DARLINGTON LOCAL PLAN - NORTH DARLINGTON AIMSUN MODELLING

SYSTRA

DARLINGTON LOCAL PLAN SUPPORT

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1. INTRODUCTION

1.1.1 In order to assess the transport impacts of the Darlington Local Plan, a set of local microsimulation models have been developed. The figure below illustrates the extents of the microsimulation models.

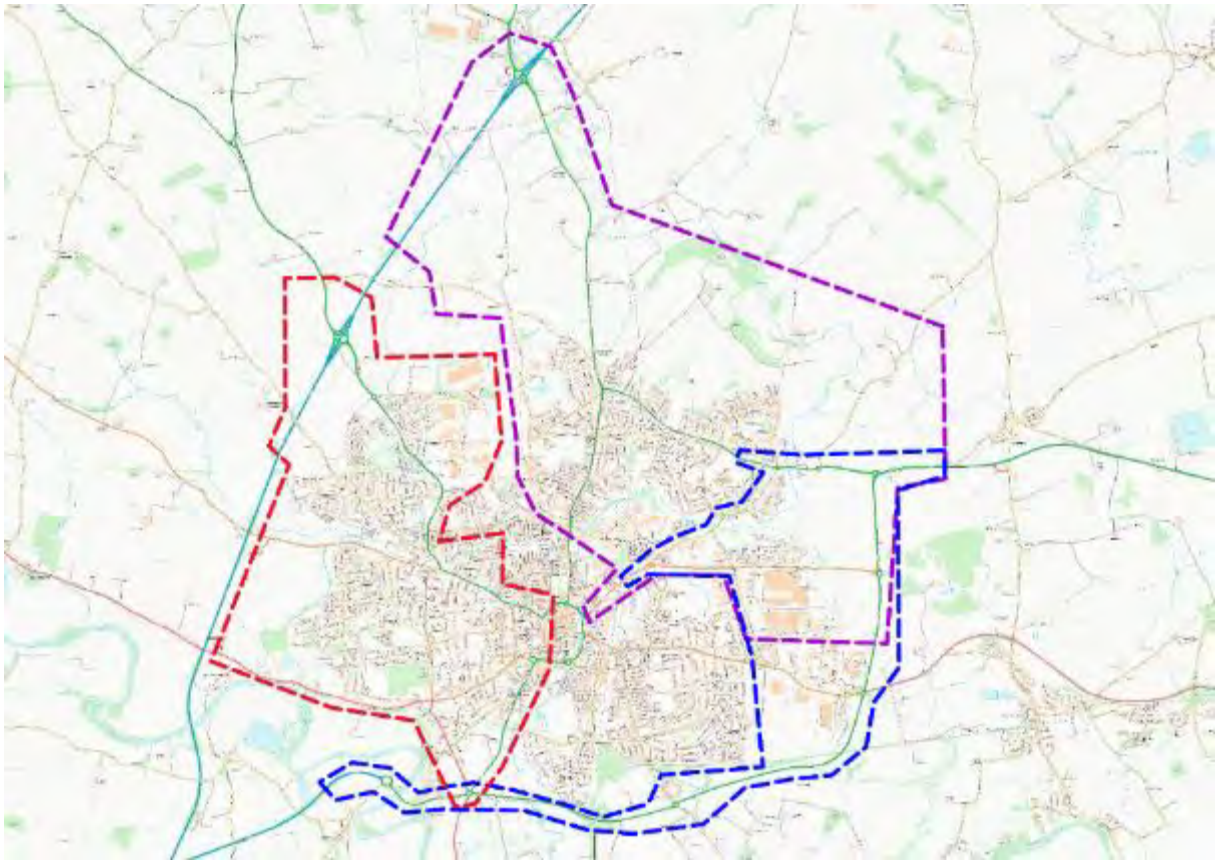


Figure 1. Microsimulation Models

1.1.2 The three models are named as below:

- East Darlington A66 Corridor – Blue outline;
- West Darlington A68/Coniscliffe – Red outline; and
- North Darlington A1150/A167 Corridor – Purple outline.

1.1.1 Fore undertook traffic modelling in support of the proposed new housing development of Skerningham Garden Village. SYSTRA has been engaged by Darlington Borough Council (DBC) to use Fore's Aimsun model to assess the impact that traffic generated by Darlington Local Plan land allocations will have on the road network in the north of Darlington.

1.1.2 The following scenarios have been analysed up to 2035 within the microsimulation software program Aimsun:

- Natural Growth: Growth calculated from assumed TEMPro growth factors as per standard Transport Application methodology;

- Do Nothing: No additional homes or jobs are created and no schemes are delivered;
- Development Only: The impact of the developments included within the local plan, with no mitigation schemes; and
- The Local Plan: The impact of the development and the associated infrastructure based mitigation schemes that are included in the local plan.

1.1.3 These scenarios enable a comparison to be made between the impacts of releasing Local Plan traffic onto the network and providing a package of mitigation schemes in order to address this.

1.1.4 This report will cover the following:

- A background to the Aimsun model used for the forecasting scenarios, including details of the mitigation schemes coded;
- The demand forecasting methodology used to generate demand matrices representing Local Plan traffic:
- Results observed from the modelled scenarios:
- A conclusion summarising the key issues arising from the results.

2. AIMSUN MODEL DEVELOPMENT

2.1 Background

2.1.1 The Aimsun models used for Local Plan forecasting have been derived from the 2017 Skeringham Aimsun Base Model developed by Fore Consulting on behalf of the Skerningham Estates Ltd. The network included in this model is shown in grey in **2.2.21** below.

Figure 2. Skerningham Aimsun Base Model

2.1.2 SYSTRA, on behalf of Darlington Borough Council, have reviewed the base year model and subsequent future year assessments undertaken for Skerningham Estates Ltd by Fore Consulting Ltd.

2.1.3 During April / May 2019, SYSTRA reviewed the base model Local Model Validation report (dated 10 October 2018). A number of queries were raised and addressed by Fore through a technical note dated 14 May 2019.

2.1.4 During the autumn of 2019 changes were made to the access arrangements for Skerningham Garden Village through the removal of the northern arm of the Thompson Street roundabout improvement scheme.

2.1.5 Further Aimsun modelling on behalf of the developer was undertaken by Fore and reported through the Aimsun Modelling Report (Fore Consulting, version 0.6 dated 7 May 2020) which SYSTRA subsequently reviewed,

2.1.6 Following this review, SYSTRA have used the model to scenario test the local plan to demonstrate the need for mitigation measures to deliver the housing and employment opportunities within the plan.

2.1.7 Forecast year matrices have been derived from the Tees Valley Combined Authority Cube Voyager Network Model (see Strategic Transport Modelling report for further details).

2.1.8 Within mitigation scenarios, a number of improvements have been coded into the model. These comprise of a mix of localised junction and road improvements plus new link roads providing access to development sites at Skerningham (from A1150 and A167), Burtree Lane and Berrymead Farm (from Whessoe Road, Burtree Lane and A167 Beaumont Hill), and joining A1150 to Tornado Way. The schemes are detailed in the section below.

