Medway LP Regulation 19 – Initial Transport Modelling Results

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Medway Council
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13 June 2025

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Jacobs UK

Cottons Centre
Cottons Lane
London SE1 2QG
United Kingdom

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1. Introduction

1.1 Foreword

As Kent Transport Model (KTM) custodian to Kent County Council (KCC), Jacobs have been asked by Medway Council (MC) to develop the required strategic modelling necessary to provide the evidence base for the Regulation 19 (Reg19) Local Plan (LP) Consultation, following on from the refinements made in the strategy further to Regulation 18 (Reg18) consultation.

1.2 Background Information

The development of the Medway Transport Model (MTM) is based on an existing cordon of the KTM, developed to support Gravesham's Local Plan transport evidence base (namely, the Gravesham Transport Model). The MTM follows a standard sufficient for this purpose, with due regard to Transport Analysis Guidance (TAG). Further details of the MTM model build can be found in the Local Model Validation Report (LMVR) "Medway Local Plan – Local Model Validation_Final" and the forecasting methodology and results of the Reg18 assessment can be found in the Forecasting Report "240606_MedwayTransportModel_ForecastingReport_wAppendices_Optimised".

The MTM was used as the basis for developing a 2041 Reference Case (RC) (e.g. without the LP) in which committed developments and infrastructure were modelled, in addition to adjusted background growth and a 2041 'DS' model (e.g. with the LP option) was developed to assess the proposed LP allocations, which was consulted upon as part of Reg18.

After Reg18 consultation in Autumn 2023, refinements were made to the LP strategy, and the following scenarios were developed as part of the Reg19 LP allocations and used to assess the transport impact:

1. 2041 Refined Reference Case (rRC): includes completions and consented development and infrastructure planned for the 2019-2041 growth period within Medway; outside of the Area of Detailed Modelling, 'near certain' developments were modelled in adjoining authorities (Gravesham, Tonbridge & Malling, Maidstone and Swale) and background car growth came from TEMPro v8 (using alternative assumptions tool for adjoining authorities to ensure no double counting). Goods vehicle growth across the model will be provided by Road Traffic Forecasts (RTF). This differs to the Reference Case developed to support the Reg18 assessment as it includes the full build out at the MedwayOne development site and considers reduced trip rates at some consented sites that may benefit from more sustainable transport methods (detailed further in "Medway LP2041 TEB Mode Share Strategy Stage 3_Draft").
2. 2041 Interim Do Something (iDS): built upon the rRC scenario, with the inclusion of proposed LP allocations and associated infrastructure (where appropriate). The only difference between the RC and the DS is the proposed LP demand and infrastructure. The proposed LP assessed was an interim scenario used to determine where potential junction mitigations were required on the network.
3. 2041 Final Do Something (fDS): alike the iDS with the addition of junction mitigations identified (later discussed) and the final Reg19 LP site allocations. This scenario also considers the revised trip rates at consented and LP sites that may have provisions for more sustainable transport methods.

Following the Development Consent Order (DCO) for the Lower Thames Crossing (LTC) in April 2025, all scenarios discussed in this Technical Note have LTC as default.

1.3 Interim Do Something Assessment

An interim Do Something assessment was developed further to the Reg18 consultation; these models were primarily devised to identify the "hot spot" areas on the network that deteriorate in network performance compared to the RC scenario. This interim assessment included the proposed LP sites at the time of model development (refined further to create the final list of Reg19 allocations, assessed in the fDS scenario).

There were mitigation schemes identified at Four Elms and Main Road Hoo roundabouts as part of Uniper's MedwayOne application which are sufficient in accommodating the additional demand associated with full build-out at MedwayOne in the rRC, however additional LP growth in the iDS forces these junctions to become significantly over capacity. Capacity constraints in these locations prevented demand from accessing/egressing the Hoo peninsula and potentially masking hot spots elsewhere on the network. In order to identify other locations where local junction modelling and potential highway interventions were required, a version of the iDS was assigned with Four Elms and Main Road Hoo roundabouts unconstrained.

"Hot spot" areas were defined using a combination of model outputs, such as:

- Actual flow difference plots; between the iDS and rRC to identify areas with significant change to flow behaviours
- Demand vs Actual Flow Plots; used to identify areas on the network where actual flows were not reaching the route due to the congestion holding flows elsewhere on the network
- Junction LoS
- Queue Plots; useful to identify links on the network with high levels of delay
- Link and Turn Volume Capacity Ratio

The combination of the above model outputs identified twelve junctions that required a more detailed assessment using local junction modelling software such as Junctions 10 or LinSig. Local junction modelling provides more comprehensive analysis as this captures more detailed junction geometries, which can more accurately model junction behaviours and understand whether further junction mitigations may be required.

The "hot spot" analysis identified the following junctions required further analysis using local junction modelling:

1. Four Elms Roundabout
2. Cornwallis Avenue / Yokosuka Way
3. Peninsula Way / Main Road Hoo
4. Peninsula Way / Dux Court Road
5. Peninsula Way / Ropers Lane
6. Sans Pareil Roundabout
7. A2 / High Street / Station Road / Canal Road
8. Pier Road / Pegasus Way
9. Pier Road / Gillingham Gate
10. Dock Road / Middle Street
11. M2 Junction 4
12. Union Street / Best Street

The locations of these junctions are presented graphically on the network in Figure 1-1

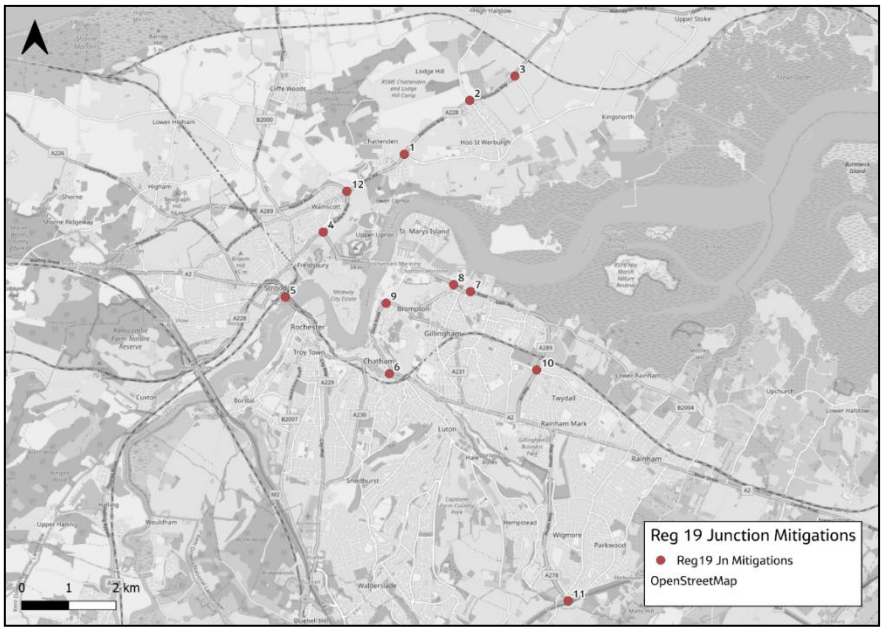

Figure 1-1: Junction Mitigations

Further to the detailed local junction modelling, three junctions that were flagging in the VISUM model were identified to be within capacity. These junctions were:

- A2 New Road/ Union Street Signalised Junction
- Pier Road/ Pegasus Way Signalised Junction
- Cornwallis Roundabout

The junction geometries and capacity in these locations was updated in the VISUM model to reflect those output from the local junction models.

