bourne Rd	Inner SE	11	RefCase18
125	St John's St/Stanwell St	Central	10	RefCase12
126	Middleborough/North Hill/St Peter's St	Central	10	n/a
128	A133 Cowdray Avenue/Meander Mews	Inner NE	n/a	RefCase19
137	Ipswich Road signal improvements	Outer NE	20	n/a
141	Essex Yeomanry Way A1124 and Western Approach	Outer W	6,7	n/a