2.2 Mitigation Schemes

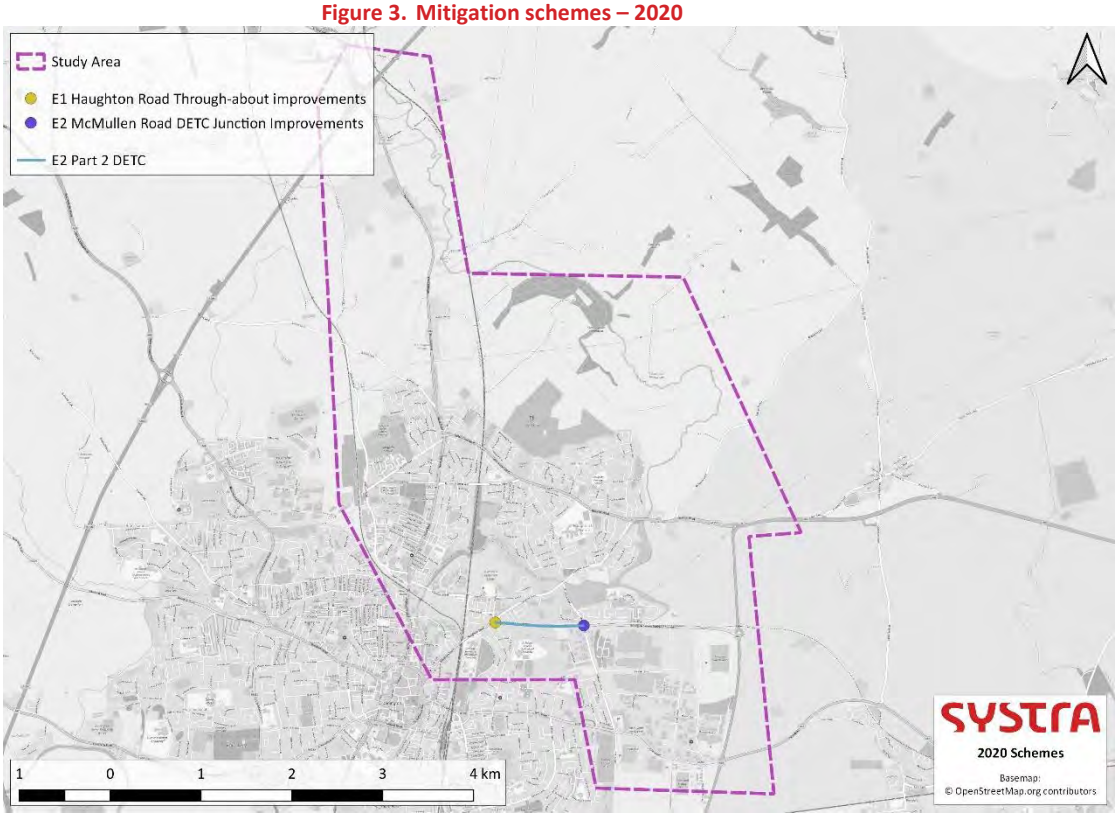
2.2.1 A series of mitigation schemes have been identified by developers and by Darlington Borough Council. These have been included within the **With Mitigation** scenarios. Plans showing the location of measures to be introduced across Darlington in each model year are shown below in **Figure 3**, **Figure 4** and **Figure 5**. More detail is provided in the next section.

2.2.2 For 2020 two schemes are included:

- E1 Haughton Road through-about improvements
- E2 McMullen Road / Tornado Way junction improvements

2.2.3 These are shown in **Figure 3** below.

Figure 3. Mitigation schemes – 2020

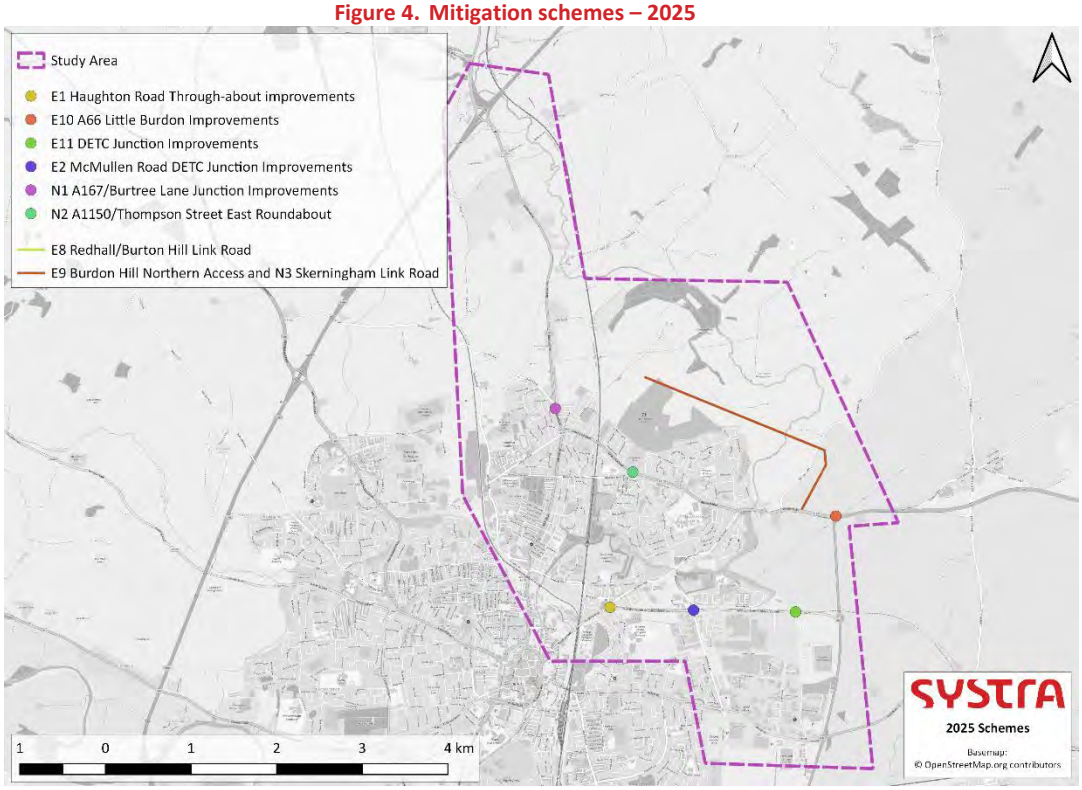


2.2.4 From 2025 an additional six schemes are included, along with development access for Skerningham and the Banks site:

- E8 Redhall link road
- E9 Burdon Hill northern access and N3 Skerningham link road
- E10 A66 Little Burdon improvements
- E11 Tornado Way junction improvements
- N1 A167 / Burtree Lane junction improvements
- N2 A1150 / Thompson Street East roundabout improvements

