Three Rivers and Watford LDF

Technical Note 3: 2026 LDF Sites

Technical note

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1 Task 3: Impact of Potential LDF Sites by 2026

Introduction

1.1 Technical Note 2 provided a detailed summary of the development of 2026 future year demand matrices for use in the Three Rivers and Watford SATURN model, and the derivation of future year networks changes required to help accommodate committed development.

1.2 This third Technical Note looks specifically at growth to 2026, constrained by Tempro, under two scenarios:

- Base + Committed Development + Background Growth to 2026
- Base + Committed and Potential Developments + Background Growth to 2026

1.3 First a comparison is made of the 'Base+Committed+Growth' assignment against the 'Base+Committed' only results, to help illustrate those areas affected by additional demand growth beyond those sites where committed development has been identified.

1.4 Second, we compare differences in 2026 model performance when a proportion of the future growth is allocated to directly to sites which have been identified as potential sites for further development through both Three Rivers' and Watford's ongoing LDF process.

Recap

1.5 To recap, the following table provides a summary of matrices used under each model scenario. User Class 1 (UC1) represents existing trips, plus growth where applicable, with UC2 and UC3 representing trips associated with committed developments and potential LDF development sites respectively.

TABLE 1.1 FUTURE YEAR MATRIX TOTALS

Matrix Scenario	2026			Total
	UC1	UC2	UC3	
AM: Base + Committed	50925	3104	-	54029
AM: Base + Committed + Growth	55050	3104	-	58154
AM: Base + Committed + Potential + Growth	52300	3104	2742	58146
PM: Base + Committed	54829	3150	-	57979
PM: Base + Committed + Growth	59600	3150	-	62749
PM: Base + Committed + Potential + Growth	56145	3150	3428	62723

1.6 Growth from 2010 to 2026 has been estimated as 1.142 for the AM peak, and 1.144 for the PM peak. This equates to less than 1% per annum. Applying these

factors to the base 2010 matrices gives 2026 matrix total of 58157 in the AM peak and 62725 in the PM peak.

1.7 In each scenario, committed developments (UC2) account for 3104 and 3150 of the growth in the AM and PM peaks respectively. The difference in modelling terms between the two scenarios is that 'potential' developments (UC3) are also seen to account for 2742 additional trips in the AM peak and 3428 in the PM peak.

1.8 With the addition of committed and potential development trips to the base demand, only an additional 1386 and 1318 trips, AM and PM peaks, are added to reach overall growth forecasts for 2026 contained in Tempro.

1.9 The 2026 network includes committed proposals for the Health Campus Link and Colonial Way Extension. In addition, minor improvements were also identified to help accommodate additional demand associated with committed development. These include optimisation of traffic signals at a number of junctions, physical changes to the network at junctions along Hempstead Road and additional capacity at the A412/A404 roundabout to the west of Rickmansworth Town Centre.

1.10 With the network improvements identified, it is predicted that operation of the junction of Eastbury Road/Deacons Hill is likely to be cause for concern in future years, with increased delay compared to the base also predicted on approach to Rickmansworth in the morning peak and along Hempstead Road in the evening peak.

1.11 These concerns are highlighted in the following figures, showing the volume of traffic on key links as a percentage of the capacity of those links. The volume/capacity plots also highlight further links over, or close to, capacity which were not identified as changes to the base in Technical Note 2. This indicates that these links are also likely to be causes for concern in the base. These include the southbound approach to Bushey Arches in the morning peak and both on exit from the town centre on Rickmansworth Road and on the M25 Spur from Junction 19 in the evening peak.

FIGURE 1.1 VOLUME/CAPACITY – AM PEAK – BASE + COMMITTED SCENARIO

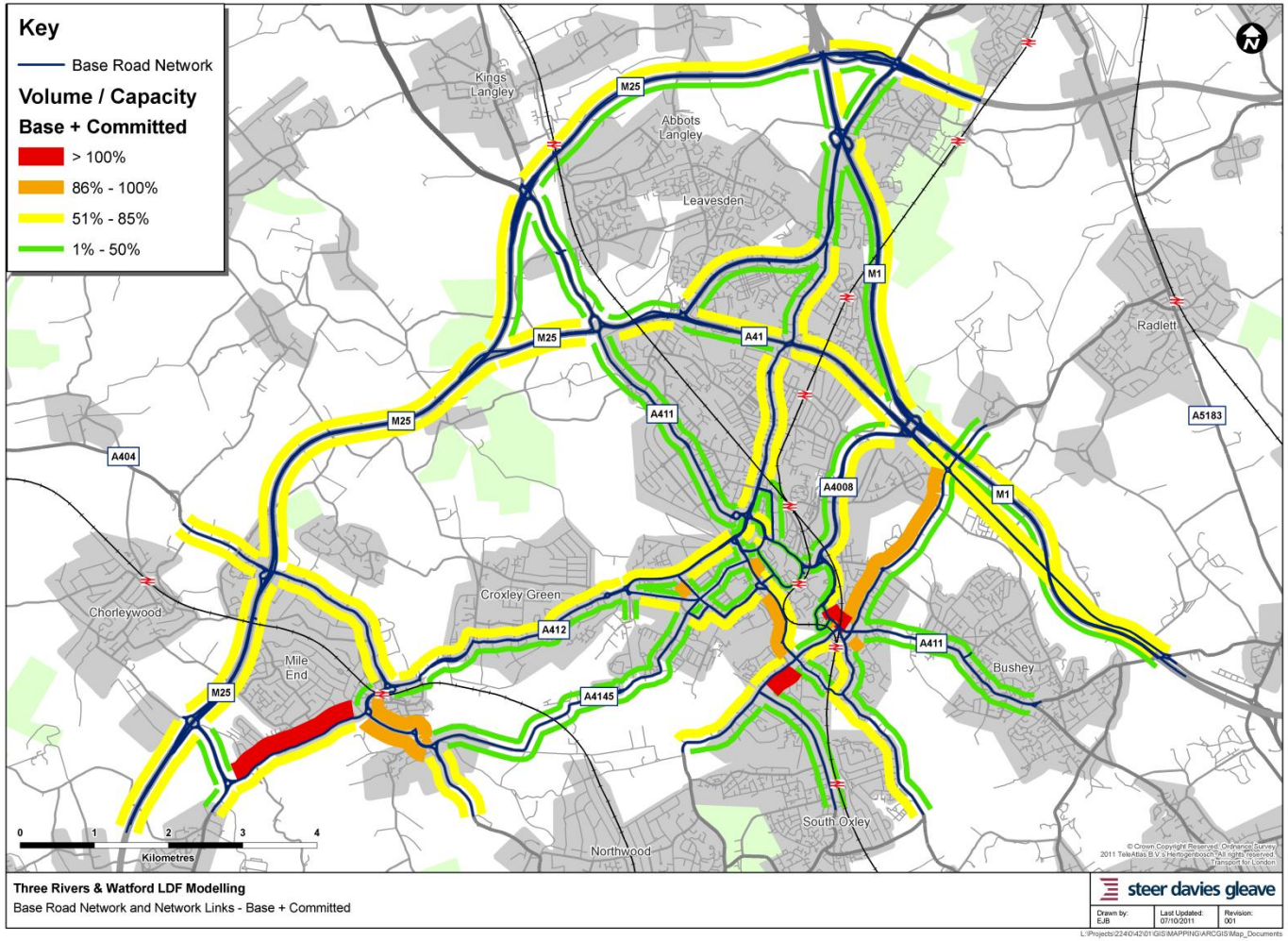
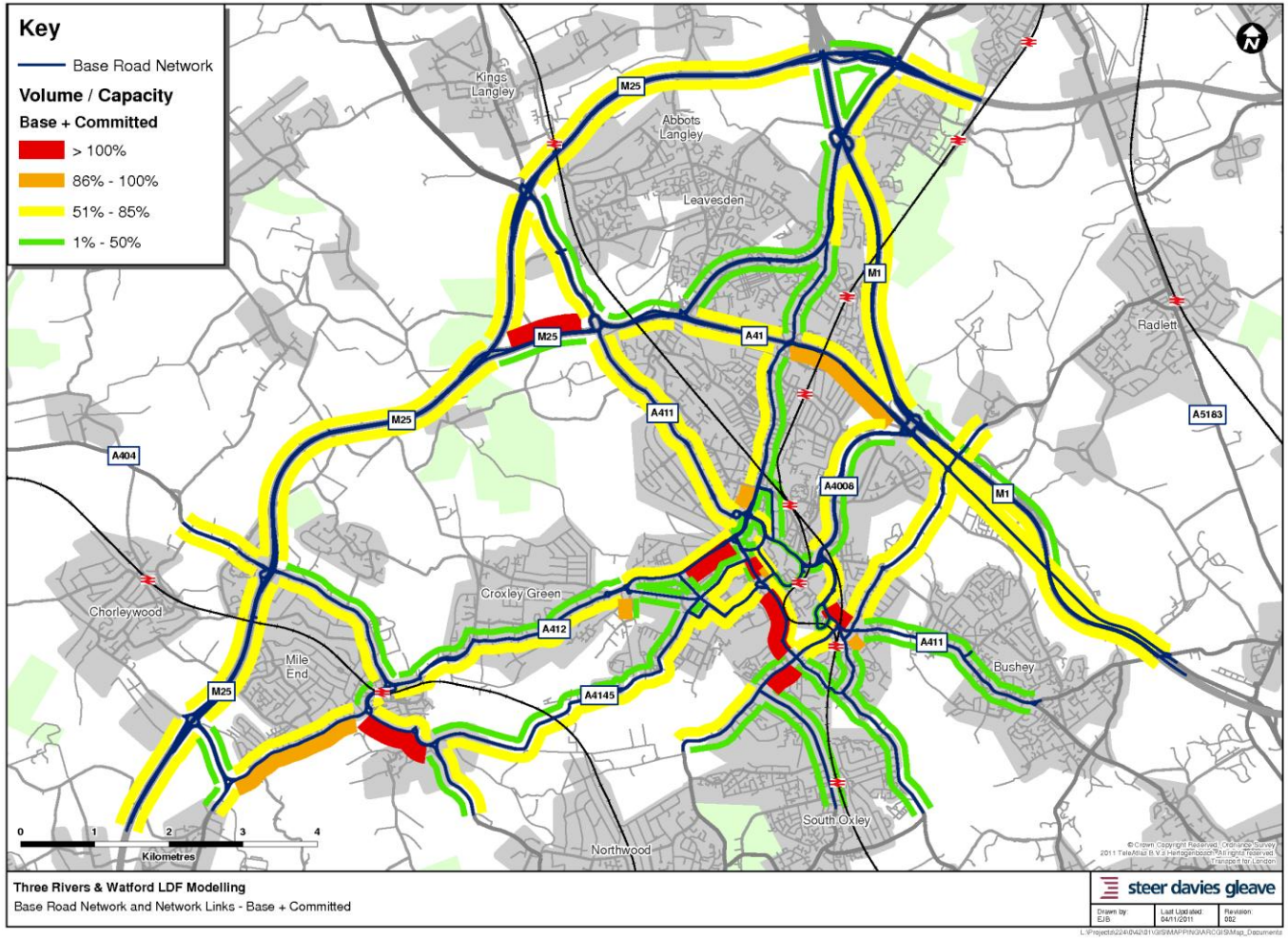


FIGURE 1.2 VOLUME/CAPACITY – PM PEAK – BASE + COMMITTED SCENARIO



Base + Committed + Growth

1.12 Similar volume/capacity plots are also provided for the Base+Committed+Growth scenario. In the morning peak, the findings are similar to Figure 1.1 although we do see increased congestion on routes in and out of the Bushey Arches gyratory and also along the A41 outer orbital route.

1.13 In the evening peak, with unconstrained future growth, we predict volumes in excess of existing capacity on exit from Ascot Road and also show increasing volumes of flow along St Albans Road and Hempstead Road (outbound) and on the M25 between junctions 18 and 19.

1.14 Comparing the 'Base+Committed+Growth' assignment against the 'Base+Committed' only results gives an indication where additional future year traffic is likely to be focussed if there is little control over where that growth occurs. Figures 1.5 and 1.6 illustrate difference plots of demand flows between the two scenarios for the AM and PM peak respectively. The majority of links are green, as expected, showing an increase in flow with the additional demand. However, there are pockets of network, particularly around Leavesden in the morning peak, where rerouting is predicted to occur to such an extent that link flows are reduced, although these reductions are countered by large increases on adjacent links.

1.15 Closer inspection of assignments in the Leavesden area indicates that this part of the model is sensitive to minor changes in delay on competing rotes with very similar journey times, resulting in the 'switch' of flows from one route to another between different model runs. This is more a reflection on the model assignment techniques than any real difficulties within the network. The relatively strange re-routing effects shown in Figure 1.5 are largely removed if slightly more capacity is coded for the A405 Kingsway approach to the A41 North Western Avenue junction.

1.16 The majority of the increase is shown on the motorways which, given growth is relatively unconstrained and that the strategic network is most heavily trafficked, is not a surprise.

1.17 Perhaps more interestingly, the changes in delay on the network shown in Figures 1.7 and 1.8 , are relatively low and suggest that the model adjusted to best accommodate committed development demand, can also largely accommodate further growth to 2026.

1.18 As discussed above, if increased capacity is modelled at the A405/A41 junction, the high delays around Leavesden shown in the AM peak (Figure 1.7) are removed.