The local junction models identified nine junctions that were over capacity and required mitigation, these were:

- Four Elms Roundabout
- Sans Periel Roundabout
- A228 Peninsula Way/ Dux Court Road/ Bells Lane Roundabout
- A228 Peninsula Way/ Roper's Lane/ Ratcliffe Highway Roundabout
- A228 Peninsula Way/ Main Road Hoo
- A2 High Street/ Station Road/ Canal Road Signalised junction
- Gillingham Gate Gyratory
- Dock Road/ Middle Street/ Wood Street
- M2 Junction 4

Of those junctions detailed to require, a mitigation strategy was developed, and concept design drawings were produced and discussed with Medway Council. These mitigation proposals were then input into the fDS models to identify if there were any remaining hot spots on the network resulting from the LP allocations. More detail of the mitigations developed will be provided in the Regulation19 Forecasting Report.

1.4 Final Do Something Regulation 19 Assessment

The Final Do Something (fDS) has been used to assess the final residential and employment allocations as part of Reg19, following Reg18 consultation (and mitigations designs that were identified as part of the iDS assessment). The fDS assesses the impact of 18,887 houses and 249,501 employment space across the

Medway network. A more detailed breakdown of residential and employment sites used to inform the fDS scenario will be provided in the Regulation 19 Forecasting Report (quantum, location and trip rates).

1.4.1 Network

The fDS scenario uses the rRC network as a basis, with the addition of development specific access arrangements or infrastructure associated with the proposed Final LP allocations. All proposed LP allocations with greater than 100 dwellings or 100 jobs (when calculated using the employment density matrix) have been modelled explicitly and the access/egress to the existing highway network to reflect allocation proposals (same method as RC and DS). Figure 1-2 illustrates the locations of those explicitly modelled developments in the fDS scenario.

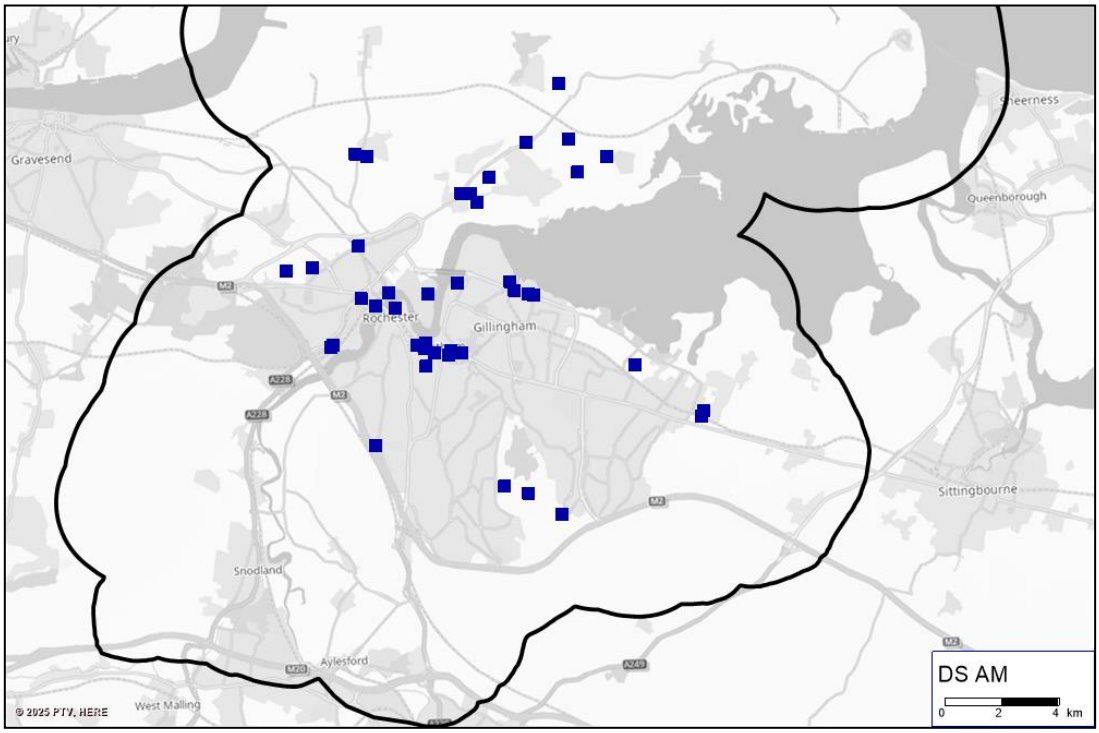

Figure 1-2: New Zones in Final DS model compared to Reg19 RC

2. Model Outputs

This section describes the 2041 forecast results within the MTM with and without LP allocations; the performance of the forecast assignment has considered the impact of the final Reg19 LP sites (fDS – rRC) with the inclusion of the junction mitigations and reduction of trips further to the transport strategy assessment.

The impacts of the Final Reg19 LP allocations have been considered in terms of the following to identify the potential impacts on the network:

- Actual Flow Plots
- Flow Difference Plots
- Queues
- Junction Level of Service
- Link and Turn Volume Capacity Ratio

2.1 Actual Flow

Actual flow plots have been produced to illustrate the flows on links in the fDS in the AM and PM Peak for the Final DS AM and PM scenarios are shown in Figure 2-1 and Figure 2-2.

Both the AM and PM peak illustrate a large reliance on key strategic routes such as the A2/ M2 corridor which experiences the highest volumes, with two-way flows reaching 12,580 in AM and 13,750 in PM. Other routes with high volumes of flow are the A228 Four Elms Hill (7,170 two-way flows in AM and 7,075 two-way flows in PM), A289 Hasted Road (6,195 two-way flows in AM and 6,365 two-way flows in PM) and A289 Pier Road (5,555 two-way flows in AM and 5,380 two-way flows in PM).