2.2.5 These are shown in Figure 4 below.

Figure 4. Mitigation schemes – 2025

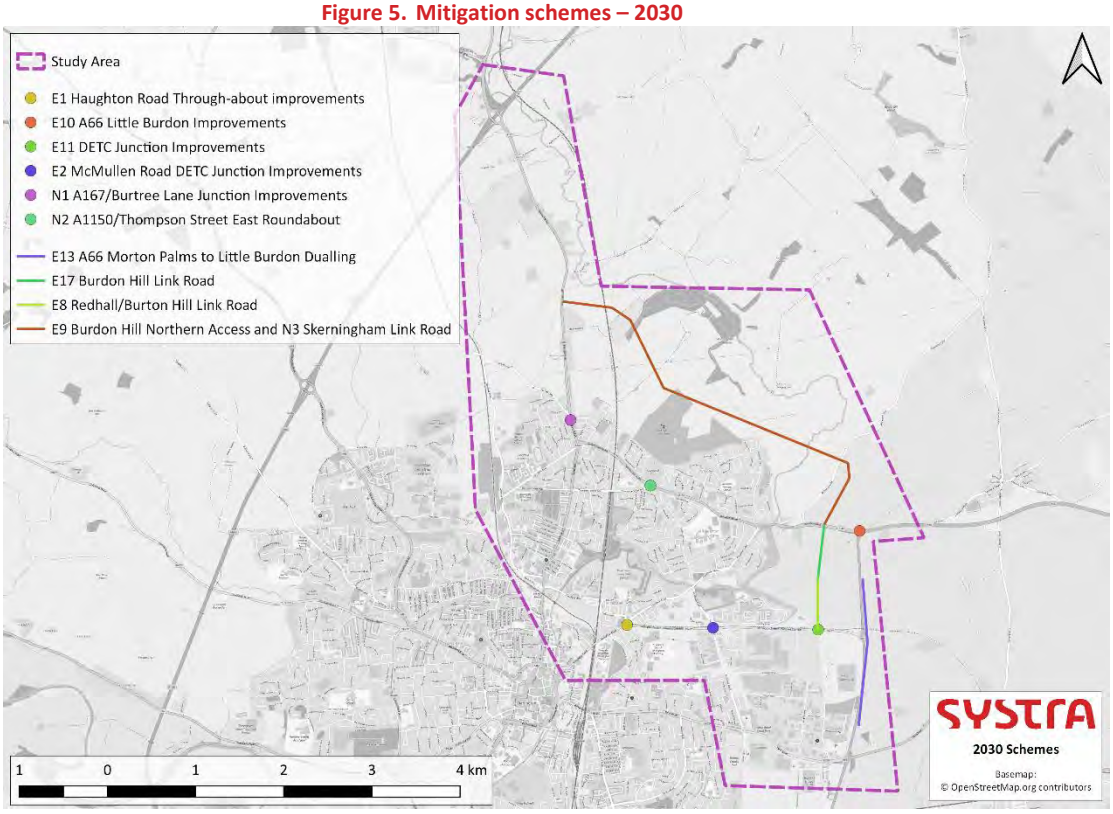


2.2.6 From 2030 an additional 3 schemes are included, along with development access for Burtree Lane and Berrymead Farm:

- E13 A66 Morton Palms to Little Burdon dualling
- E17 Burdon Hill link road
- N3 Skerningham Link Road

2.2.7 These are shown in Figure 5 below.

Figure 5. Mitigation schemes – 2030



2.2.8 No additional schemes are included in 2035.

2.2.9 The latest drawings of these schemes used to code the model are provided in Appendix A. A summary of each of the schemes is provided in the following section.

Haughton Road Through-about Improvements

2.2.10 To accommodate Local Plan traffic the existing through-about at Haughton Road / B6279 / Barton Street will be reconfigured to a more standard roundabout. The location is shown

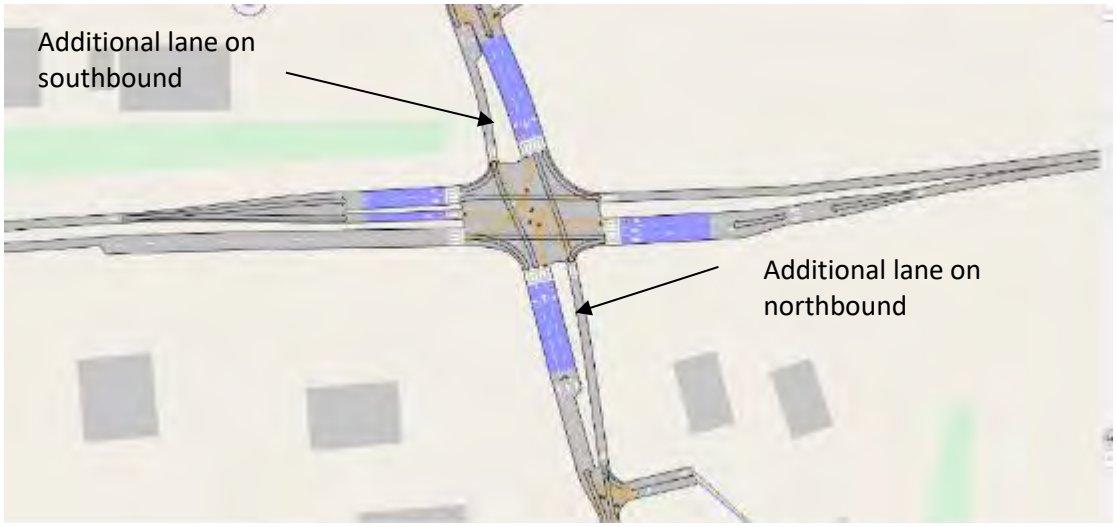
as E1 in **Figure 3** above and a screenshot showing the proposed layout is shown in **Figure 6** below. This scheme is included in the mitigated scenarios from 2020.

Figure 6. Haughton Road Through-about

McMullen Road / Tornado Way Junction Improvements

2.2.11 General widening is proposed at the McMullen Road / B6279 Tornado Way junction to accommodate Local Plan traffic. The north and south approaches will include a flare to 3 lanes, and the westbound exit is also widened to 2 lanes. The location is shown as E2 in **Figure 3** above, and the proposed layout in **Figure 7** below. This scheme is included in the mitigated scenarios from 2020.