FIGURE 1.3 VOLUME/CAPACITY – AM PEAK – BASE + COMMITTED + GROWTH SCENARIO

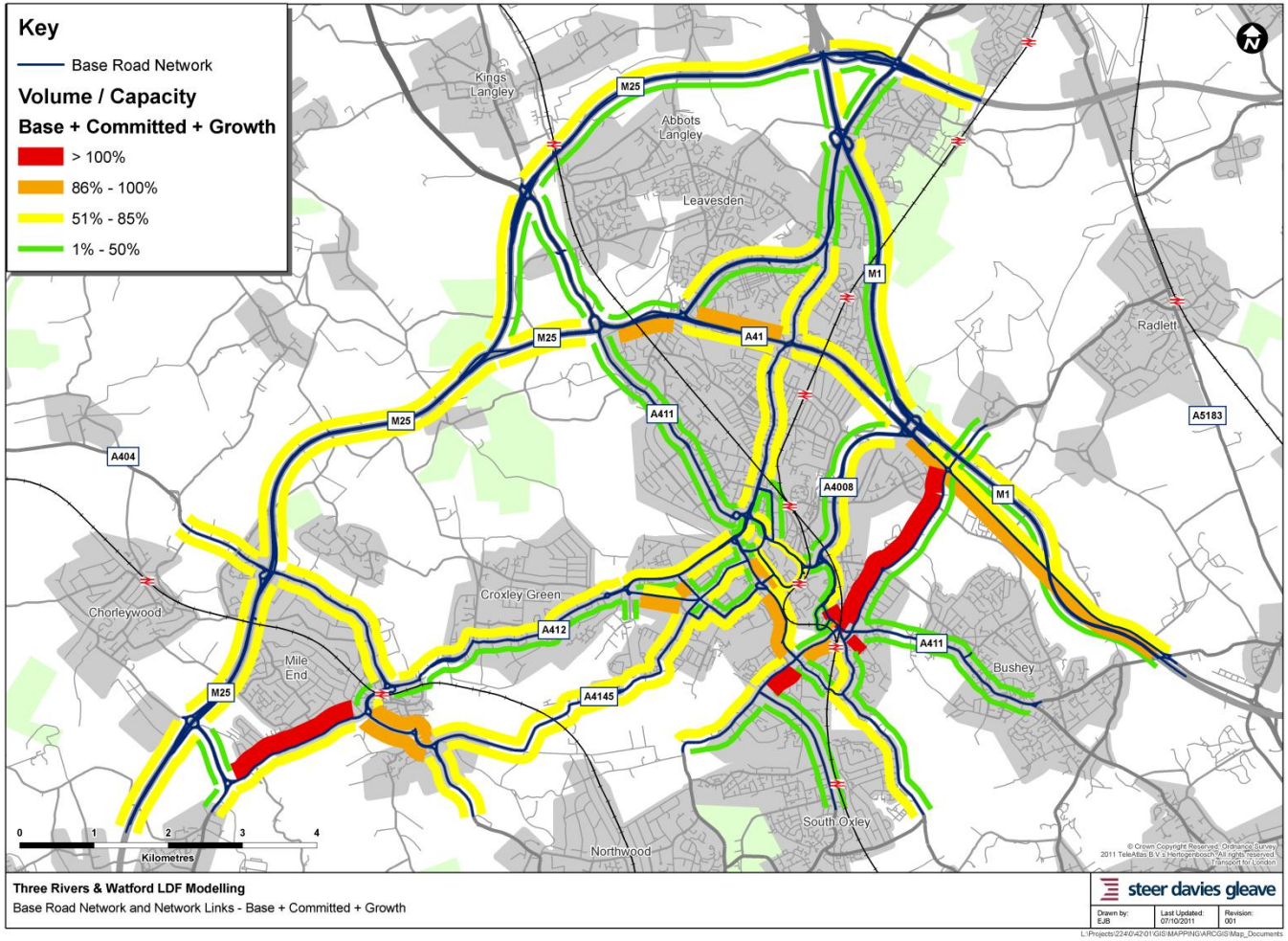


FIGURE 1.4 VOLUME/CAPACITY – PM PEAK – BASE + COMMITTED + GROWTH SCENARIO

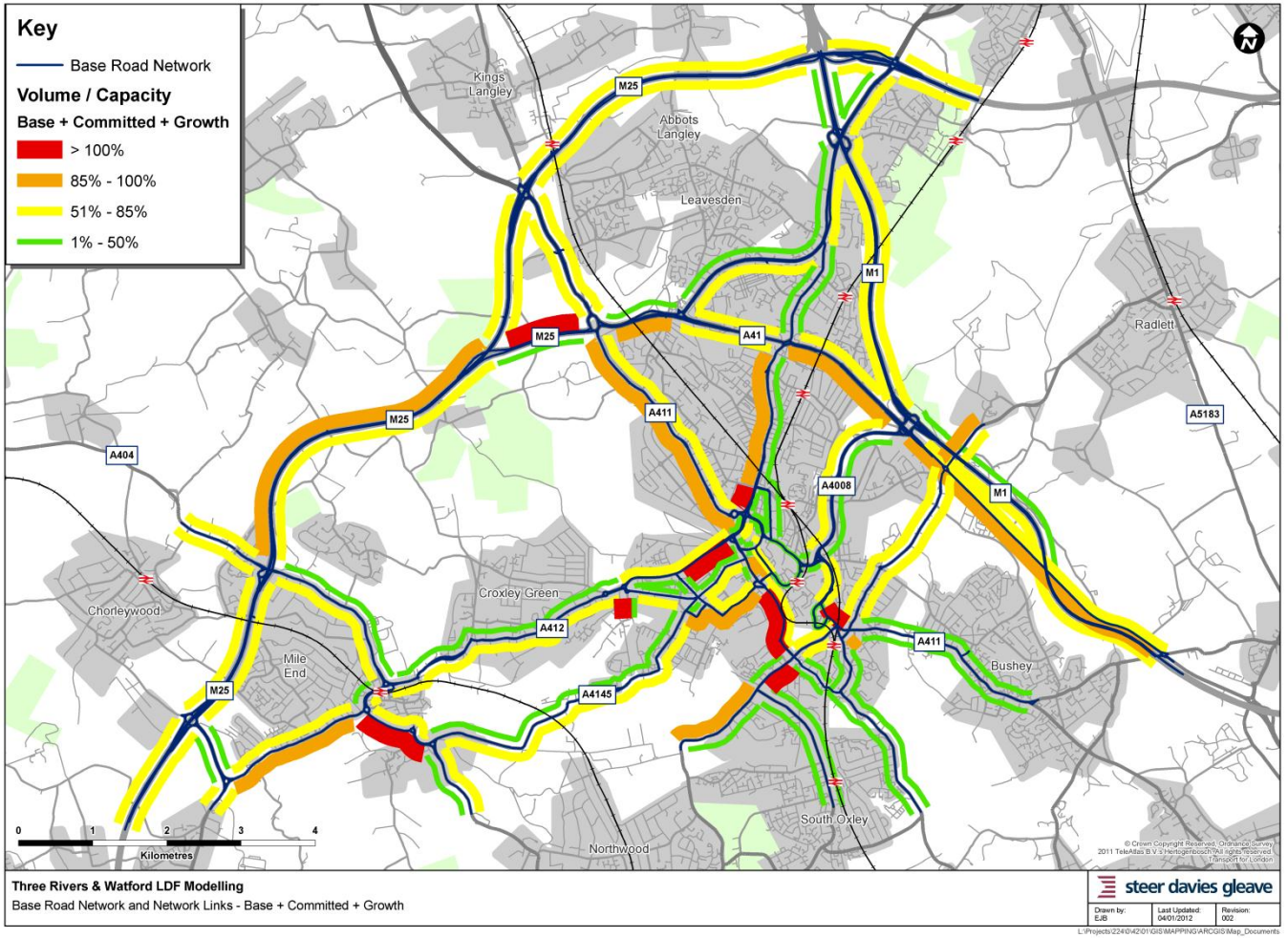


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FIGURE 1.5 DIFFERENCE PLOT – AM PEAK DEMAND FLOWS – IMPACT OF GROWTH TO 2026