A large proportion of LP growth is forecast on the Medway Peninsula (5,240 houses and 171,408sqm of employment), with the main route for flows to access this development via the A228 Peninsula Way. During the AM peak there are high volumes of flow travelling eastbound and westbound on the A228 Peninsula Way to access the Peninsula (3,140, and 4,025 vehicles respectively) with similar demand observed on this route in the PM Peak (3,550 and 3,530).

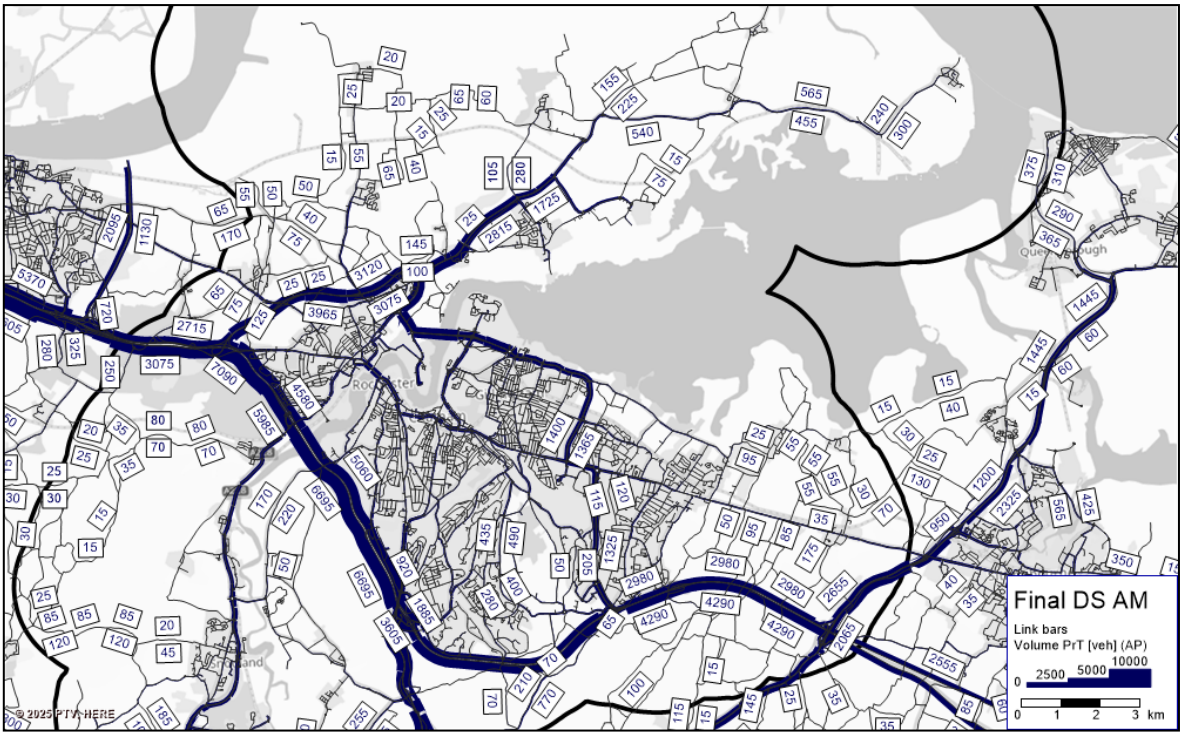

Figure 2-1: Final DS Actual Flow, AM Peak

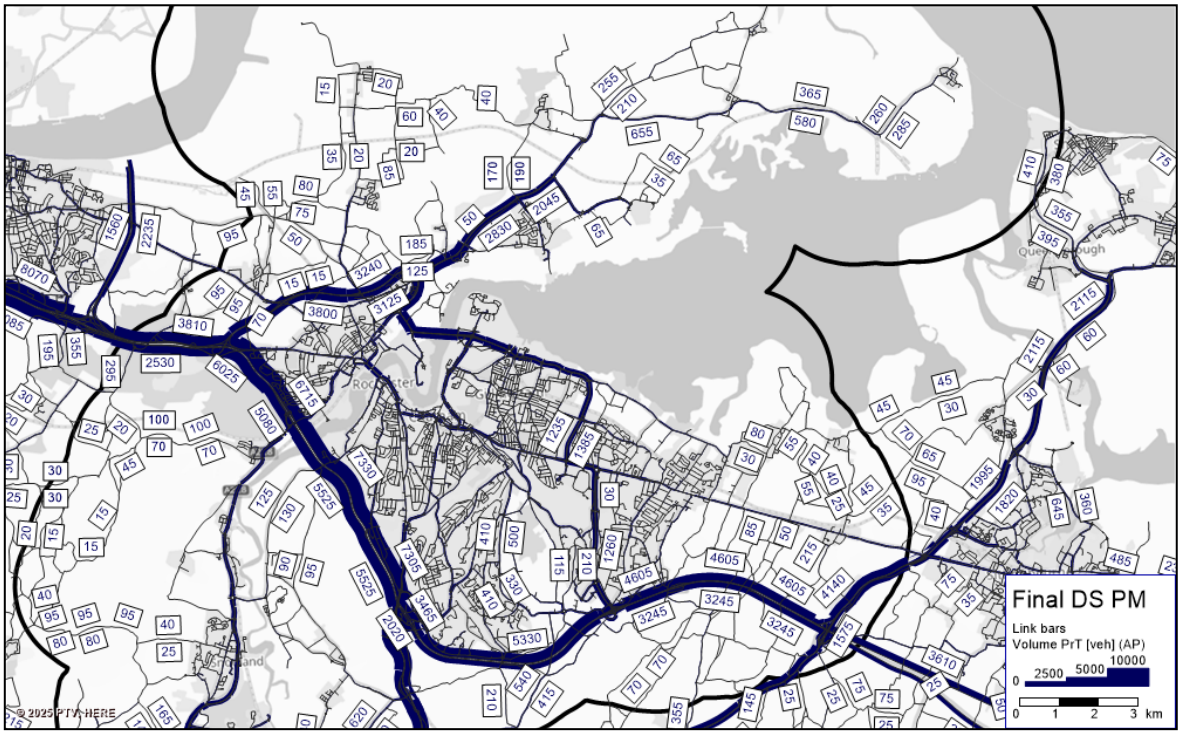

Figure 2-2: Final DS Actual Flow, PM Peak

2.2 Flow Difference

Actual flow difference plots between the fDS and rRC have been produced to identify the change in flows on the network resulting from the Reg19 LP allocations and the proposed junction mitigations. The red bars identify an increase in flow whereas the decrease in flows are evidenced by green bars.