Figure 7. McMullen Road / Tornado Way Junction Improvements



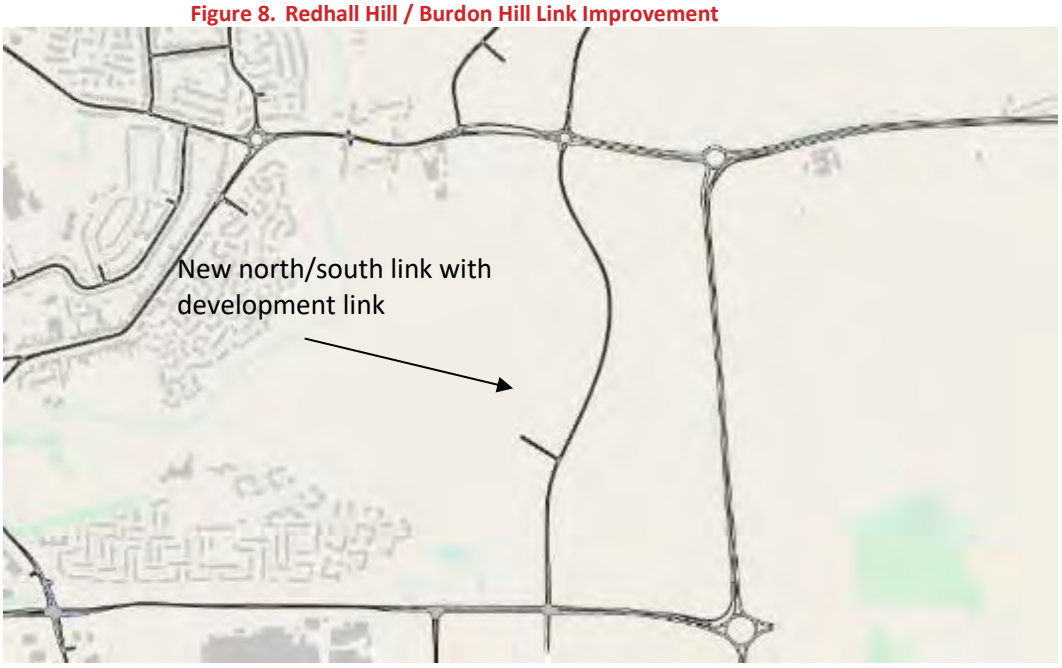
Redhall Hall / Burdon Hill Link Road

2.2.12 As part of the Local Plan a new link road is proposed between the B6279 Tornado Way and the A1150 Stockton Road, to serve new developments at Redhall Hall and Burdon Hill as well as providing extra capacity for north-south traffic. At the roundabout connecting this link road to A1150 Stockton Road the Skerningham Garden Village developer proposes to add a north arm providing access to the Skerningham site.

2.2.13 The southern section of the link road will be delivered as the first phase by 2025, with the northern section as a second phase by 2030.

2.2.14 The location of the link road is shown as E8 in **Figure 4** above and the proposed layout in **Figure 8** below. The scheme is included in the mitigated scenarios from 2025.

Figure 8. Redhall Hill / Burdon Hill Link Improvement



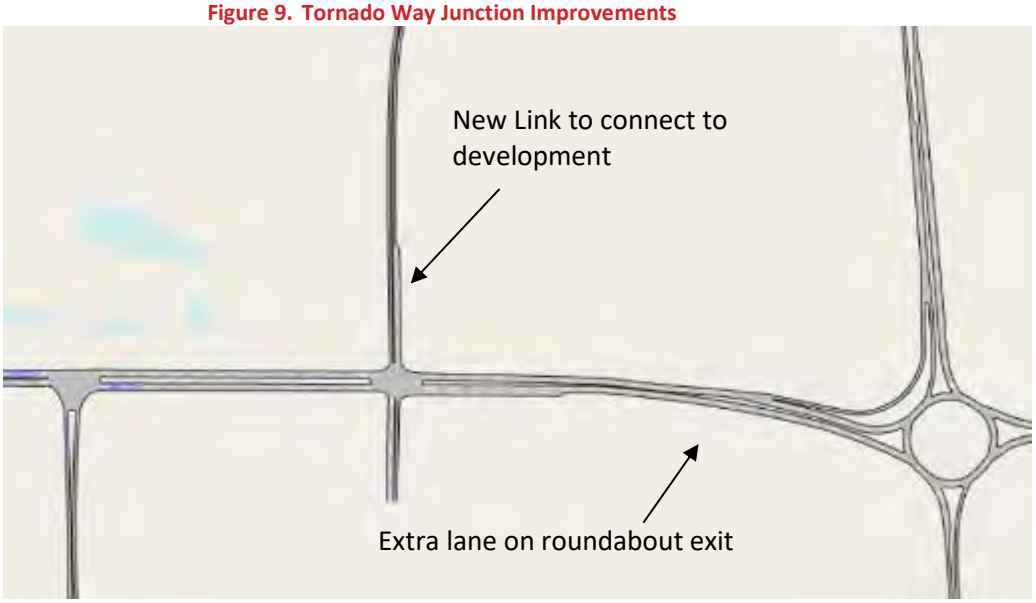
Burdon Hill Northern Access

2.2.15 The Burdon Hill site will be accessed via a new roundabout on the A1150, which also provides access to the Skerningham site and the Redhall Hall / Burdon Hill Link Road. The link road is shown as Local Plan scheme E9 in **Figure 4** above, and the layout is shown combined with in **Figure 8** above.

Tornado Way Junction Improvements

2.2.16 Where the new link road connects to the B6279 Tornado Way, the road will be widened westbound from the A66 roundabout. The location of this scheme is shown as E11 in **Figure 4** above, while the layout is shown in **Figure 9** below.

Figure 9. Tornado Way Junction Improvements



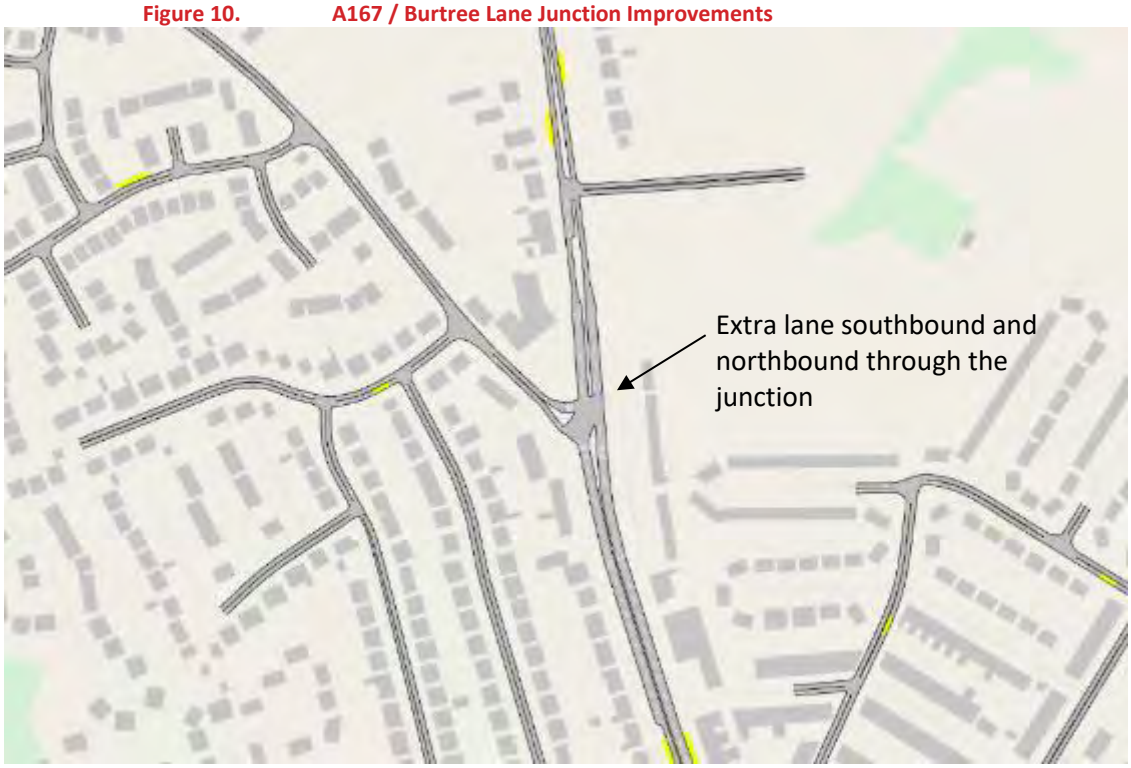
2.2.17 The scheme impacts directly on the A66 corridor. At the time of modelling, the A66 schemes are still being developed. Therefore the scheme has been coded primarily to ensure that vehicles are not blocked on the A66 to ensure a robust assessment within the north Darlington Aimsun modelled area.