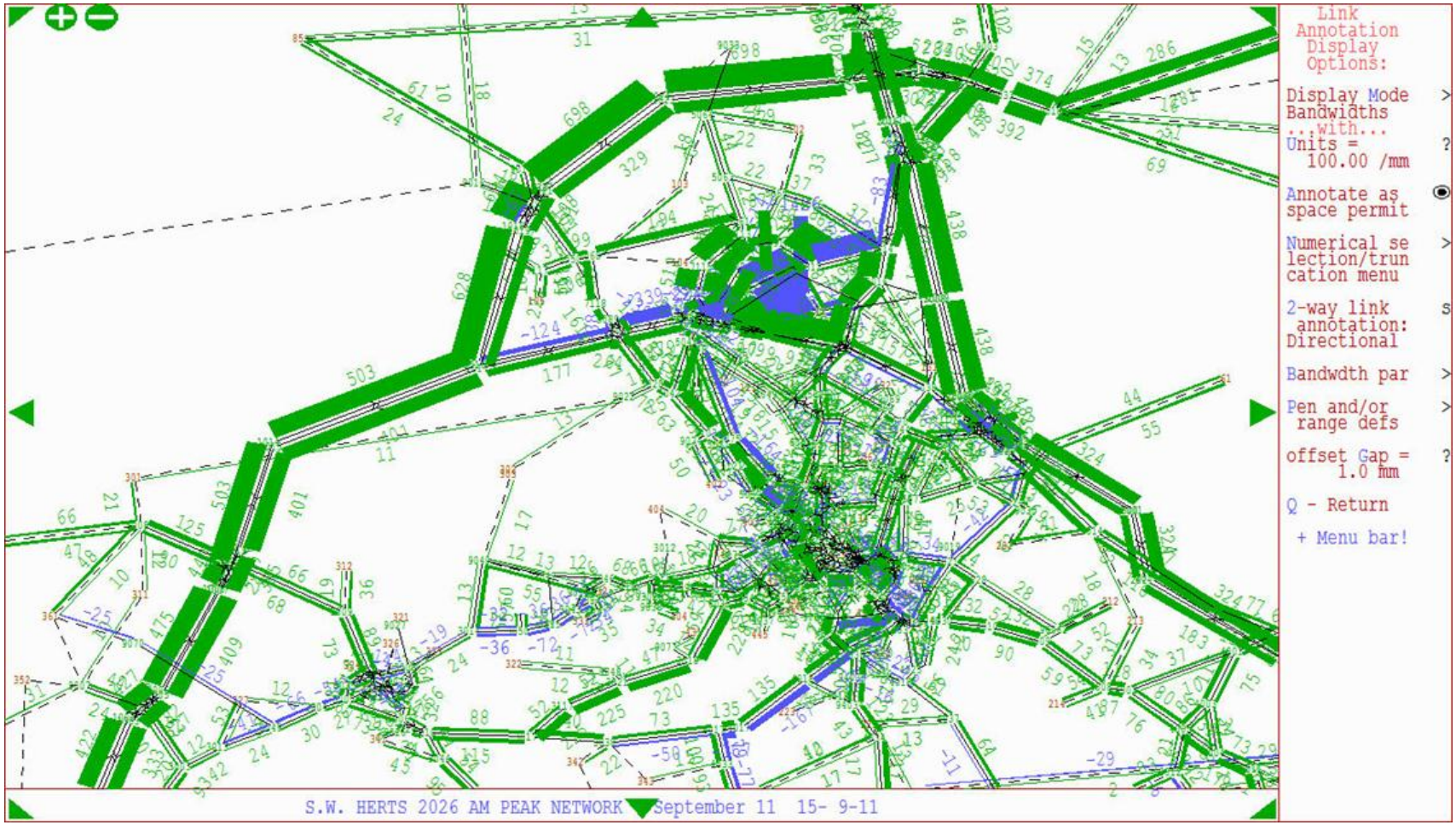


FIGURE 1.6 DIFFERENCE PLOT – PM PEAK DEMAND FLOWS – IMPACT OF GROWTH TO 2026

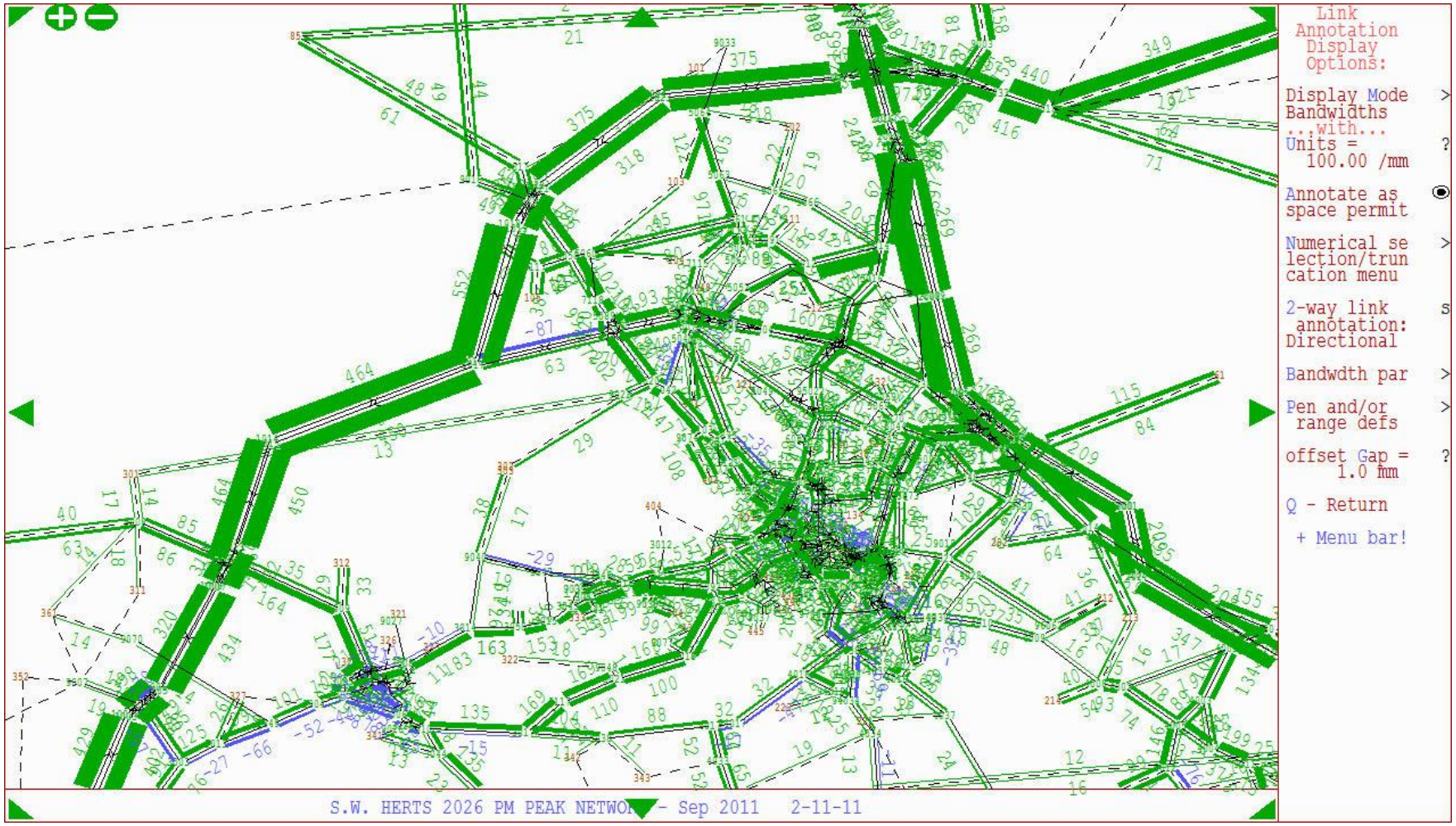


FIGURE 1.7 DIFFERENCE PLOT -AM PEAK DELAY - IMPACT OF GROWTH TO 2026

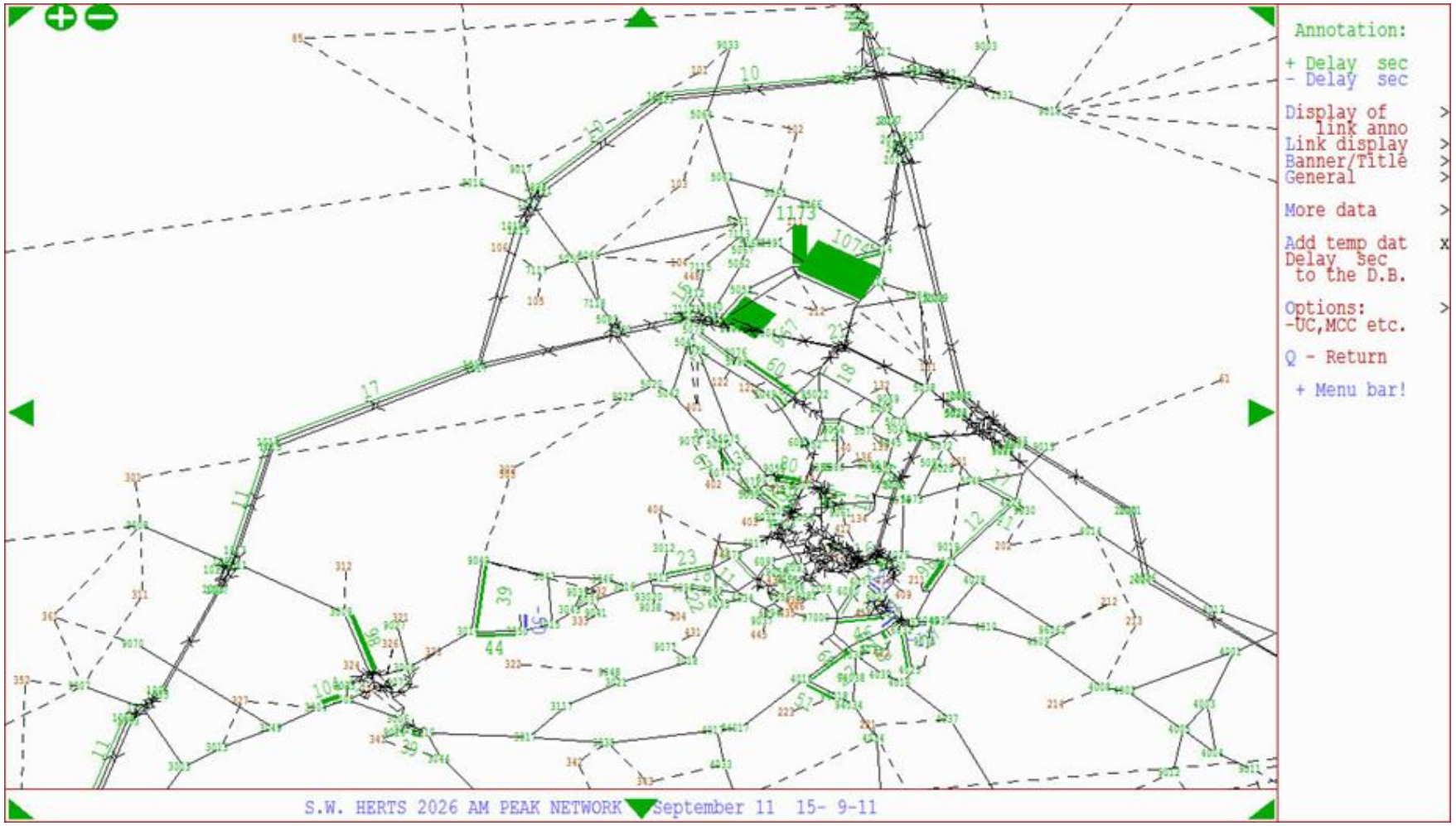
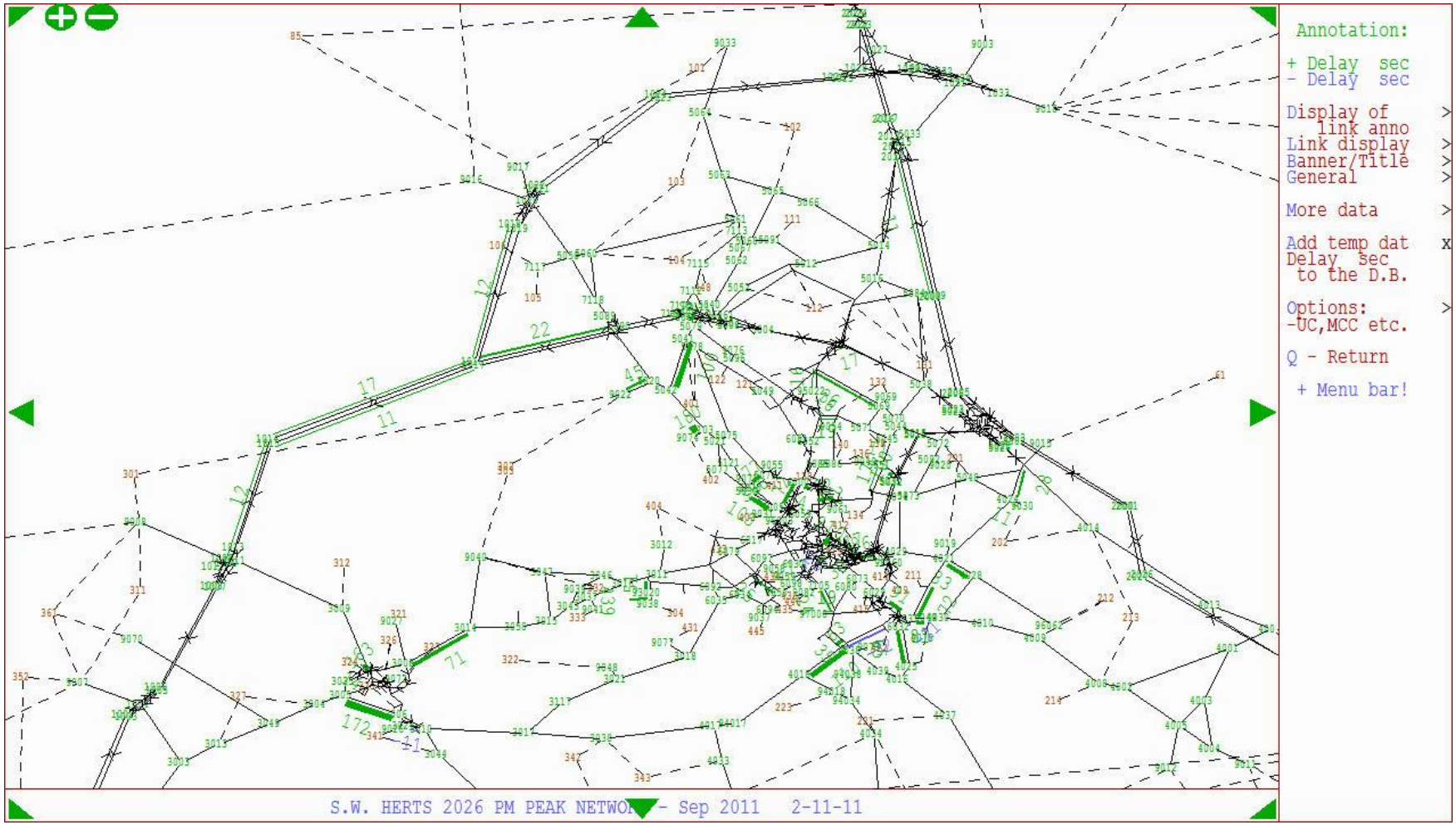


FIGURE 1.8 DIFFERENCE PLOT – PM PEAK DELAY – IMPACT OF GROWTH TO 2026



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Base + Committed + Potential + Growth (LDF Scenario)

1.19 With future growth focussed on those areas identified in the LDF as having potential deliver additional development, we see changes in the distribution of traffic across the network.

1.20 Figure 1.9 shows volume/capacity for the AM peak with future growth largely constrained to LDF sites. PM peak results are shown in Figure 1.10.

1.21 The main highlight in the AM peak results from more detailed modelling of the LDF sites around West Watford. In the PM peak the main benefits predicted from assigning growth to LDF sites is that we forecast less stress on the M25 J18-19 and we also see a change in pressures around the south and west of Rickmansworth and flows just reaching 100% of modelled capacity outbound on Stephensons Way.

1.22 Figure 1.11 shows the impact of focussed growth in the AM peak in terms of differences in flows on links when compared to unconstrained growth (Base + Committed + Growth). The difference plot shows reduction in flow on the M25 and M1 links implying that the growth is more self-contained within the study area when applied to potential allocations. A similar pattern is shown for the PM peak in Figure 1.12.

1.23 The main differences between the two peaks is that we again see significant re-routing around Leavesden in the AM peak, implying that the assignment is very sensitive to changes in journey time in this part of the network. In both peaks, we see increased demand for busy routes between Rickmansworth and Watford, particularly around Watford Business Park, but in the PM peak, where we have more trips associated with the potential sites, the impact is greater and also shown to extend beyond Rickmansworth along the A412 Uxbridge Road to the M25.

1.24 Figure 1.13 shows that the major re-routing around Leavesden in the AM Peak is a result of major delays around Kingsway which, as described earlier, can be addressed through minor increases in modelled capacity at the A405/A41 junction. Changes in delay elsewhere are small in comparison.

1.25 Changes in delay in the PM peak are isolated and relatively small, as shown in Figure 1.14.

1.26 Figures 1.15 and 1.16 also show total delay for the LDF scenario for the AM and PM peaks respectively. To highlight areas of concern, only those areas with delays in excess of 120 seconds are shown. For the AM peak, the delay in Leavesden is highlighted, and although not identified in the comparison of delay against the unconstrained growth scenario, we also see delays above 2 minutes on roads close to Watford Junction Station and on approaches to Rickmansworth.

1.27 In the PM peak delays correspond well with the volume/capacity analysis in that we see significant delay on Ascot Road, as well as delays along, and joining, Hempstead Road, at Eastbury Road/Deacon's Hill and at Bushey Arches.