Some large increases of flow can be seen in the network and are due to new links being coded into the fDS compared to the rRC and as such all flow on the new link is an increase. The new links coded within the with fDS are illustrated in Figure 2-3; red bars in these locations should be ignored.

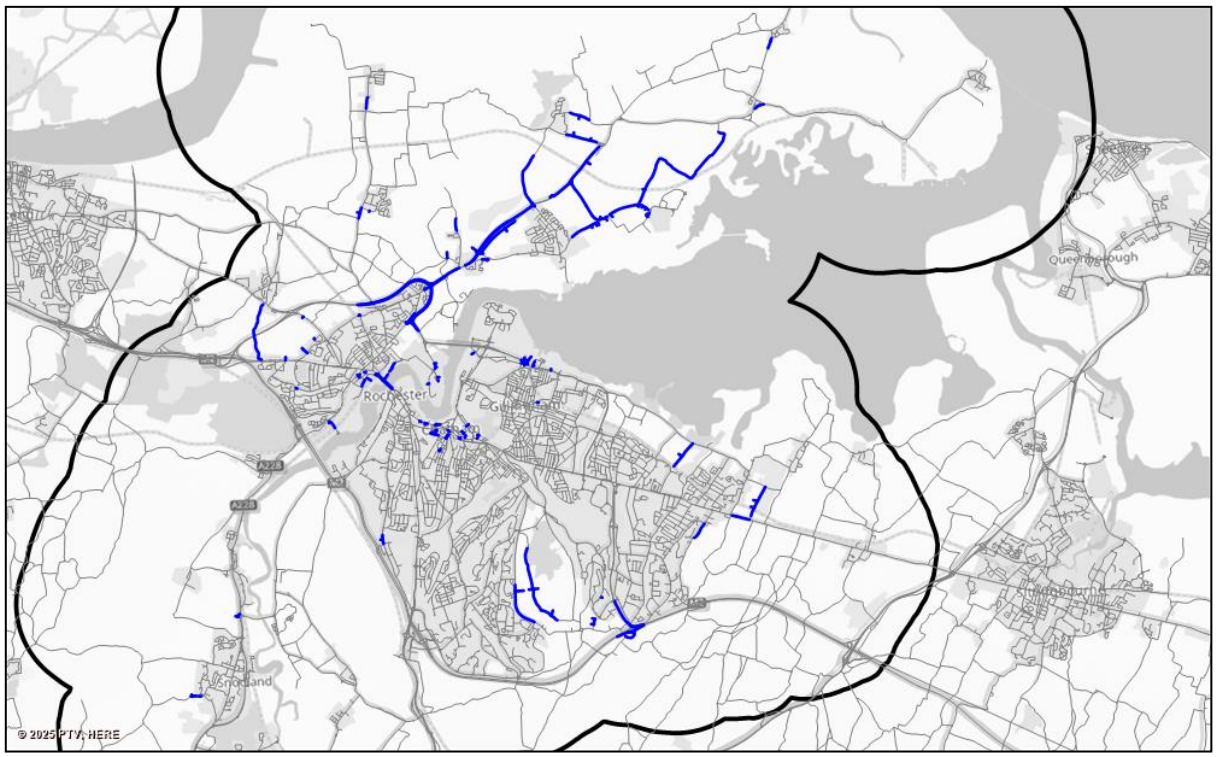

Figure 2-3: New Links in Final DS model compared to Reg19 RC

The AM and PM peak behaviours are presented in Figure 2-4 and Figure 2-5 respectively. During the AM Peak the largest increases in two-way flows are observed on key main routes serving Medway; A228 Four Elms Hill, A289 Pier Road and A289 Hasted Road. There are multiple Local Plan allocations on the Peninsula (5,240 houses and 495,858 sqm of employment), resulting in additional demand routing on the A228 Four Elms Hill (with increases of up to 2,860 two-way flows). Additionally, increases are noted on A289 Pier Road of 1,710, this serves east-west movements within Medway with flows travelling between Higham/ Chattenden areas and Grange and Gillingham.

Decreased flow of up to 270 vehicles is observed on Main Road Hoo westbound, west of Bells Lane, the decreased demand on this route is resultant of the mitigation at Dux Court Road/ A228 Peninsula Way and Bell's Lane roundabout encouraging flow back onto the most direct route rather than seeking alternate parallel routes. Similar observations are evidenced through Wainscott, where reductions of 645 two-way flows are noted on Iden Road, this is due a combination of the proposed realignment of Beneden Road as part of the proposed mitigation at Sans Periel Roundabout[1] (where flow routing via Wanscott use Cooling Road) and the mitigation at Four Elms/ Sans Periel encouraging flow back onto major routes via A289 Wulfere Way.

[1] Junction Mitigation design will be further discussed in the Regulation19 Forecasting Report

The PM Peak (Figure 2-5) presents similar trends to those in the AM Peak, with the largest increases of flow on key main routes serving Medway; A228 Four Elms Hill (2,760 two-way flows), A289 Pier Road (1,300 two-way flows) and A289 Hasted Road (1,130 two-way flows).

Unlike the AM peak, there are reductions of flow noted on A228 northbound through Snodland of up to 230 vehicles, this is due to queues forming on the circulatory arm of the A228/ Peter's Bridge Roundabout causing queues of up to 210 vehicles on the A228.