2.2.18 Further assessment of this corridor with optimisation of schemes has been undertaken with the A66 simulation model.

A167 / Burtree Lane Junction Improvements

2.2.19 Improvements are proposed to the A167 Beaumont Hill / Burtree Lane junction, with the A167 north and southbound being widened to 2 lanes through the junction. The location is shown as N1 in **Figure 4** above, while the layout is shown in **Figure 10** below.

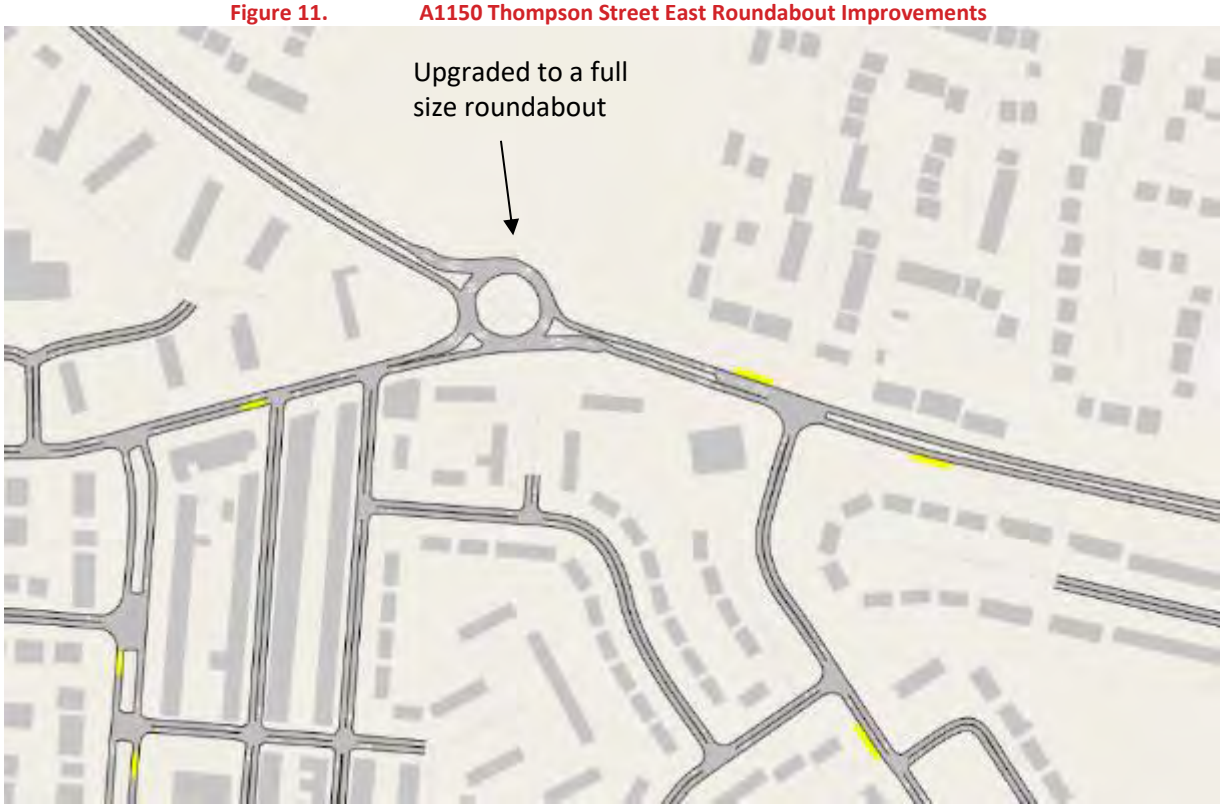
Figure 10. A167 / Burtree Lane Junction Improvements



A1150 / Thompson Street East Roundabout Improvements

2.2.20 Improvements to the existing A1150 / Thompson Street East mini roundabout will be upgraded to a standard roundabout, with all 3 approaches flared to 2 lanes. The location of the scheme is shown as N2 in **Figure 4** above, while the layout it shown in **Figure 11** below.

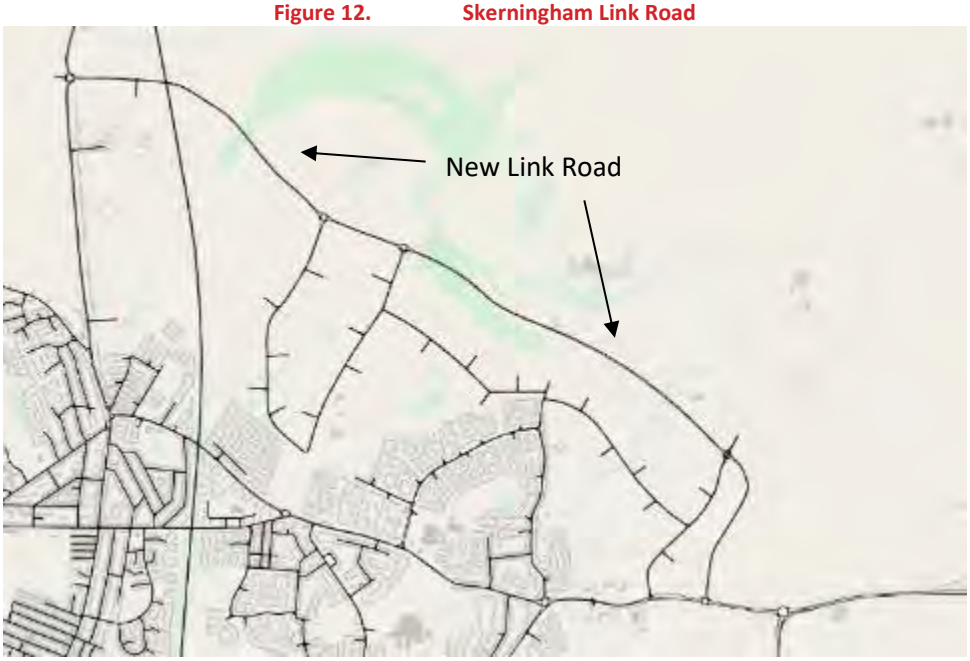
Figure 11. A1150 Thompson Street East Roundabout Improvements



Skerningham Link Road

2.2.21 The proposed Skerningham development will be accessed from a new link road connecting to the A1150 at the same roundabout as the Burdon Hill link road, and to the A167 Beaumont Hill north of the Burtree Lane junction. The general location of the link road is shown as N3 in **Figure 4** above, with the layout shown in more detail in **Figure 12** below. The link road is coded as a single-carriageway 30mph road with one lane in each direction.