FIGURE 1.9 VOLUME/CAPACITY – AM PEAK – BASE + COMMITTED + POTENTIAL + GROWTH SCENARIO

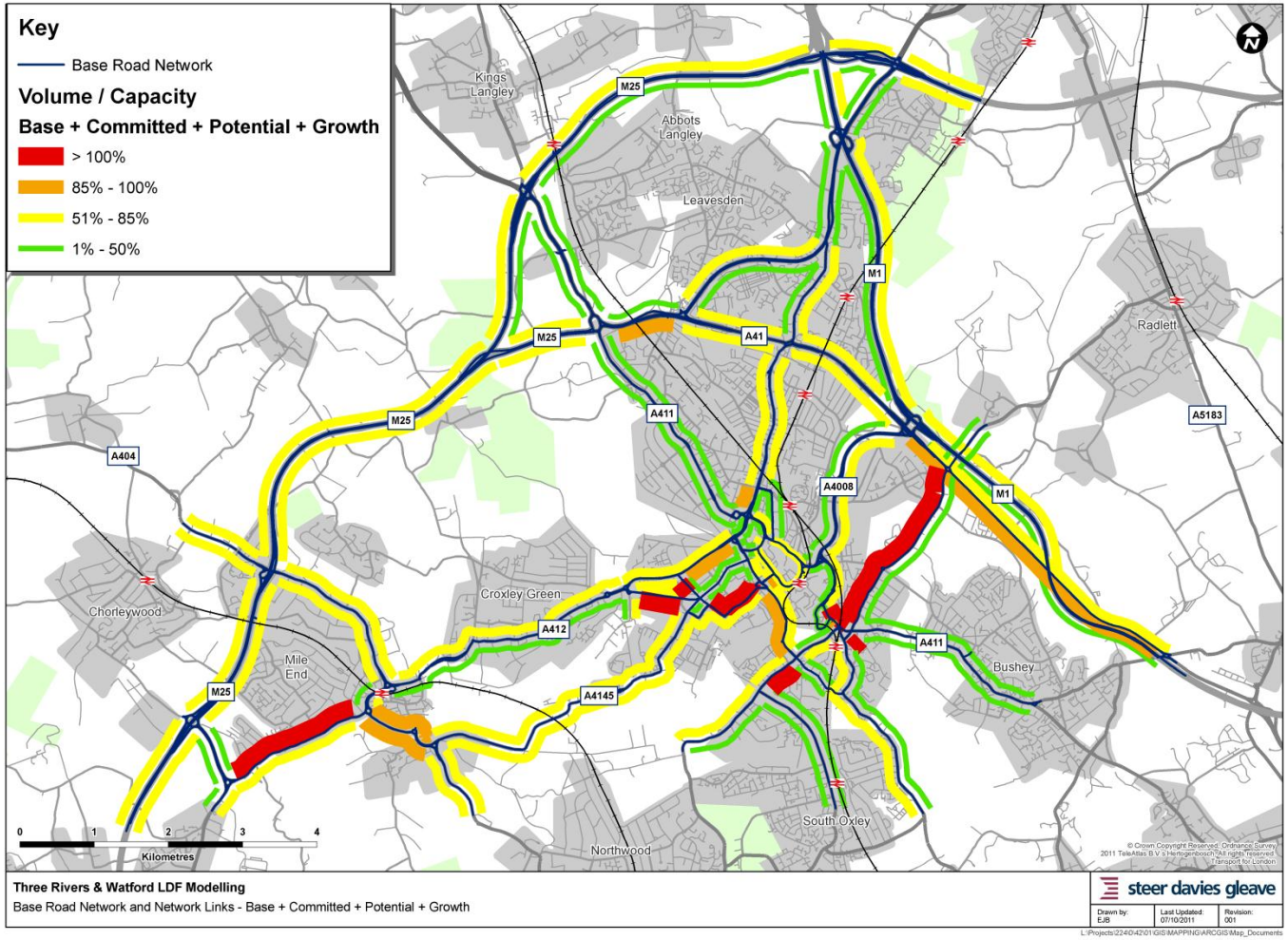

FIGURE 1.10 VOLUME/CAPACITY – PM PEAK – BASE + COMMITTED + POTENTIAL + GROWTH SCENARIO

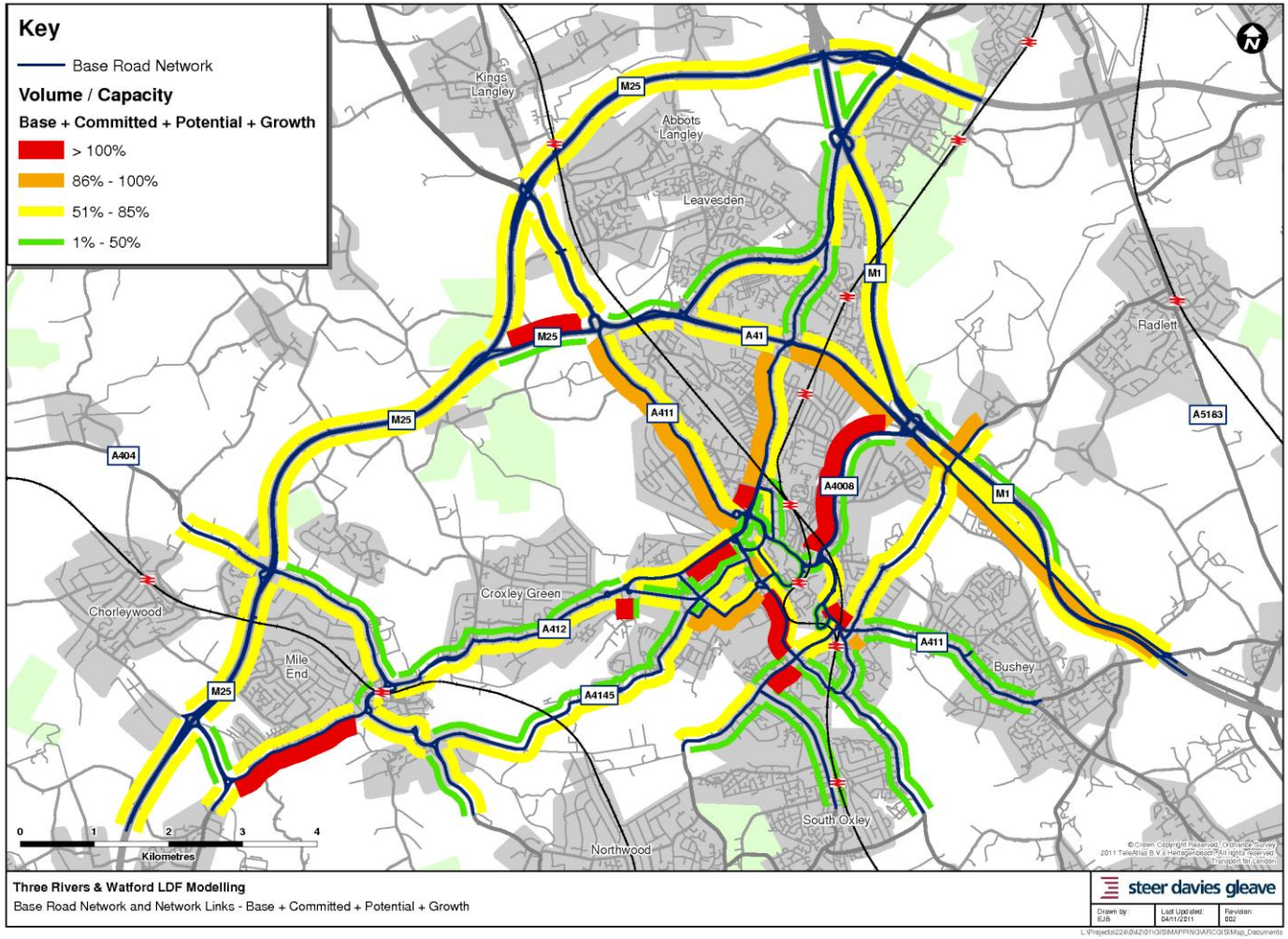

FIGURE 1.11 DIFFERENCE PLOT – AM PEAK DEMAND – IMPACT OF GROWTH FOCUSSED IN POTENTIAL ALLOCATION SITES

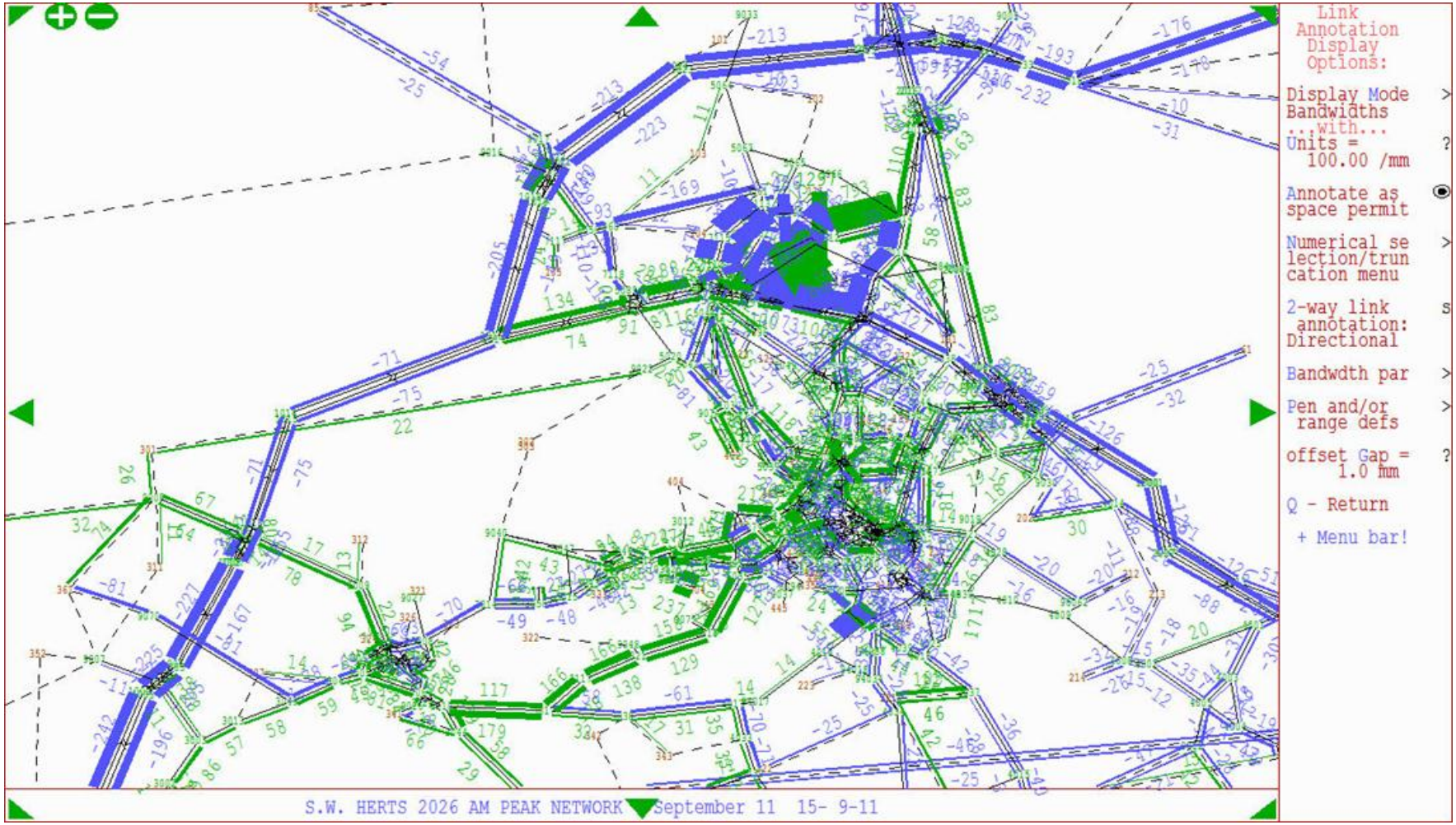

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FIGURE 1.12 DIFFERENCE PLOT – PM PEAK DEMAND – IMPACT OF GROWTH FOCUSSED IN POTENTIAL ALLOCATION SITES