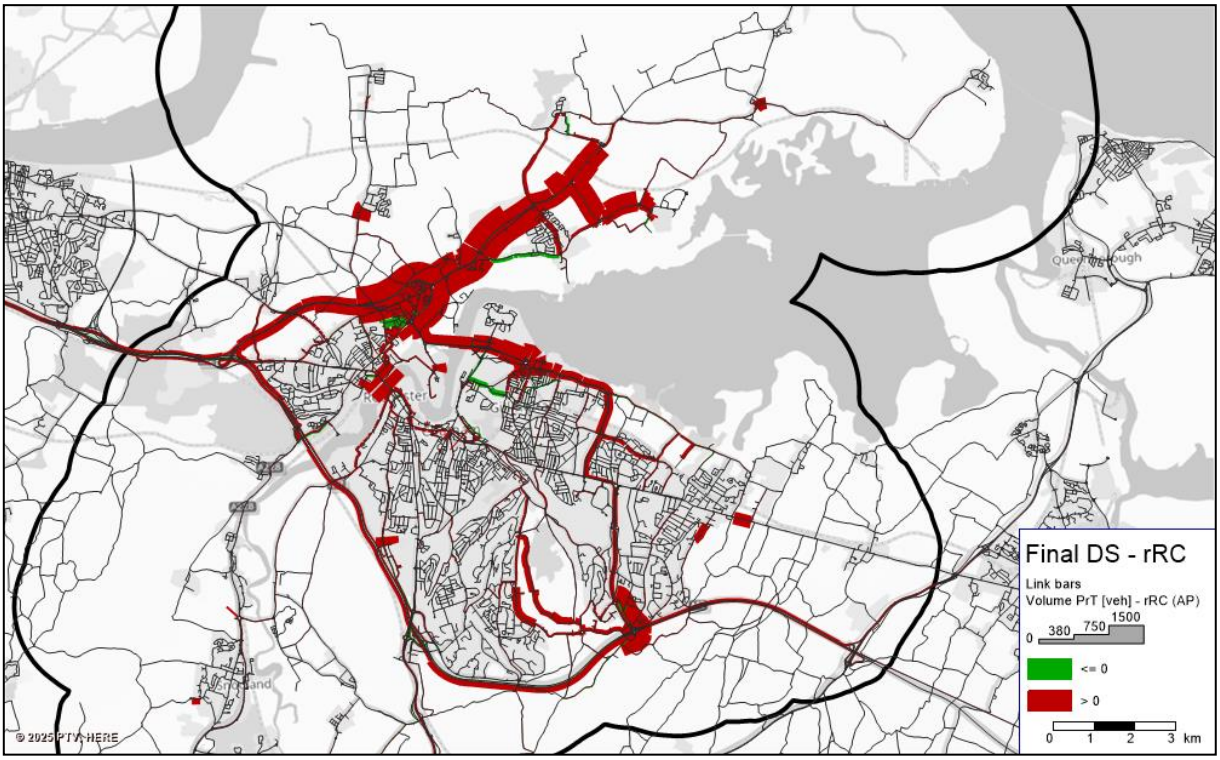

Figure 2-4: Final DS vs Reg19 RC Actual Flow Difference, AM Peak

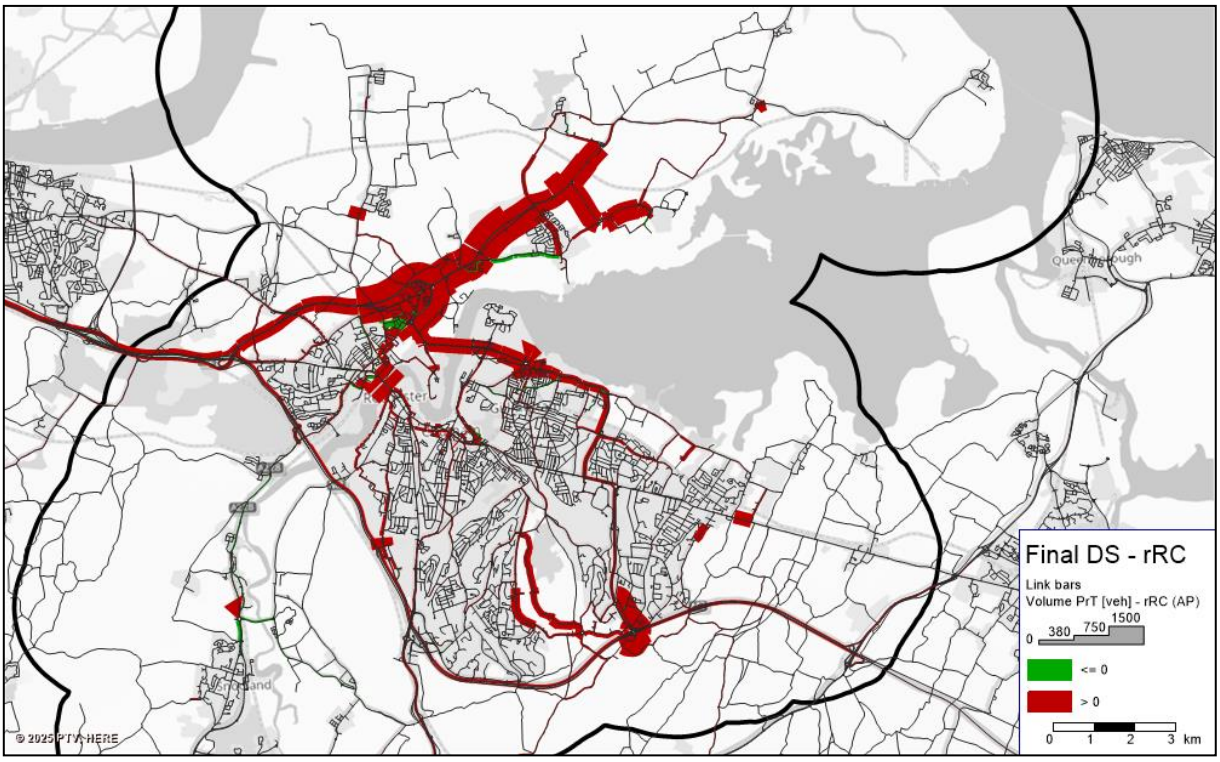

Figure 2-5: Final DS vs Reg19 RC Actual Flow Difference, PM Peak

2.3 Queues

Actual queue differences on the network compared to the rRC were obtained for the AM and PM Peak, as presented in Figure 2-6 and Figure 2-7 respectively.

In the AM peak the largest queue differences are illustrated on the westbound approach to the Berwick Way roundabout with queues of 283 vehicles, this is due to the mitigations proposed at Sans Periel and Four Elms Roundabouts, alongside the additional growth on the network attracting up to 240 additional vehicles on this route.

Queues are also noted on Corporation Street north/westbound; this junction is east A2 / High Street / Station Road / Canal Road junction which has been mitigated as part of the fDS model assignments. The queues in this locality are resultant from the Esplanade/ High Street signalised junction whereby vehicles travelling straight through the junction can incur up to 1 minute 20 seconds of delay. Signal optimisation of all signalised junctions along this corridor may ease the queues in this vicinity.

The final noteworthy queues in the AM peak are evidenced at the M2 Junction 3 Taddington Roundabout, these queues extend from the Maidstone Road/ A229 signalised junction (which was congested in the rRC with queues of up to 35 vehicles extending to the Taddington Roundabout circulatory arm), however, in the fDS scenario, there are an additional 160 vehicles approaching the Taddington Roundabout from the M2 diverge northbound and 133 from the M2 diverge southbound, which further exacerbates the problem in this location.