Figure 12. Skerningham Link Road



A167 / Burtree Lane Link Road

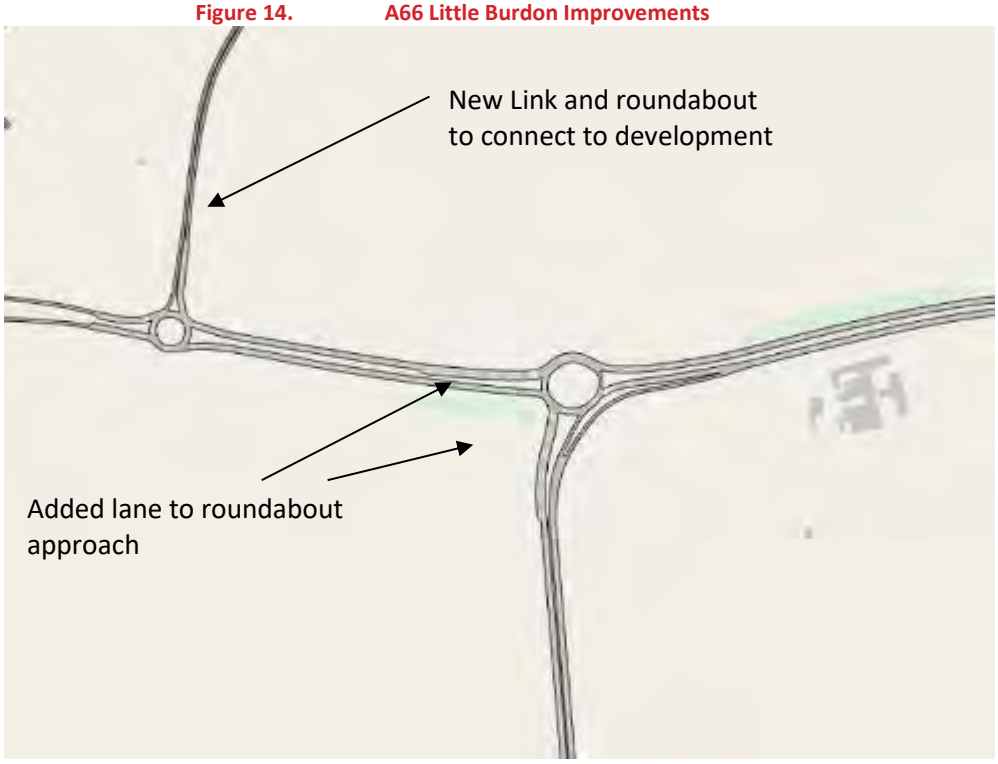
2.2.22 A new link road will be delivered as part of the proposed Burtree Lane and Berrymead Farm development sites. The new road will link Whessoe Road, Burtree Lane and the A167 Beaumont Hill. The general location is shown as "development access" in **Figure 5** above, while the layout is shown in **Figure 13** below.

Figure 13. A167 / Burtree Lane Link Road

A66 Little Burdon Improvements

2.2.23 To accommodate Local Plan traffic, widening is proposed at the A66 / A1150 Little Burdon roundabout. The south and west approaches will be widened to 3 lanes and the westbound exit widened to 2 lanes. The location is shown as E10 in **Figure 4** above, and the layout is shown in **Figure 14** below.

Figure 14. A66 Little Burdon Improvements

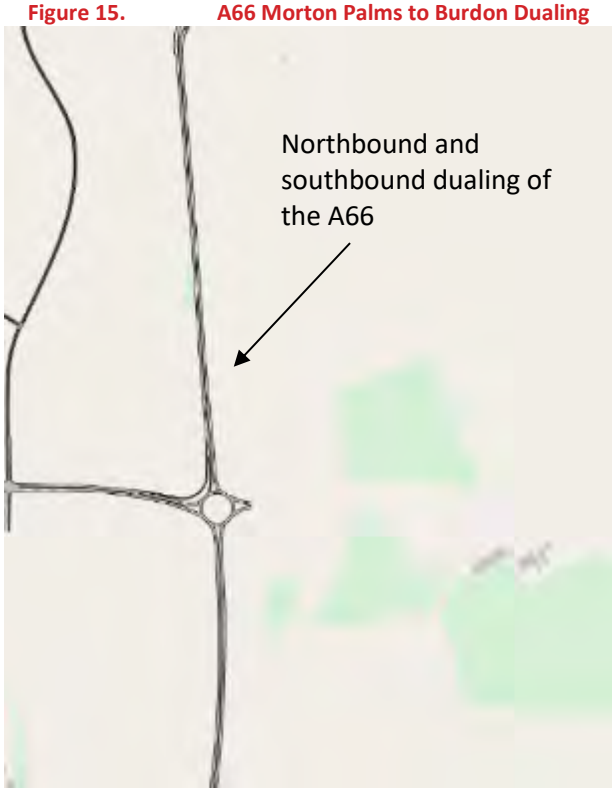


A66 Morton Palms to Burdon Dualling

2.2.24 At present sections of the A66 south of the A1150 Little Burdon roundabout are one lane in each direction. To accommodate the Local Plan traffic it is proposed to upgrade the A66 to dual carriageway between Little Burdon and south of the A66 / B6279 Tornado Way roundabout. The general location is shown as E13 in **Figure 5** above and in more detail in **Figure 15** below.

2.2.25 The A66 schemes are based on the latest information available at the time, and have been coded primarily to ensure that vehicles are not blocked off the northern Darlington network to ensure a robust assessment within the Aimsun modelled area.

Figure 15. A66 Morton Palms to Burdon Dualing



Traffic Signal Optimisation

2.2.26 With the inclusion of Local Plan schemes identified above, initial model runs with Local Plan traffic still showed significant congestion.

2.2.27 Some of this congestion was due to vehicles travelling from the B6279 / Haughton Road roundabout to Tornado Way travelling north east up Haughton Road and then turning right onto McMullen Road before turning left onto Tornado Way. This caused delays around the Tornado Way / Haughton Road / McMullen Road triangle.

2.2.28 A "user defined cost" has been applied to discourage the right turn from Haughton Road to McMullen Road, making the route along the Tornado Way (the "bottom" of the triangle) more attractive. This routing could be encouraged on-street through signing to the new Tornado Way as part of the E1 Haughton Road through-about improvements.

2.2.29 Signal timings have also been optimised to prioritise traffic on the main corridors. The changes outlined below have been made at junctions throughout the model area as listed below:

2.2.30 These changes do not represent a formal mitigation scheme. They represent the continuous network management that the council undertakes as development comes forward.

3. FORECASTING TRAFFIC DATA

3.1 Introduction

3.1.1 Traffic forecasts associated with the Darlington Local Plan implementation have been calculated, using TRICS trip rates, from the development database supplied by Darlington Council on 25/01/2018.