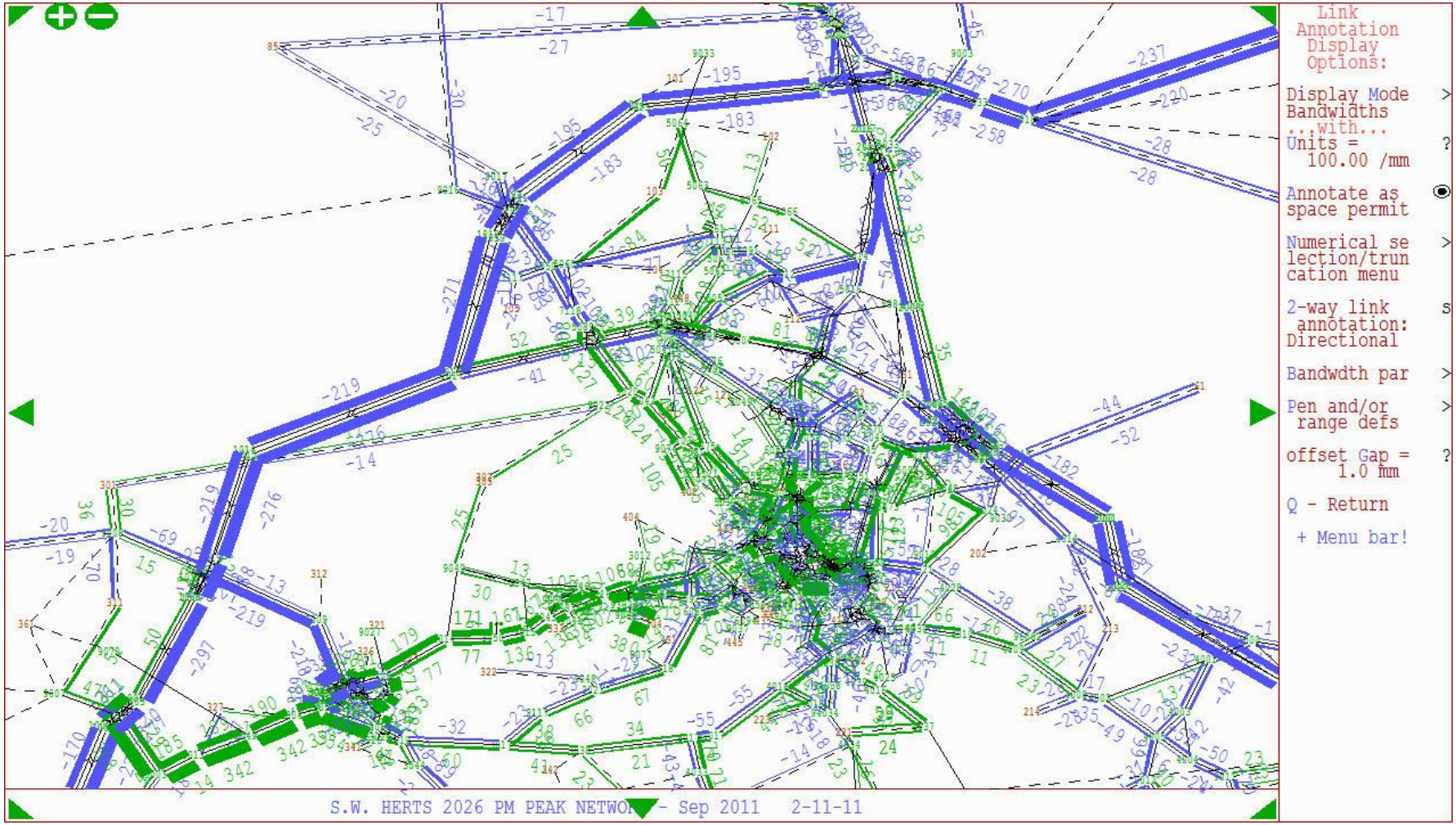

FIGURE 1.13 DIFFERENCE PLOT – AM PEAK DELAY - IMPACT OF GROWTH FOCUSSED IN POTENTIAL ALLOCATION SITES

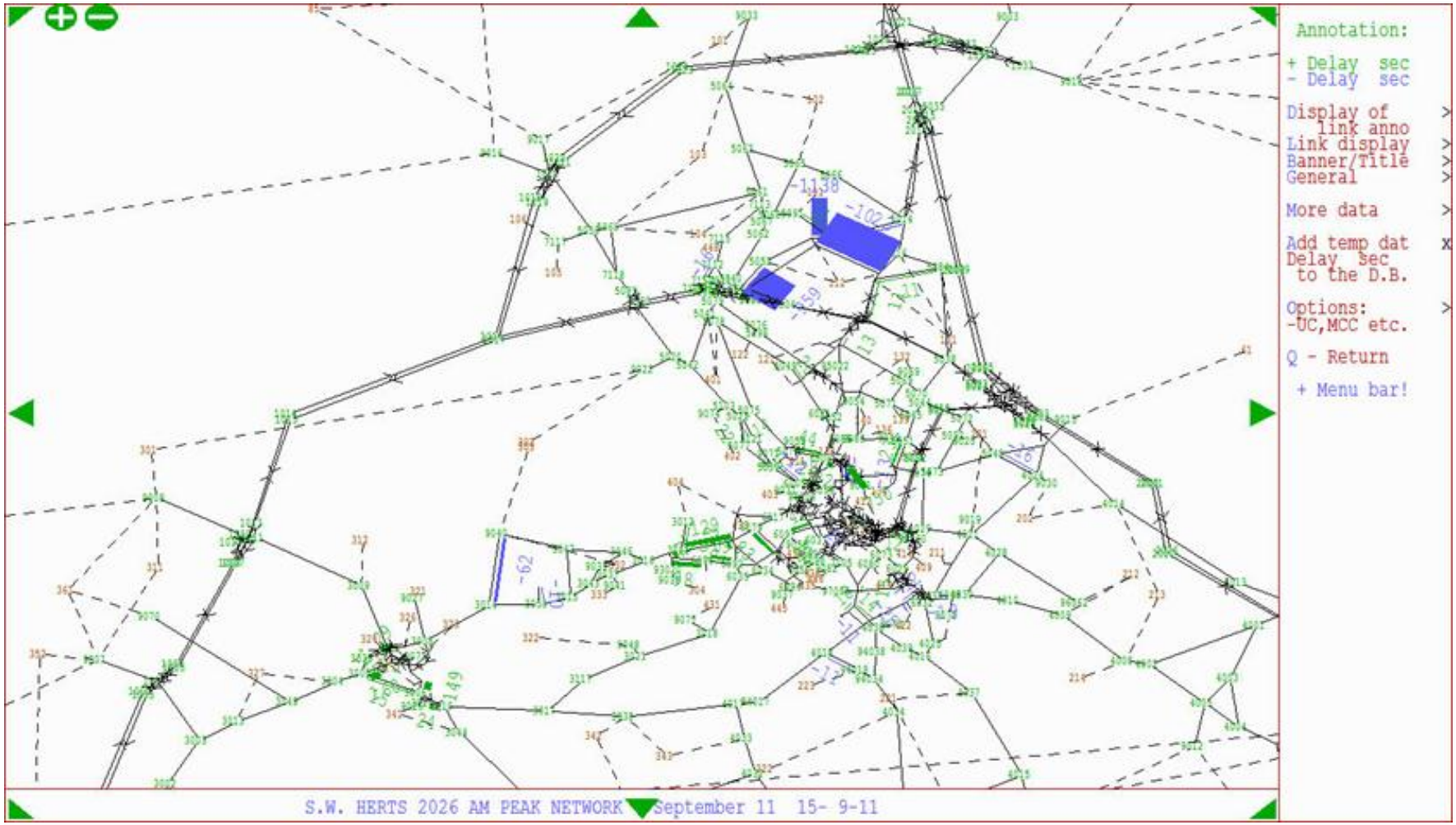

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FIGURE 1.14 DIFFERENCE PLOT – PM PEAK DELAY - IMPACT OF GROWTH FOCUSSED IN POTENTIAL ALLOCATION SITES

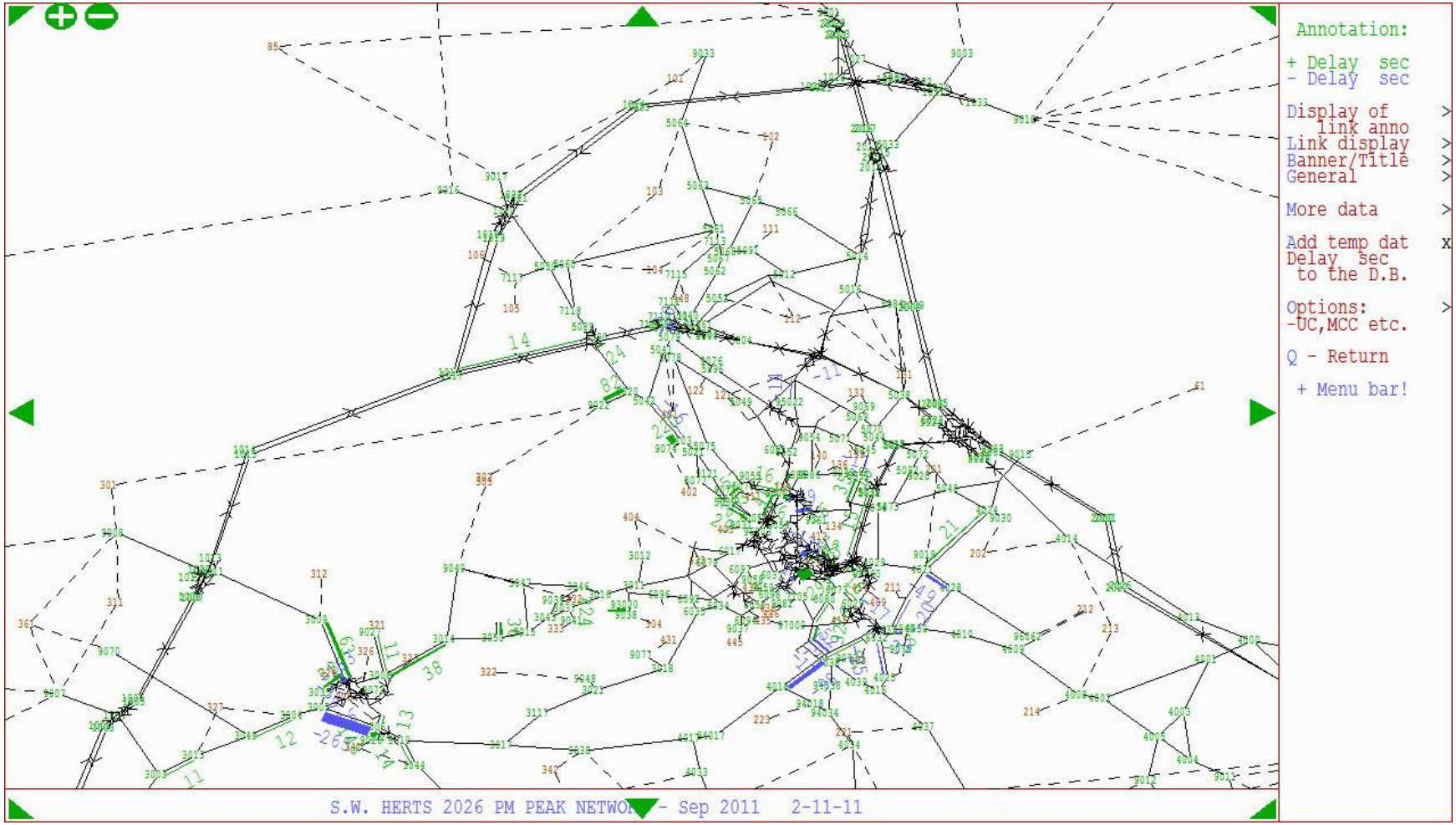

FIGURE 1.15 DELAY (SECONDS) – AM PEAK – LDF SCENARIO

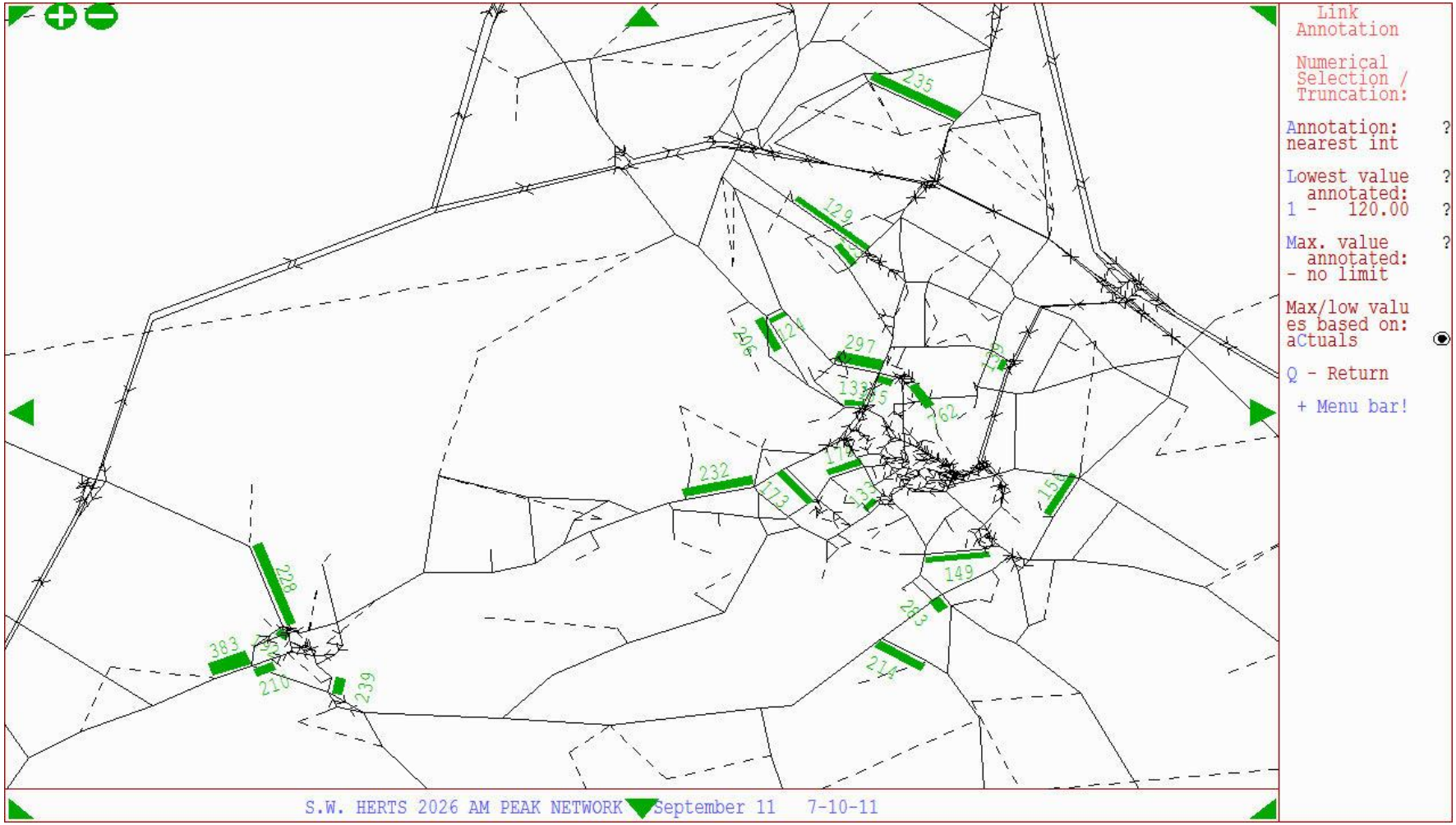

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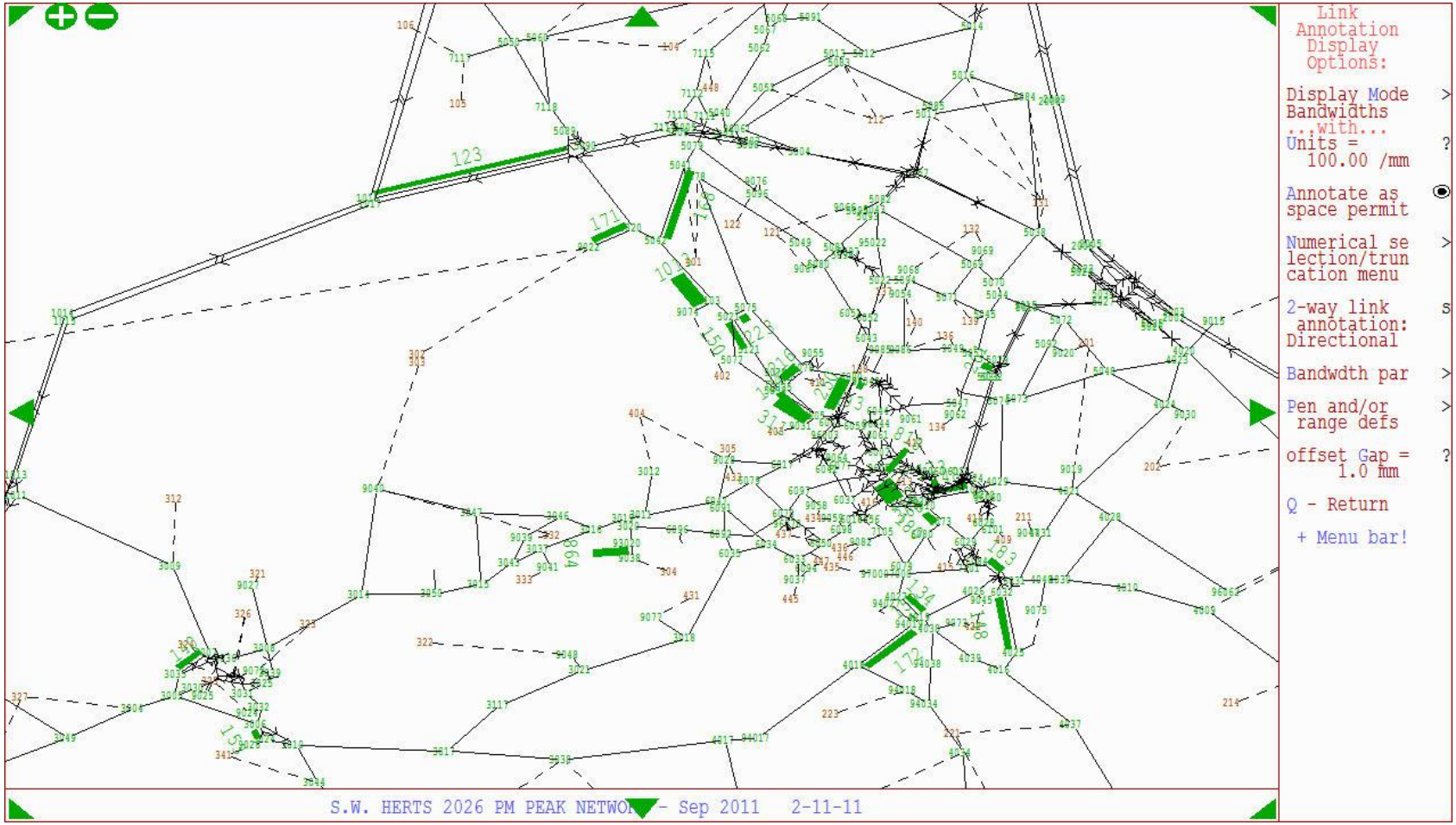
FIGURE 1.16 DELAY (SECONDS) – PM PEAK – LDF SCENARIO



1.28 This analysis above essentially concentrates on differences in traffic patterns between defined and undefined full development scenarios. The following diagrams show differences in link flows between the full LDF scenario, ie with potential sites for future development identified, and the Base+Committed. That is we focus on the impact of levels of growth that could be delivered through the LDF proposals for both Three Rivers and Watford.