The PM peak shows similar queues as the AM peak at Corporation Street northbound and M2 Junction 3, however, Taddington Roundabout notes larger increases in queue on the southbound diverge arm than observed in the AM peak due to the tidal nature of flows in this area. There is a significant increase in queueing on the circulatory arm of A228/ Peter's Bridge roundabout resulting in queues of up to 210 vehicles on the A228.

Figure 2-6: Final DS vs Reg19 RC Queues, AM Peak

Figure 2-7: Final DS vs Reg19 RC Queues, PM Peak

2.4 Junction Level of Service

Junction level of service shows the performance of each junction within the model using values A-F, A being the best and F being the worst possible value. A definition of each category performance can be found in Table 2-1.

Table 2-1: LoS Level Description

LOS Level	Description
A	Level A represents the best quality of traffic where the driver has the freedom to drive with free flow speed.
B	Level B represents good traffic quality where driver can reasonably maintain free flow speed and manoeuvrability within the traffic stream is slightly restricted.
C	Level C represents stable traffic flows, at or near free flow. Ability to manoeuvre through lanes is noticeably restricted and requires awareness.
D	Level D represents almost unstable traffic flows. Speeds slightly decrease as traffic volume slightly increase. On this level driver comfort decreases.
E	Level E represents unstable traffic flows, operating at capacity. Driver's level of comfort becomes poor.
F	Level F represents the worst traffic quality with forced or breakdown traffic flows. Travel time cannot be predicted, with generally more demand than capacity.

Figure 2-8 and Figure 2-9 show the LoS values for nodes that have deteriorated to level C or worse in the fDS models when compared to the rRC models, this has also been summarised in Table 2-2. In the AM peak there are 15 junctions within the AODM that have deteriorated to a level C or worse and in the PM Peak there are 14 junctions.

The majority of the 15 junctions that operate at an LoS C or worse in the fDS scenario have deteriorated compared to the rRC by one LoS level only, with the exception of two junctions; northern entry arm to The Strand roundabout (operating at a level F which was previously a level A) and the western approach to the Stoke Road / Eshcol Road roundabout near Kingsnorth on the Hoo Peninsula (operating at level D where previously level A).

The northern approach arm to the Strand Roundabout (LoS F) and the western approach to the Stoke Road / Eshcol Road roundabout near Kingsnorth on the Hoo Peninsula (LoS D) deteriorate compared to the rRC resultant of the LP growth in the vicinity, as these junctions serve as main access points for LP developments.

The A2 between Otterham Quay Lane and Chatham town centre see multiple nodes with a LoS deterioration, this is due to the increase demand using the route (up to 300 two-way flows). Most of the deteriorating nodes on this route are signalised nodes and may benefit from signal optimisation in order to improve their efficiency.

In the PM (Figure 2-9), six of the nodes showing a deterioration in LoS are the same as those in the AM Peak, these are on routes such as B2004 Lower Rainham Road, A299 City Way and A2 Sovereign Boulevard. The Stoke Road / Eshcol Road roundabout near Kingsnorth notes LoS deterioration, however, in the PM peak, this is on the eastern approach from Eschol Road which has worsened from level A in the rRC to D in the fDS; the deterioration is linked to the increase in flow from nearby LP sites resulting in 1,000 more cars entering the roundabout from Eschol Road.