3.1.2 The quantum of developments to be considered as part of the local plan beyond 2020 is shown in **Table 1** below:

Table 1. Darlington Local Plan Development Quantums 2025-2035

PLAN PERIOD	2025	2030	2035
Dwellings	6,116	9,214	11,810
Jobs	7,465	8,763	9,950

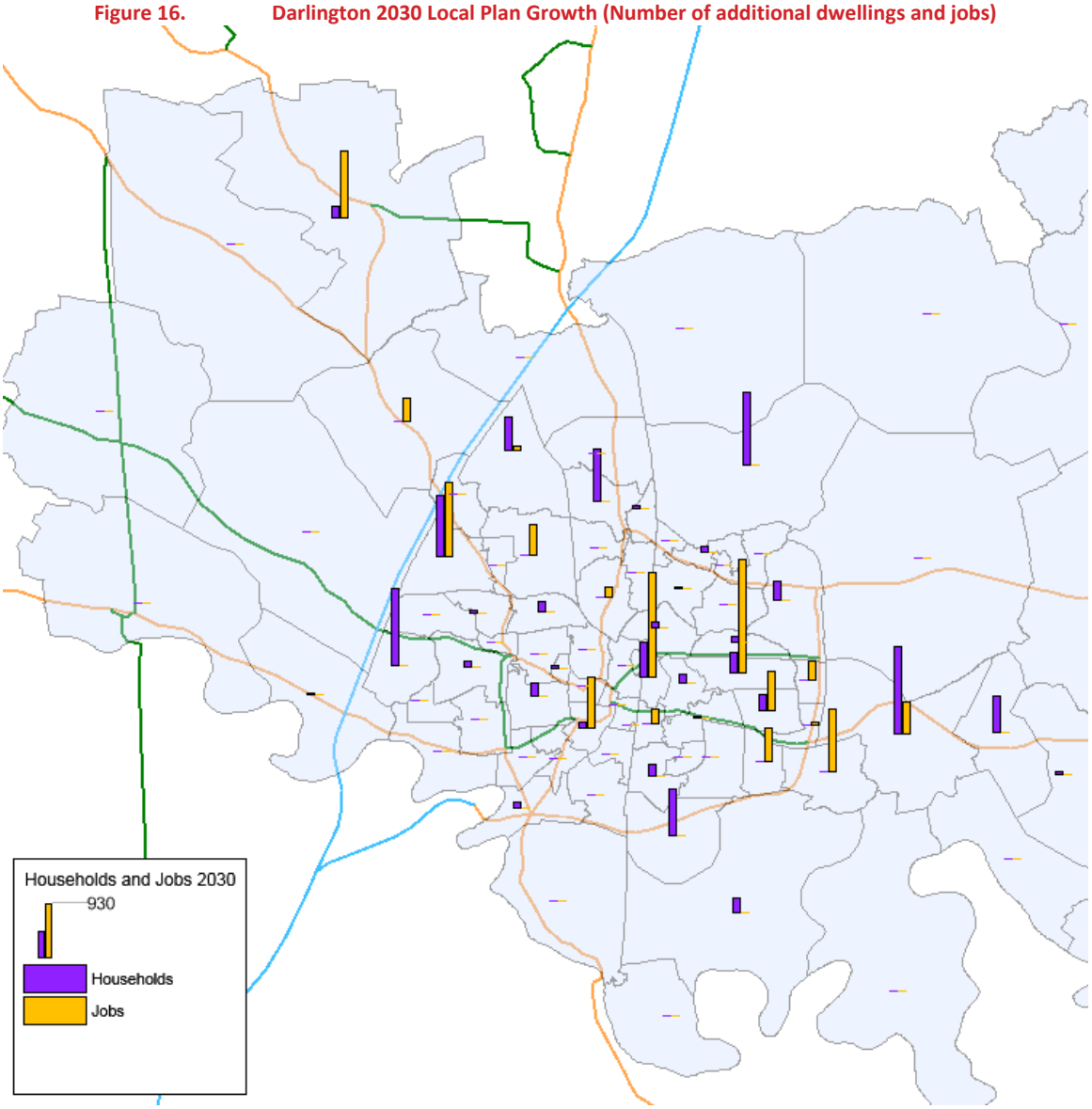
3.1.3 The TVCA Cube Voyager model was then used to allocate Local Plan traffic onto the Aimsun model network.

3.2 Housing and Employment Growth

3.2.1 Housing and employment growth forecasts used in the TVCA Cube Voyager model to derive forecast year traffic demand are illustrated in **Figure 16**. A considerable amount of the development quantum is located on the Skerningham site in the north and Tornado Way corridor in the east of the town.

3.2.2 The development database was sourced as part of initial local plan work, and is dated January 2018. The database included developments that where (at that time) committed, these have been included within the local plan forecasts as the forecast period begins in 2015.

Figure 16. Darlington 2030 Local Plan Growth (Number of additional dwellings and jobs)



3.3 Local Plan Development Demand Totals

3.3.1 **Table 2** through to **Table 4** show the total peak hour demand included in the forecasts from 2025 through to the 2035 Local Plan without mitigation scenarios scenario.

Table 2. Total Vehicles in 2025 Peak Hour Matrix

TIME	CAR	LGV	HGV	DARLINGTON LOCAL PLAN	TOTAL VEHICLES
AM	13089	2253	1073	1891	18307
PM	15543	1899	907	1896	20246

Table 3. Total Vehicles in 2030 Peak Hour Matrix

TIME	CAR	LGV	HGV	DARLINGTON LOCAL PLAN	TOTAL VEHICLES
AM	13300	2255	1089	2629	19273
PM	15695	1916	907	2672	21191

Table 4. Total Vehicles in 2035 Peak Hour Matrix

TIME	CAR	LGV	HGV	DARLINGTON LOCAL PLAN	TOTAL VEHICLES
AM	13542	2250	1090	3392	20273
PM	15856	1907	922	3469	22153

3.3.2 The mitigations have been encoded into the Voyager strategic model and the simulation matrix extraction process reran. The increase in capacity on the road network across Darlington results in an increase in vehicle demand within the North Darlington area.

3.3.3 This is primarily as a result of the rerouting of traffic from other corridors onto roads in the North Darlington area that have had relief through mitigation schemes.

3.3.4 **Table 5** through to **Table 7** show the total peak hour demand included in the forecasts through to the 2035 Local Plan with mitigation scenarios.

Table 5. Total Vehicles in 2025 Peak Hour Matrix (with mitigations)

TIME	CAR	LGV	HGV	DARLINGTON LOCAL PLAN	TOTAL VEHICLES
AM	13171	2217	1031	1849	18269
PM	15880	1902	860	1802	20444

Table 6. Total Vehicles in 2030 Peak Hour Matrix (with mitigations)

TIME	CAR	LGV	HGV	DARLINGTON LOCAL PLAN	TOTAL VEHICLES
AM	13687	2227	1004	2576	19495
PM	16425	1888	849	2575	21738

Table 7. Total Vehicles in 2035 Peak Hour Matrix (with mitigations)

TIME	CAR	LGV	HGV	DARLINGTON LOCAL PLAN	TOTAL VEHICLES
AM	13921	2245	999	3280	20444
PM	16726	1891	849	3327	22793

3.3.5 In common with the A68 simulation modelling, a 2020 forecast has been calculated however given the prevailing situation with Covid19 and the forward looking nature of this report, the 2020 forecasts have not been reported.