1.29 Referring to the volume/capacity plots in Figures 1.9 and 1.10 and comparing to the results in Figures 1.1 and 1.2 we can see that, in the AM peak, pressures associated with the combined LDF proposals are focussed on Watford, with network stress in West Watford and around the Bushey Arches gyratory. In the PM peak we predict changes in stress patterns around south-west Rickmansworth and increased stress at Watford Business Park and outbound on St Albans Road.

1.30 Changes in link demand flows between the two scenarios are shown in Figures 1.17 and 1.18 for the AM and PM respectively.

1.31 For the AM peak, we should compare the output to Figure 1.5. The results are very similar in that we still see re-routing around Leavesden and westbound along Eastbury Road, but we do see smaller increases in flow on the motorway links, particularly the M25. The areas where increases are generally greater is around West Watford.

1.32 Similarly, the PM peak results should be compared to Figure 1.6. Not surprisingly, the majority of links are still green, indicating an increase in flow, but the increases on the M25 and M1 are not as great. The main areas of difference are around West Watford, Hempstead Road and the town centre in general where the bandwidths are wider, showing a greater concentration of development traffic in those areas. There is some PM peak re-routing on exit from Rickmansworth towards the M25, with more traffic using Uxbridge Road rather than Chorleywood Road.

FIGURE 1.17 DIFFERENCE PLOT – AM PEAK DEMAND – IMPACT OF LDF SCENARIO

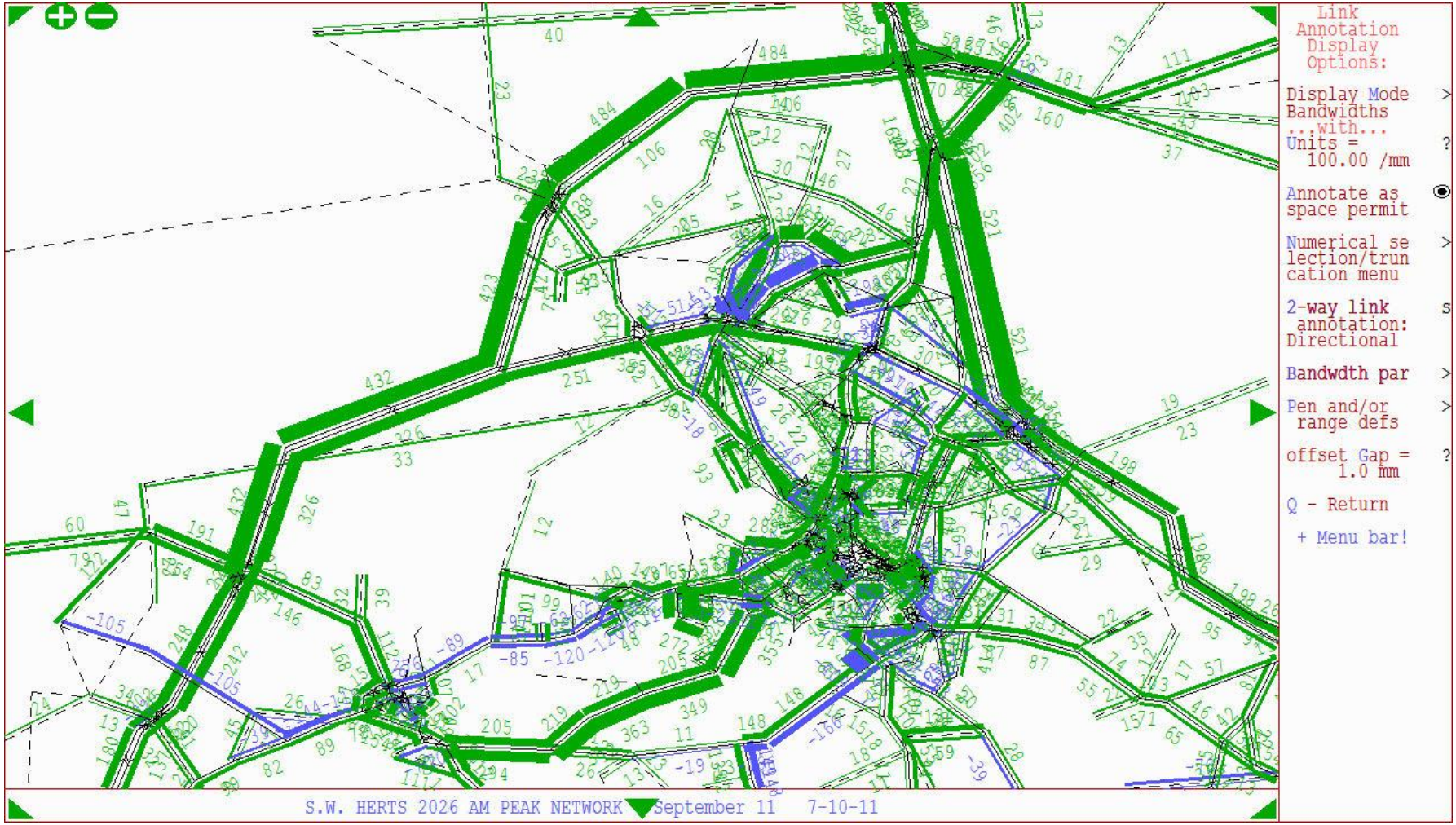
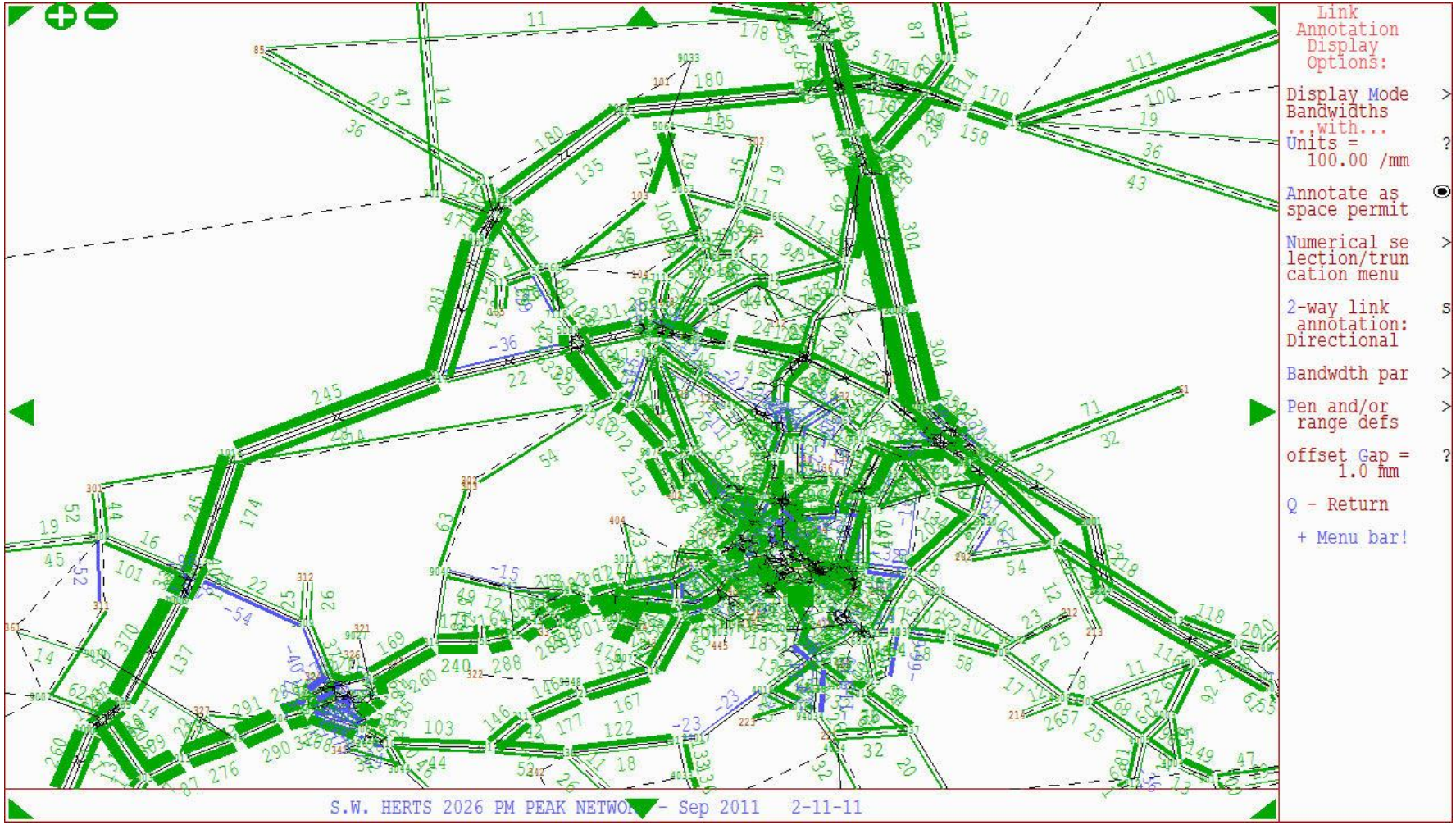


FIGURE 1.18 DIFFERENCE PLOT – PM PEAK DEMAND – IMPACT OF LDF SCENARIO



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Cause of Problems

1.33 We have identified, in the sections above, a series of potential problems with highway capacity in future years. These can be summarised as:

- Eastbury Road/Deacons Hill
- St Albans Road/Station Road
- Bushey Arches
- Ascot Road/Whippendell Road
- Sheepcot Lane/St Albans Road (AM peak)
- A412 Uxbridge Road/A404 Riverside Drive (AM peak)
- Hempstead Road/Courtlands Drive (PM peak)
- Hempstead Road/Langley Road (PM peak)
- M25 Spur towards Hunton Bridge roundabout (PM peak)

1.34 To assess whether potential problems can be associated with particular development scenarios, the following diagrams show the pattern of trips associated with each of the committed and potential development sites.

FIGURE 1.19 COMMITTED DEVELOPMENT TRIPS (USER CLASS 2) - AM PEAK

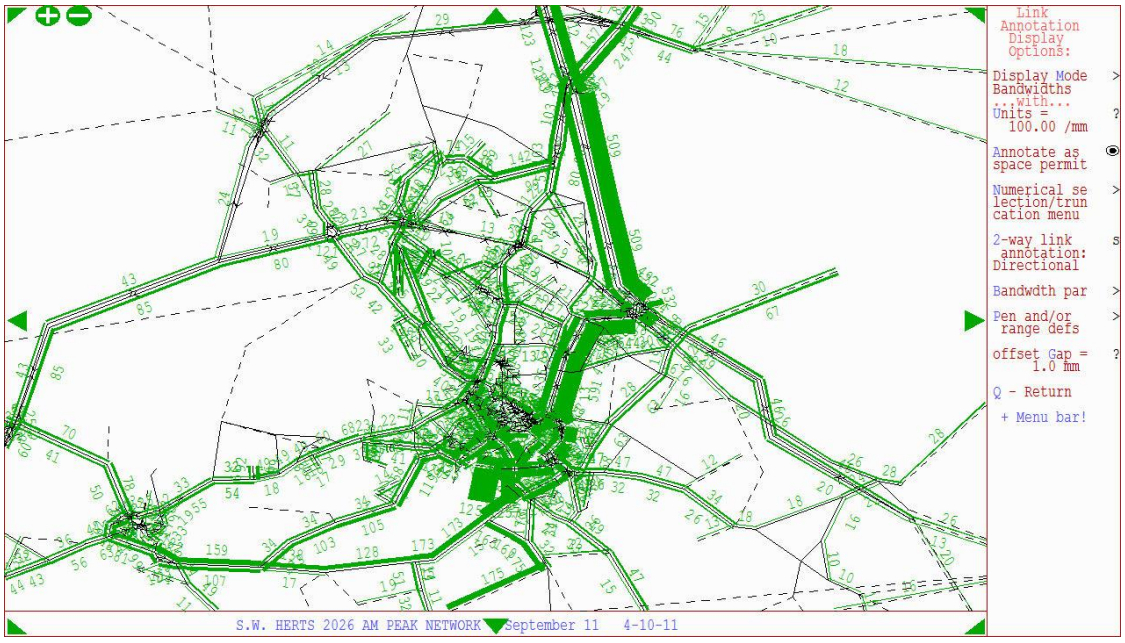
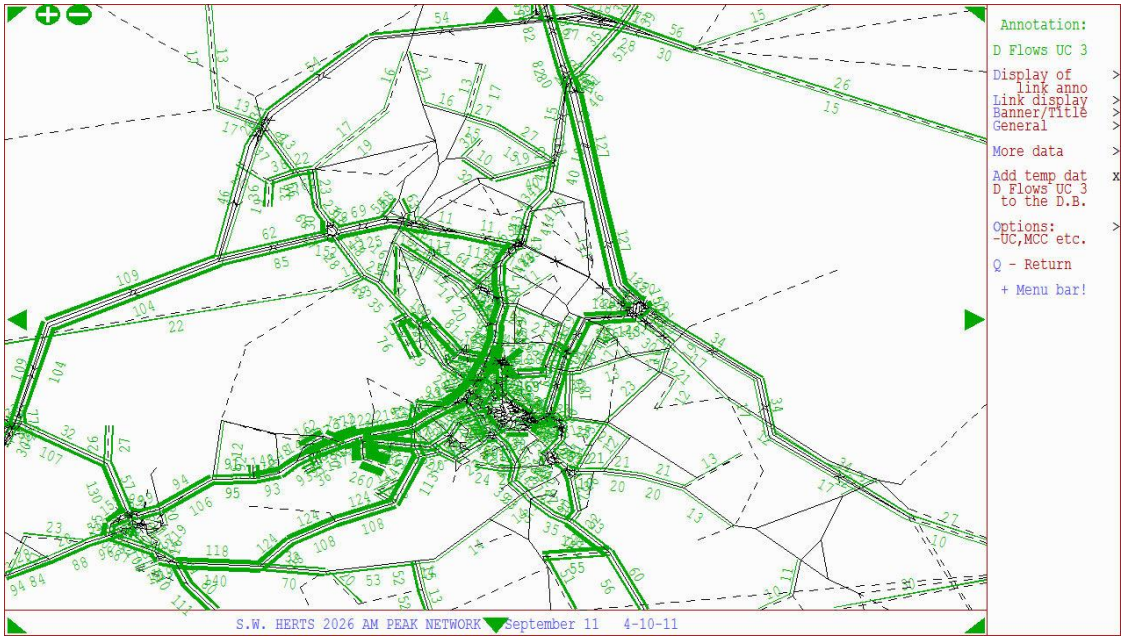