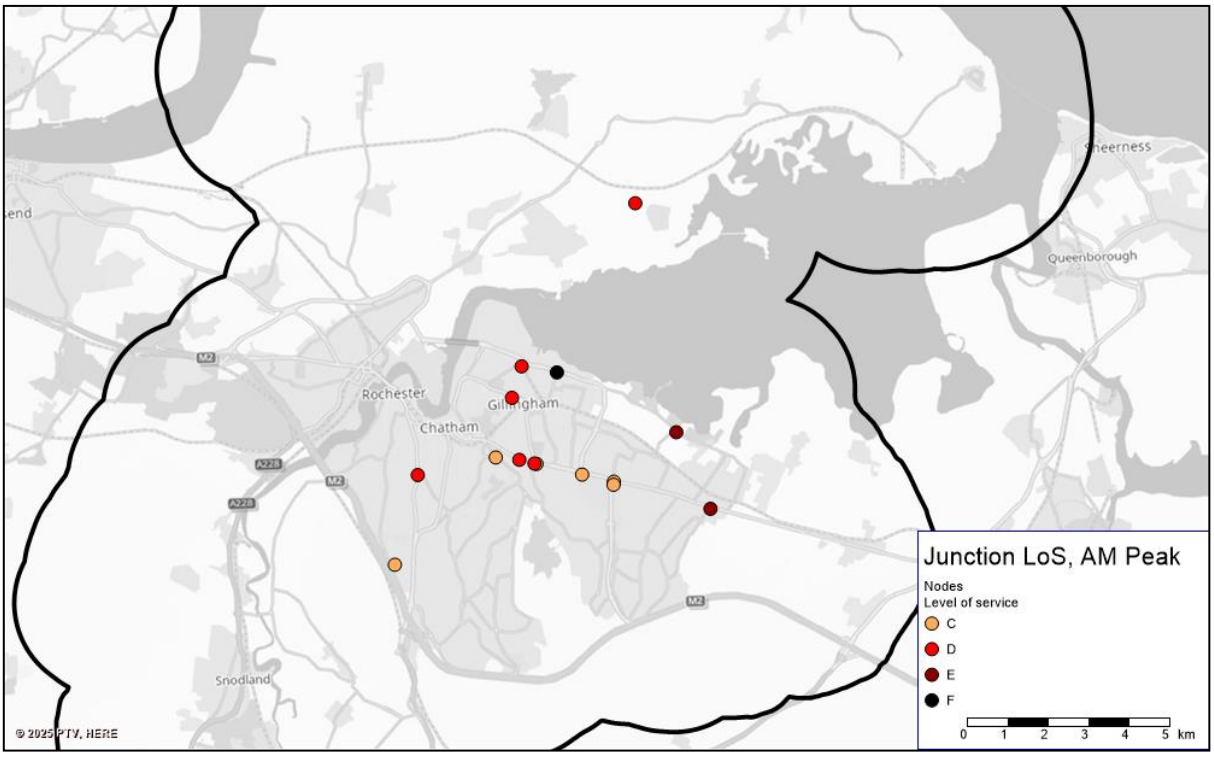

Figure 2-8: Final DS vs Reg19 RC Junction Level of Service, AM Peak

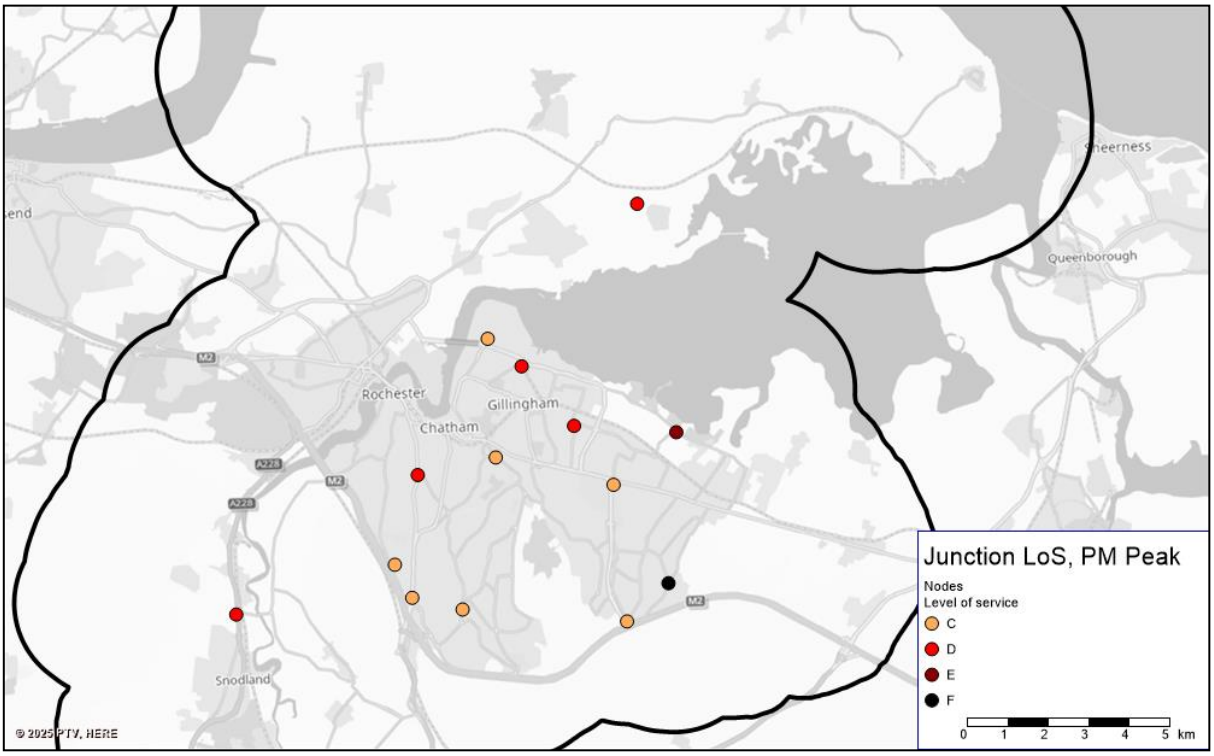

Figure 2-9: Final DS vs Reg19 RC Junction Level of Service, PM Peak

Table 2-2: Junction LoS Summary Table

Junction Location	Junction Type	AM		PM	
		Reg19 RC	Final DS	Reg19 RC	Final DS
Medway Road / B2004 Medway Road	Signalized	C	D	C	D
Courteney Road onto Bowaters Roundabout	Signalized	B	C	B	C
A229 City Way / Pattens Lane	Signalized	C	D	C	D
Lower Rainham Road east of Pump Lane	Signalized	D	E	D	E
Laker Road	Two-way yield	B	C	B	C
Luton Road / Constitution Hill / Castle Road	Signalized	B	C	B	C
A2 Chatham Hill / Rock Avenue	Signalized	C	D	-	-
Strand Approach Road onto The Strand Roundabout	Roundabout	A	F	-	-
High Street / Mierscourt Road	Signalized	D	E	-	-
Sovereign Boulevard onto Will Adams Roundabout	Roundabout	B	C	-	-
Unnamed arm onto Stoke Road / Eshcol Road roundabout	Roundabout	A	D	-	-
A2 Rainham Road / Canterbury Street / A2 Watling Street	Signalized	B	C	-	-
Skinner Street / Jeffery Street	Signalized	C	D	-	-
Twydall Lane onto Bowaters Roundabout	Signalized	B	C	-	-
Ash Tree Lane / A2 Rainham Road	Signalized	C	D	-	-
Walderslade Road / Princes Avenue	Roundabout	-	-	B	C
Eshcol Road onto Stoke Road / Eshcol Road roundabout	Roundabout	-	-	A	D
A229 Maidstone Road at Asda entry road	Signalized	-	-	B	C
Deanwood Drive / Wigmore Road / Maidstone Road	Two-way yield	-	-	B	C
Deanwood Drive / Lovelave Close	Two-way yield	-	-	A	F
Maritime Way near Quayside / Dock Head Road roundabout	Two-way yield	-	-	B	C
Cornwallis Aevnue / Woodlands Road	Signalized	-	-	C	D
New arm on Peters Village Roundabout	Roundabout	-	-	-	D

2.5 Link and Turn Volume Capacity Ratio

The assessment undertaken was to understand links and turn performance in the AODM, this considered the volume of vehicles on a link/ turn and divided by the capacity. V/C was then summarised into four categories, as shown in Table 2-3.

Table 2-3: Junction and Link Volume Over Capacity Assessment Criteria

Volume over Capacity Thresholds	Impact Assessment
V/C <75	Operating within capacity
75 <= V/C <85	Operating within capacity but approaching 85%
85 <= V/C <100	Operating close to capacity
V/C >= 100	Over capacity

Figure 2-10 and Figure 2-11 show the V/C for the fDS (both AM and PM peaks) where the LoS category differs in comparison to the rRC scenario. The most constrained links are on major strategic routes such as A2, A229 south of M2, A228 Sundridge Hill south of M2, and A289 between the A2 and St Mary's Island area. During the AM Peak the M2 westbound between J5 and J4 is overcapacity with V/C values greater than 100%, the reverse is observed in the PM Peak (M2 eastbound, between J4 and J5), due to the tidality of flow.

Ropers Lane/ Stoke Road eastbound is nearing capacity with V/C values between 90% and 99% in the AM peak, this is a route serving many of the employment sites proposed in the LP. In the PM peak, the westbound direction of this route nears capacity (86% - 92%), due to the demand leaving the employment sites in this locality.

Turn capacity considers the worst turn at a junction as it is considered that the worst turn will have an impact on the junction performance overall. This analysis identifies junctions in similar locations to those presented in the LoS analysis; with those junctions nearing or exceeding capacity typically on A289 Pier Road and A2 Chatham Hill.

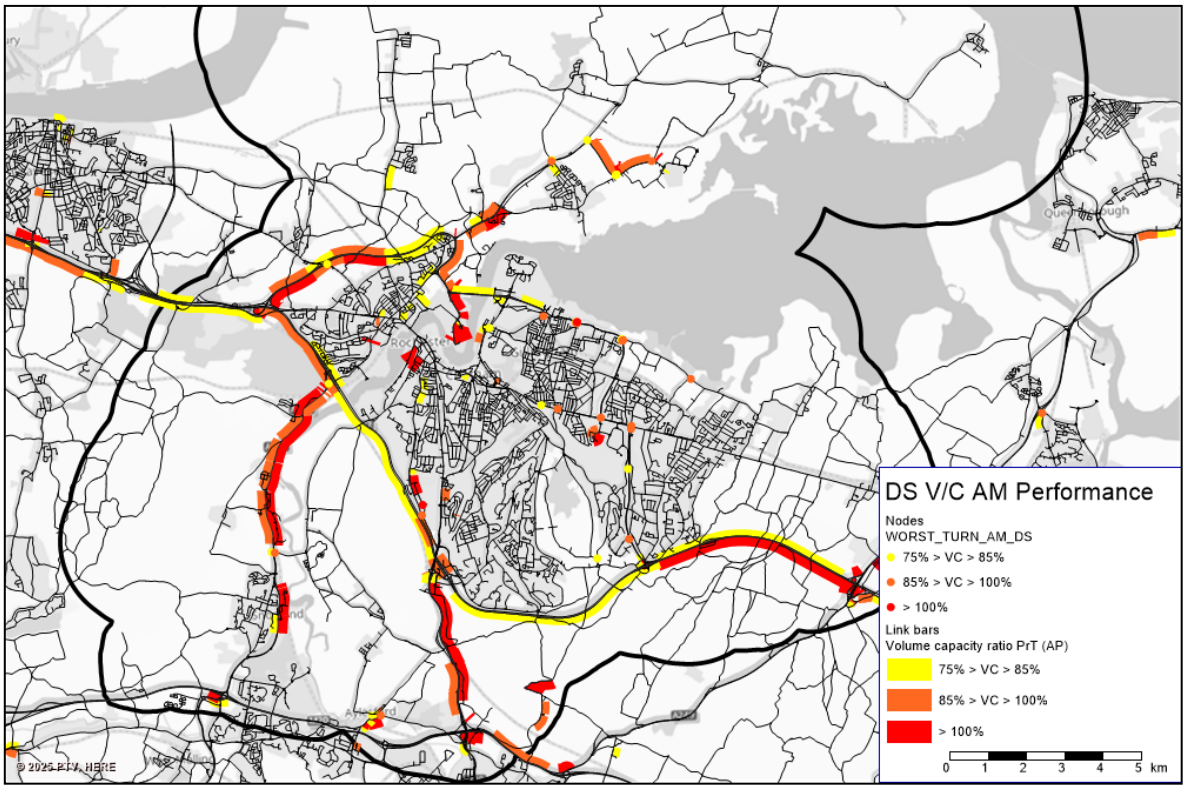

Figure 2-10: Final DS vs Reg19 RC Link and Turn V/C, AM Peak

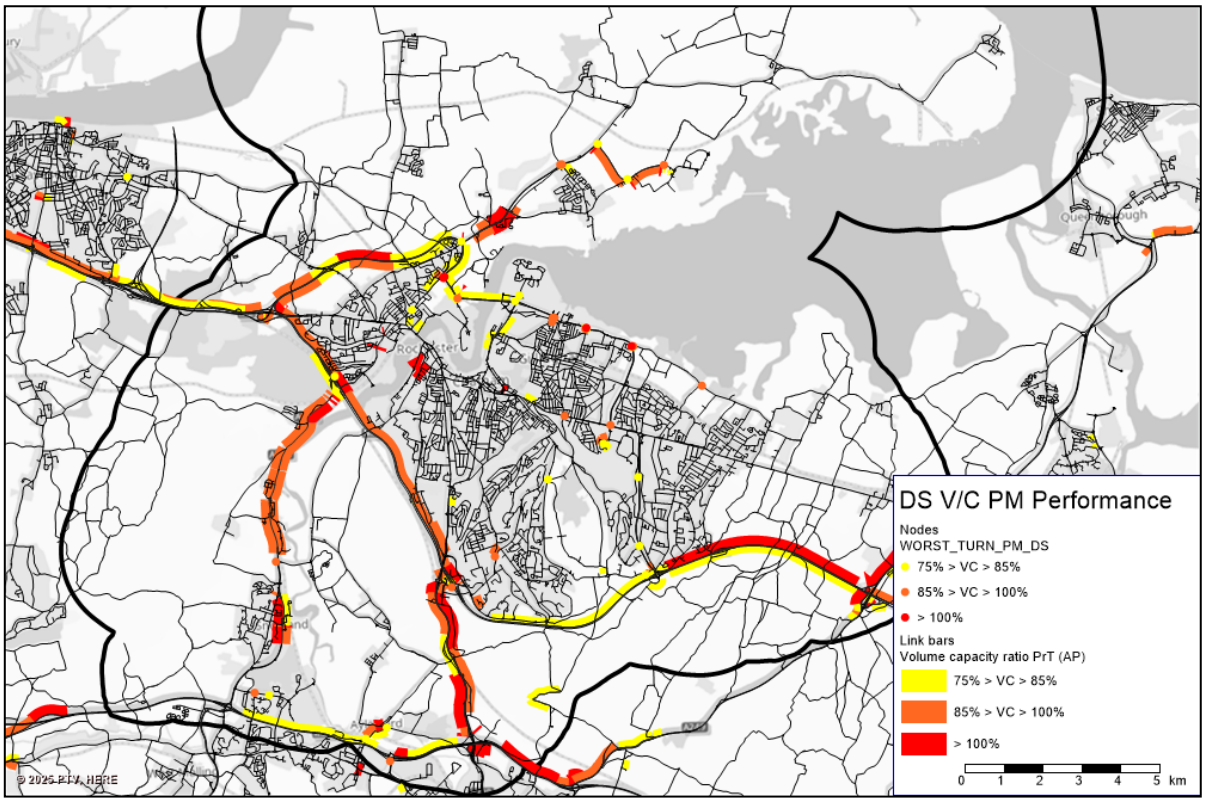

Figure 2-11: Final DS vs Reg19 RC Link and Turn V/C, PM Peak

3. Notes

It should be noted that the outputs presented in this summary note are subject to final review. The analysis and conclusion will be further developed in the Regulation 19 Forecasting Report, including further detail on the link and turn V/C performance.