FIGURE 1.20 LDF DEVELOPMENT TRIPS (USER CLASS 3) – AM PEAK



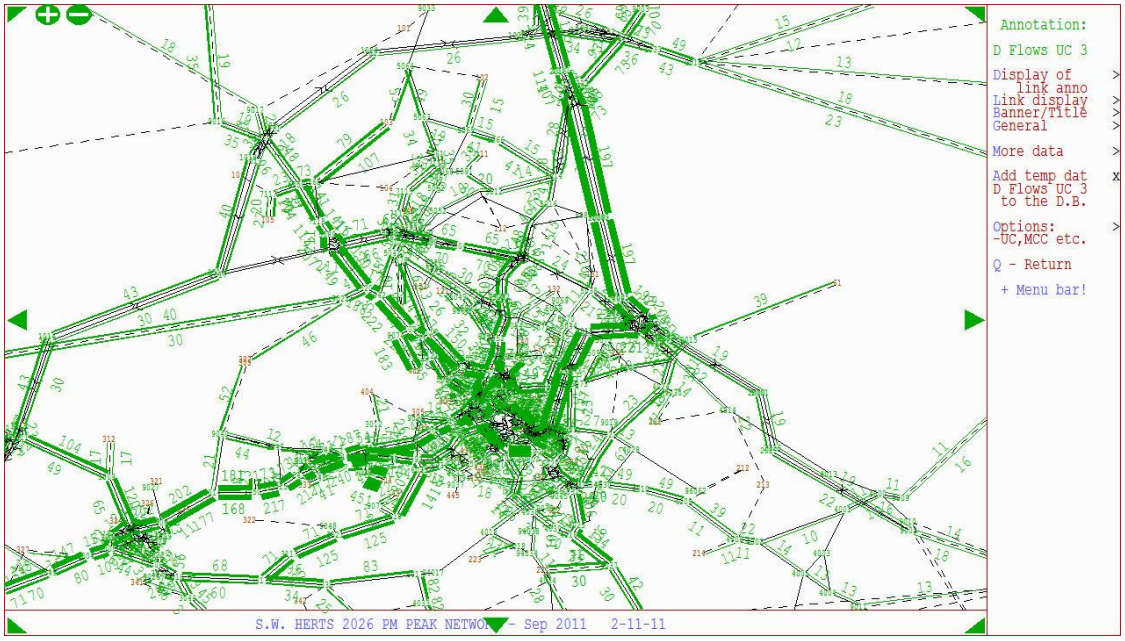
1.35 In Figure 1.19 we see that the greatest increases are towards the Health Campus, with a significant increase in flow from the M1 and along Stephenson Way. These are not routes obviously impacting on the problem areas listed above.

1.36 Figure 1.20 shows the impact of trips associated with potential LDF sites. Here we can link increases in demand to some of the problem areas, seeing significant increases forecast for Ascot Road, Hempstead Road to Langley Road and through the St Albans Road/Station Road junction.

1.37 The impact of committed development trips in the PM peak is very similar to Figure 1.19. However, Figure 1.21 shows the impact of LDF sites and we see greater increases along Hempstead Road, which are likely to be a cause of the problems at Courtlands Drive and Hunton Bridge.

1.38 The other problem areas of Eastbury Road/Deacons Hill, Bushey Arches and the western side of Rickmansworth are all areas of existing congestions, expected to worsen with growth to 2026.

FIGURE 1.21 LDF DEVELOPMENT TRIPS (USER CLASS 3) – PM PEAK



Strategic Highway Routes

1.39 Tables 1.1 and 1.2 below show the change in flow on the motorway network between each model scenario.

TABLE 1.2 STRATEGIC NETWORK – MOTORWAY LINKS – DEMAND FLOW

Motorway Links		AM Peak				PM Peak			
		Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25	s of J17	9571	9625	10380	9943	9822	9719	10551	10110
	17-18	10367	10154	11038	10644	10168	10332	11087	10840
	18-19	10751	10887	11791	11646	11073	11316	12230	11735
	19 spur	2766	2806	2859	3067	1640	1373	1349	1359
	19-20	7985	8081	8933	8577	9434	9943	10881	10375
	20-21	8317	8064	9091	8654	9094	9265	9959	9581
	e of J21	9484	9575	10341	9916	9848	9942	10799	10271
M1	n of M25	8935	9681	10501	10222	9556	9785	10594	10335
	M25-J6	5862	6312	6741	6658	5381	5608	6054	5977
	6-5	8294	8827	4087	9670	8742	9201	9973	9867
	s of 5	6203	6194	6701	6487	6617	6735	7291	6877

TABLE 1.3 STRATEGIC NETWORK – MOTORWAY JUNCTIONS – DEMAND FLOW

Motorway Junctions		AM Peak				PM Peak			
		Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25	J17	11193	11048	11942	11537	11079	11151	11972	11871
	J18	12510	11755	13713	13557	12420	12642	13662	13148
	J19	10751	10887	11791	11646	11073	11316	12230	11734
	J20	9909	9597	10657	10238	11662	12379	13454	12903
	M25/M1	14808	15358	16775	16331	15345	15776	16952	16478
M1	J6	10431	11272	12228	12205	11099	11833	12868	12687
	J5	10688	11039	11943	11765	11161	11643	12601	12298

1.40 In both peaks, we see only modest changes in flow on the M25 between the base scenario and 'Base+Committed' although greater increases are predicted for the M1, north of Junction 5.

1.41 Adding unconstrained growth, we see increases in flows through junctions of between 7% and 17% in the morning peak, the greatest increases being through Junction 6 of the M1. With growth constrained to LDF sites, we generally see a 2-3% reduction in the increased demand through each junction, except M1 J6 where the increase remains 17% above the base.

1.42 In the PM peak we see a similar picture where again M1 J6 sees the greatest increase in through demand at 16% in the unconstrained scenario, with the remaining junctions seeing increases of between 8% and 15%. Again, under the LDF scenario we see general reductions of up to 4% over the unconstrained growth scenario.

1.43 A more detailed breakdown of changes in flow at motorway junctions is provided in Appendix A. For each scenario, flows on each approach to the junction are provided, giving an indication of which movements are most impacted by each different growth scenario.

1.44 In all cases it should be noted that while the motorway network is included in the highway model, these routes form the edges of the model and are not modelled in the same level of detail as the more central parts of the model area and the impacts of queues and delay are not modelled in detail. We therefore have less confidence in the flows quoted for these outer 'buffer' parts of the model and recommend that it is the absolute changes in flow that should be considered, rather than the actual flows quoted.

1.45 As such, while the Watford SATURN model is able to provide forecasts of changes in flow at motorway junctions associated with committed and proposed development sites to 2026, it is recommended that these absolute changes in flow are in turn reflected in more specific models of the strategic network, such as the M25 Assignment Model, before any significant conclusions can be drawn.

Public Transport Supply

1.46 Development related trips generally spread across the network, and main radial routes into and out of the town, particularly from the north and west, are well served by existing bus services, linking Watford and Rickmansworth to surrounding towns. A summary of peak hour services along each key radial is provided below in Table 1.4.

1.47 Although not shown in Table 1.4, there are also approximately 4 buses per hour linking Watford Business Park to the town centre (Service W30) and Watford Junction. There is scope for this service to help accommodate some of the extra demand to the business park as it expands. However, the current service routes via Watford Metropolitan station and there might be merit in instead routing the service along Rickmansworth Road to offer improved journey times, particularly if the Croxley Rail Link proposals are delivered, which will result in closure of the station on the Metropolitan Line.

1.48 It is also worth noting that the Croxley Rail Link proposals themselves introduce new stations at both Ascot Road and at the Health Campus, which will provide additional public transport options to each of these key employment destinations.

1.49 Similarly, it can be implied that these model results represent a worst case given that no account is made of expected reductions in flow on local highways as a result of the Croxley Rail Link (CRL) scheme nor Abbey Line improvements. It is worth noting that for CRL alone, the supportin Transport Assessment indicates a predicted reduction of some 287 peak hour trips from the network following introduction of the scheme as drivers change mode from the car to rail. These reductions in flow offer moderate improvement in future year operational conditions at both the Rickmansworth Road/Ascot Road and Ascot Road/Whippendell Road junctions.

TABLE 1.4 EXISTING BUS ROUTE SUMMARY – KEY RADIALS

Corridor	Service No	Frequency
Hempstead Road	318	2 per hour
	500	Up to 4 per hour (directional)
	550	2 per hour
	T2	2 per hour
St Albans Road	1	2 per hour
	320	2 per hour
	321	Approx 3 per hour
	621	Hourly
	724 (Limited Stop)	Hourly
London Road	142	4 per hour
	258	4 per hour
Eastbury Road	2	2 per hour
	8	2 per hour
Rickmansworth Road, west of Ascot Road	320	2 per hour
	321	Approx 3 per hour
	336	Hourly
	352	Hourly
	724 Limited Stop)	Hourly
Uxbridge Road, west of Rickmansworth	320	2 per hour
	321	Approx 3 per hour
	724 (Limited Stop)	Hourly
	R21	Hourly
Chorley Wood Road, west of Rickmansworth	336	Hourly

Potential solutions

1.50 As outlined in Technical Note 2, the 2026 network includes committed proposals for the Health Campus Link and Colonial Way Extension. In addition, minor improvements were also identified to help accommodate additional demand associated with committed development. These include optimisation of traffic signals at a number of junctions, physical changes to the network at junctions along Hempstead Road and additional capacity at the A412/A404 roundabout to the west of Rickmansworth Town Centre. These additional improvement are all minor scale and relatively low cost.

1.51 Beyond these improvements initially identified, assessment of increased growth to 2026 has shown additional areas of network stress we might expect as either the LDF scenario, or the unconstrained growth scenario, is delivered. Mitigating future growth will likely be achieved through a combination of highway improvements and increased opportunity for public transport use.

1.52 Taking public transport first, future developments should each have targets set out to ensure levels of public transport use, either through better promotion, subsidised ticket prices or improvements to specific services. However, two of the main attractors in future years will be Watford Business Park and the Health Campus. There is scope for the route between the business park and the town centre to help accommodate some of this extra demand as the business park expands. There might also be scope to re-route the service to provide a more direct link along Rickmansworth Road, particularly if the Croxley Rail Link proposals are delivered, which will result in closure of the station on the Metropolitan Line. Consideration might also be given to providing a similar route between the business park and Rickmansworth.

1.53 It is also worth noting that the Croxley Rail Link proposals themselves introduce new stations at both Ascot Road and at the Health Campus, which will provide additional public transport options to each of these key employment destinations.

1.54 For highways, there are a number of areas, such as Bushey Arches and at the Eastbury Road/Deacons Hill and St Albans Road/Station Road junctions, where land constraints make it very costly to introduce additional physical capacity.

1.55 At Eastbury Road/Deacons Hill, it seems feasible to segregate left turning traffic out of Deacons Hill into a new lane, but any further widening or increase in capacity would require land –take, and possible demolition of properties. It is assumed that all movements should be retained.

1.56 At St Albans Road/Station Road, the most likely improvement might be to accommodate two full northbound lanes out of the junction, allowing outbound traffic to pass through the junction in both lanes. A review of parking on the northbound exit to the junction should also be considered.

1.57 Many studies of the Bushey Arches gyratory have been undertaken. Capacity is essentially constrained by the railway arches and any physical improvement, through widening the arches would be costly.

1.58 Capacity of the M25 spur approach to the Hunton Bridge roundabout could be achieved through widening the approach and circulatory capacity and/or signalisation of this approach, similar to the signalisation from the North Western Avenue approach.

1.59 Increased capacity can likely be provided at the St Albans Road/ Sheepcot Lane junction through further signal optimisation.

Conclusions

1.60 This Technical Note looks specifically at growth to 2026, constrained by Tempro, under two scenarios:

- Base + Committed Development + Background Growth to 2026
- Base + Committed and Potential Developments + Background Growth to 2026 (LDF Scenario)

1.61 With 'Base+Committed+Growth', there is little control over where the growth occurs. The majority of routes show an increase in flow with the additional demand and the majority of the increase is shown on the motorways which, given growth is relatively unconstrained and that the strategic network is most heavily trafficked, is not a surprise.

1.62 Perhaps more interestingly, the changes in delay on the network are relatively low and suggest that the model adjusted to best accommodate committed development demand, can also largely accommodate further growth to 2026.

1.63 With future growth focussed on those areas identified in the LDF as having potential deliver additional development, we see changes in the distribution of traffic across the network. In both peaks there is a reduction in flow on the M25 and M1 links implying that the growth is more self-contained within the study area when applied to potential allocations. We see increased demand for busy routes between Rickmansworth and Watford, but in the PM peak, where we have more trips associated with the potential sites, the impact is greater and also shown to extend beyond Rickmansworth along the A412 Uxbridge Road to the M25

1.64 Comparing the LDF scenario against 'base+committed' only, we see pressures, in the AM peak, focussed on Watford, with network stress in West Watford and around the Bushey Arches gyratory. In the PM peak we predict changes in stress patterns around south-west Rickmansworth and increased stress at Watford Business Park and outbound on St Albans Road.

1.65 When trips associated with potential LDF sites are assessed independently, we can link increases in demand to some of the problem areas identified, seeing significant increases forecast for Ascot Road, Hempstead Road (as far as Langley Road) and through the St Albans Road/Station Road junction in the AM peak. In the PM peak we also forecast greater increases along Hempstead Road, which are likely to be a cause of the problems at Courtlands Drive and Hunton Bridge.

1.66 The other problem areas of Eastbury Road/Deacons Hill, Bushey Arches and the western side of Rickmansworth are all areas of existing congestions, expected to worsen with growth to 2026.

1.67 Unconstrained growth to 2026 is predicted to add between 7-17% traffic to the motorway junctions within the study area, with M1 Junction 6 seeing the greatest increase. With growth constrained to LDF sites, we generally see a 2-3% reduction in the AM peak, and up to 4% in the PM peak.

1.68 However, it should be noted that while the motorway network is included in the highway model, these routes are not modelled in the same level of detail as the more central parts of the model area and queues and delay are not validated. We therefore have less confidence in the flows quoted for these outer 'buffer' parts of the model and recommend that it is the absolute changes in flow that should be considered, rather than the actual flows quoted.

1.69 Development related trips generally spread across the network, and main radial routes into and out of the town, particularly from the north and west, are well served by existing bus services, linking Watford and Rickmansworth to surrounding towns. Also, the Croxley Rail Link proposals introduce new rail stations at both Ascot Road and at the Health Campus, which will provide additional public transport options to each of these key employment destinations.

1.70 Similarly, it can be implied that these model results represent a worst case given that no account is made of expected reductions in flow on local highways as a result of the Croxley Rail Link (CRL) scheme nor Abbey Line improvements.

1.71 Growth in traffic on the network to 2026 will both add to pressures at locations where congestion is already a cause for concern, and introduce new concerns. The following table brings together the various proposals put forward, both to accommodate traffic associated with committed development proposals and beyond. For each solution, a scale of costs is also provided, although this must at this stage be taken as an indication only. Further detailed design and consideration of land costs would be needed to validate these costs.

TABLE 1.5 POTENTIAL FUTURE YEAR MITIGATION SUMMARY

Definition	Description	Funding / Cost
Major Schemes		
Health Campus Link	New link from development to Dalton Way via Wiggenhall Road	Developer led
Colonial Way Link	Extension of Colonial Way to St Albans Rd	Funding bid
Croxley Rail Link	New rail link from Croxley to Watford Junction Station, inc new stations at Ascot Rd and Health Campus	Funding bid
Committed Developments		
Signal optimisation	Clarendon Road/ St Johns Road Hempstead Road/ Langley Way Exchange Road/ Market Street	Low cost
Capacity improvement	Increased circulatory capacity A412/A404 roundabout	<£1m

	RT lanes into/out of Glen Way and Grove Mill La at junctions with Hempstead Road	<£0.25
Additional Mitigation		
Bus re-routing	Re-route W30 service along Rickmnasworth Rd rather than via Watford Met Station	Low cost
New bus services	New service between Watford Business Park and Rickmansworth	<£1m (subsidy?)
Signal optimisation	St Albans Road/ Sheepcot Lane	Low cost
Capacity improvement	M25 spur approach to Hunton Bridge rbt – widening approach/circulation or signalisation	~£1m
	Eastbury Road/ Deacons Hill – possible LT lane from Deacons Hill or major land-take	<£1m up to £5m+
	St Albans Rd/ Station Rd – possible 2-lanes northbound out of junction & review of parking	<£1m
	Bushey Arches – major scheme?	£10m+

Filenames

- AM Peak
  - Networks: AM26NET_COM_GROWTH.net & AM26NET_COM_POT_GROWTH.net
  - Matrices: AM_base+committed+growth.ufm & AM_base+com+pot+growth.ufm
- PM Peak
  - Networks: PM26NET_COM_GROWTH2b.net & PM26NET_COM_POT_GROWTH2b.net
  - Matrices: PM_base+committed+growth.ufm & PM_base+com+pot+growth.ufm

APPENDIX

A

MOTORWAY JUNCTIONS

A1 MOTORWAY JUNCTIONS

Model Flows

A1.1 There follows a series of tables showing flows through each motorway junction, in terms of in and out flow on each approach, for each model scenario.

A1.2 The caveats in relation to the reliability of flows in the outer 'buffer' parts of the network are noted in paragraph 1.42 of the main note, and it is recommend that it is the changes in flow that should be considered, rather than the actual flows quoted.

A1.3 Flows are provided for the following Junctions:

- M25 Junctions 17 to M25
- M1 Junction 5 and 6

M25 Junction 17

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25 J17	M25 (south)	IN	5461	5475	5897	5656	5093	4973	5402	5232
		OUT	4110	4150	4483	4287	4729	4746	5149	4878
	Long Lane	IN	430	272	315	306	168	171	185	233
		OUT	371	256	280	269	243	254	273	263
	M25 (north)	IN	4756	4695	5104	4937	4820	4894	5329	5032
		OUT	5611	5459	5934	5707	5348	5438	5758	5808
	Denham Way	IN	546	606	626	638	998	1113	1056	1374
		OUT	1100	1183	1245	1273	757	712	792	921
	TOTAL	IN	11193	11048	11942	11537	11079	11151	11972	11871
		OUT	11192	11048	11942	11536	11077	11150	11972	11870

A1.4 Total flows through the M25 Junction 17 are only marginally affected by the addition of committed development trips, in fact re-routing in the model results in a slight decrease in the AM peak. With both unconstrained growth and the LDF scenario (Base+Com+Pot+Gr), junction flows are increased, with growth constrained to LDF sites having less effect in the PM peak.

A1.5 The LDF scenario shows significant impact on Denham Way in the PM peak, with two-way flows increasing by 31% over the 'Base+Committed'. The corresponding increase in the Am peak is 16%.

M25 Junction 18

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25 J18	M25 (south)	IN	5611	5459	5934	5707	5348	5438	5758	5808
		OUT	4756	4695	5104	4937	4820	4894	5329	5032
	A404	IN	975	1169	1293	1360	941	981	1066	997
	Rickmansworth Rd	OUT	953	1101	1191	1254	876	919	1004	1019
	M25 (north)	IN	4942	5029	5430	5356	5110	5253	5703	5427
		OUT	5809	5858	6361	6290	5963	6063	6527	6308
	A404 Chorleywood	IN	982	988	1056	1134	1021	970	1135	916
	Rd	OUT	992	992	1058	1075	762	767	801	789
	TOTAL	IN	12510	12645	13713	13557	12420	12642	13662	13148
		OUT	12510	12646	13714	13556	12421	12643	13661	13148

A1.6 At Junction 18, we see a very consistent pattern between scenarios for each of the AM and PM peaks. Flows on all approaches are reduced between the unconstrained and LDF scenarios in the PM peak. In the AM peak, the LDF scenario shows reduced M25 flows, but increases in side road demand.

M25 Junction 19 (M25 Spur)

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25 J19	M25 (south)	IN	5809	5858	6361	6290	5963	6063	6527	6308
		OUT	4942	5029	5430	5356	5110	5253	5703	5427
	M25 (north)	IN	3403	3430	3654	3505	4455	4410	4797	4561
		OUT	4582	4651	5279	5074	4979	5533	6084	5814
	M25 Spur	IN	1539	1599	1776	1851	655	843	906	865
		OUT	1227	1207	1083	1216	985	530	443	494
	TOTAL	IN	10751	10887	11791	11646	11073	11316	12230	11734
		OUT	10751	10887	11792	11646	11074	11316	12230	11735

A1.7 Junction 19 of the M25 provides a spur to the A41/A411 at Hunton Bridge. The spur connects to and from M25 south only.

A1.8 In the AM peak, total flows are only marginally increased with the additional of committed development trips and it is M25(south) that has the greatest impact with future growth, with the impact only slightly dampened by the more constrained growth promoted through the LDF scenario.

A1.9 In the PM peak, the model output suggests a reduction in flow on the spur, awy from the M25, which is likely to be a result of re-routing of trips from external zones, as we see correspondingly more modelled 'outbound' on the M25 (north).

M25 Junction 20

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25 J20	M25 (south)	IN	4582	4651	5279	5074	4979	5533	6084	5814
		OUT	3403	3430	3654	3505	4455	4410	4797	4561
	A41 (north west)	IN	176	175	192	197	244	325	369	339
		OUT	229	280	291	287	698	759	808	806
	A4251 Watford Rd	IN	629	538	603	554	712	804	867	840
		OUT	595	260	287	264	698	739	807	783
	M25 (north)	IN	3711	3382	3711	3488	4753	4732	5051	4868
		OUT	4606	4682	5380	5166	4341	4533	4908	4713
	A41 (south east)	IN	811	851	872	925	974	985	1083	1042
		OUT	1077	944	1045	1016	1468	1938	2134	2039
	TOTAL	IN	9909	9597	10657	10238	11662	12379	13454	12903
		OUT	9910	9596	10657	10238	11660	12379	13454	12902

A1.10 As development is added over time, the greatest impact on AM peak flow into Junction 20 is from M25(south), with corresponding increases to M25 (north), suggesting that the main impact at this junction is on northbound through traffic. This pattern is reflected in the PM peak to some extent, although we also see increases in demand towards Watford on the A41 (south west).

M25/M1 Junction

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M25 / M1	M25 (west)	IN	4606	4682	5380	5166	4341	4533	4908	4713
		OUT	3711	3382	3711	3488	4753	4732	5051	4868
	M1 (north)	IN	4506	4821	5156	5070	4839	4919	5320	5214
		OUT	4429	4860	5245	5152	4717	4866	5274	5121
	M25 (east)	IN	4723	4706	5133	4873	4899	4878	5209	5038
		OUT	4521	4599	5279	5083	4870	5062	5483	5273
	M1 (south)	IN	2345	2472	2654	2636	2821	2969	3212	3137
		OUT	3517	3840	4087	4022	2560	2639	2842	2840
	TOTAL	IN	16180	16681	18323	17745	16900	17299	18649	18102
		OUT	16178	16681	18322	17745	16900	17299	18650	18102

A1.11 The M1 (north) and M25 (east) arms of the junction are at the very edge of the highway model and provide links to and from external zones. With trips from future development we see increases in demand in both directions on the M1(north). This pattern is largely repeated for M25(east) although the greater impact eastbound, away from the study area, in both peaks.

A1.12 There is also an increase in demand on the M25 (south) arm under each scenario. In all cases, demand with the LDF scenario is less than we would expect under unconstrained growth.

M1 Junction 6

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M1 J6	M1 (south)	IN	3201	3304	3638	3626	5095	5247	5750	5608
		OUT	5093	5523	5962	6044	3647	3954	4223	4259
	A405 (south west)	IN	1553	1744	1661	1771	1265	1362	1424	1424
		OUT	1619	1773	1977	1942	2938	3065	3462	3281
	M25 (north)	IN	3517	3840	4087	4022	2560	2639	2842	2840
		OUT	2345	2472	2654	2636	2821	2969	3212	3137
	A405 (north east)	IN	2160	2384	2842	2786	2179	2585	2852	2815
		OUT	1374	1505	1635	1583	1694	1846	1971	2010
	TOTAL	IN	10431	11272	12228	12205	11099	11833	12868	12687
		OUT	10431	11273	12228	12205	11100	11834	12868	12687

A1.13 The difference between unconstrained growth and the LDF scenario is less pronounced at this than other junctions, although the general pattern is still a reduction in demand through the junction for the LDF scenario.

A1.14 Total flows are similar for each time period under each scenario, with growth between the base and LDF scenarios of around 14-17%.

A1.15 Under each future year scenario, we see significant increase in forecast demand on the A405(north-east) arm, to and from the ST Albans area.

M1 Junction 5

Motorway Junction	Approach Arm	IN/OUT	AM Peak				PM Peak			
			Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr	Base	Base+Com	Base+Com +Gr	Base+Com +Pot+Gr
M1 J5	M1 (south)	IN	2315	2307	2490	2402	3890	4013	4360	4128
		OUT	3888	3887	4211	4085	2727	2722	2931	2749
	A41 slip roads	IN	1811	1715	1753	1656	1132	1180	1403	1317
	(south)	OUT	622	623	918	817	1348	1536	1613	1557
	A4008	IN	1391	1447	1534	1584	2037	2005	2105	2104
	Stephensons Way	OUT	2801	3088	3109	3171	1598	1817	1963	2096
	A41 slip roads	IN	78	47	204	79	455	491	510	490
	(north)	OUT	176	137	67	67	392	322	345	288
	M1 (north)	IN	5093	5523	5962	6044	3647	3954	4223	4259
		OUT	3201	3304	3638	3626	5095	5247	5750	5608
	TOTAL	IN	10688	11039	11943	11765	11161	11643	12601	12298
		OUT	10688	11039	11943	11766	11160	11644	12602	12298

A1.16 M1 Junction 5 is a complex junction, combining access to and from central Watford via Stephensons Way as well as providing connections to the A41 Orbital Route. All approaches to the junction are managed by traffic signals.

A1.17 The total flows through the junction follow a similar pattern to Junction 6 in that differences between unconstrained growth and the LDF scenario are less pronounced at this than other junctions, and total flows are similar for each time period under each scenario, with growth between the base and LDF scenarios of around 10%.

A1.18 The caveat relation to the reliability of absolute flow values in the outer buffer parts of the model appears to apply at this junction with forecast flows entering and leaving the northern section of the A41 seeming low in the AM peak.

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