3.4 TEMPro Growth Reference Case Scenario

3.4.1 To provide a comparison with the impact of Local Plan traffic forecasts on the network, reference case scenarios for 2025 through to 2035 were created with TEMPro growth factors applied to 2017 base year traffic. The TEMPro scenarios also do not contain any of the mitigation schemes.

3.4.2 **Table 8** shows the TEMPro growth factors used to generate the matrices for the reference case scenarios in the authority of Darlington. The parameters selected to generate the growth factors were for an urban area and for all road classes.

Table 8. TEMPro Growth Factors

YEAR	AM	PM
2017-2025	1.0778	1.0713
2017-2030	1.1200	1.1121
2017-2035	1.1679	1.1571

3.5 Local Plan Scenarios

3.5.1 The strategic model was used to identify the traffic associated with the Local Plan for each model year (2025, 2030 and 2035).

3.5.2 The strategic modelling work identified the A1150 and A167 corridors as requiring the introduction of mitigation measures early in the plan period. Figure 17 below shows an image extracted from the strategic modelling analysis, illustrates the volume over link capacity ratios for 2025 in the morning peak period.

3.5.3 This illustrates key issues on the A1150 corridor, that the mitigations in this report are seeking to address.

Darlington Local Plan – Strategic Model Output

'Development Only' scenario – Morning Peak for forecast year 2025

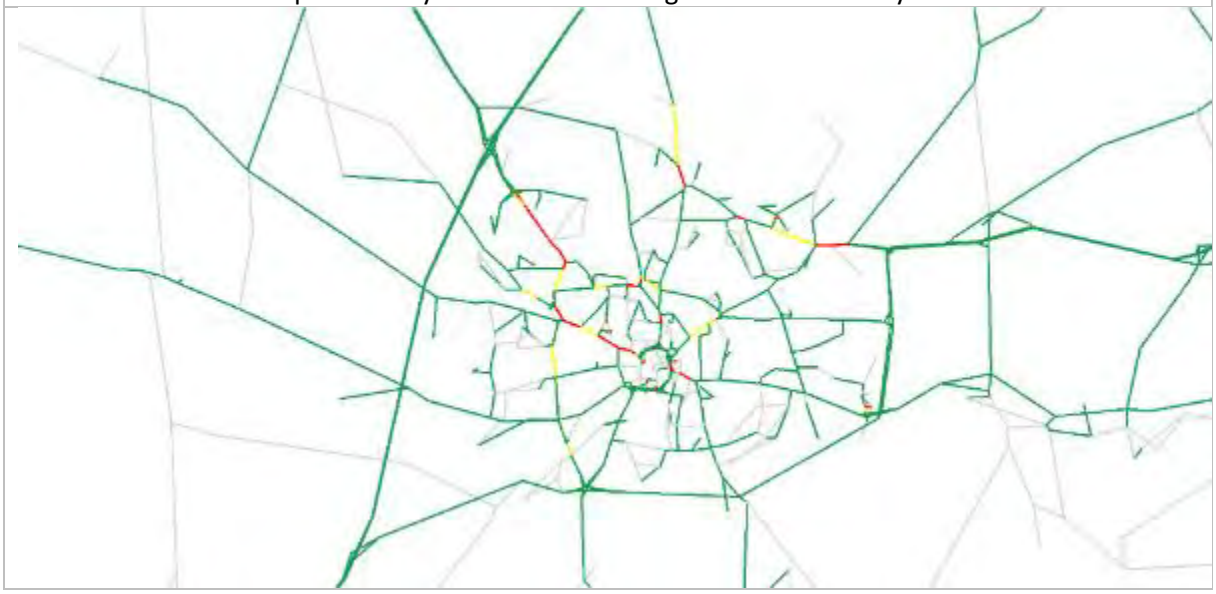


Figure 17. 'Development Only' Scenario - Morning Peak - 2025

The full Darlington Local Plan development quantum through to 2035 was tested as part of the microsimulation modelling analysis against a number of network scenarios.

4. AIMSUN MODEL RESULTS

4.1 Introduction

4.1.1 This section details the results generated from the Aimsun forecast year modelling.

4.1.2 In order to test the local plan, a series of scenarios have been evaluated and analysis of the differences undertaken to reveal emerging issues on the road network that will need to be addressed.

4.1.3 Five scenarios have been formulated for each year. These are defined as:

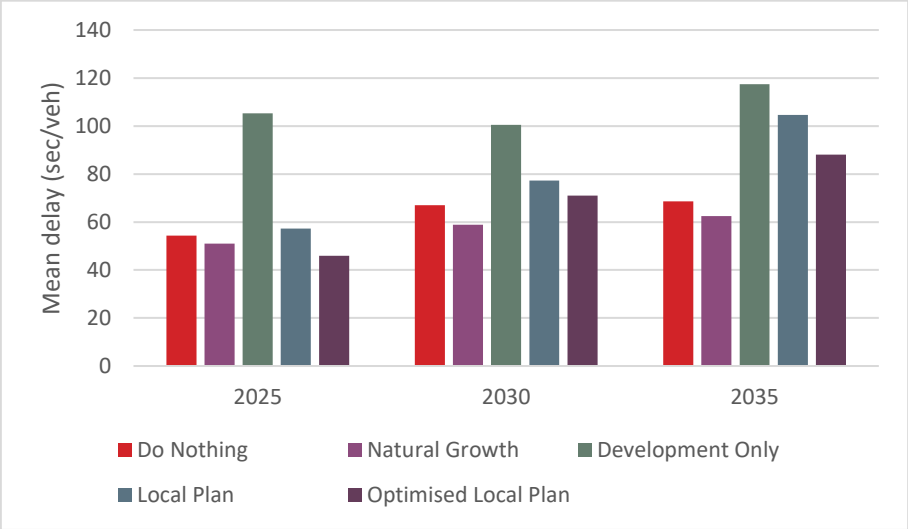
- Do Nothing: No additional homes or jobs are created and no schemes are delivered;
- Natural Growth: Growth calculated from assumed TEMPro growth factors as per standard Transport Application methodology;
- Development Only: The impact of the developments included within the local plan, with no mitigation schemes;
- The Local Plan: The impact of the development and the associated infrastructure based mitigation schemes that are included in the local plan;
- The optimised Local Plan: The impact of the development and associated infrastructure based mitigation schemes, plus optimisation of signals and signing.

4.2 Network Performance Results

4.2.1 The following parameters are used to measure results on a network wide basis within the Aimsun model. The average delay is calculated as the additional time required to travel when not at the speed limit. Given the requirement to stop at traffic lights, and slow for priority junctions there will always be some delay.

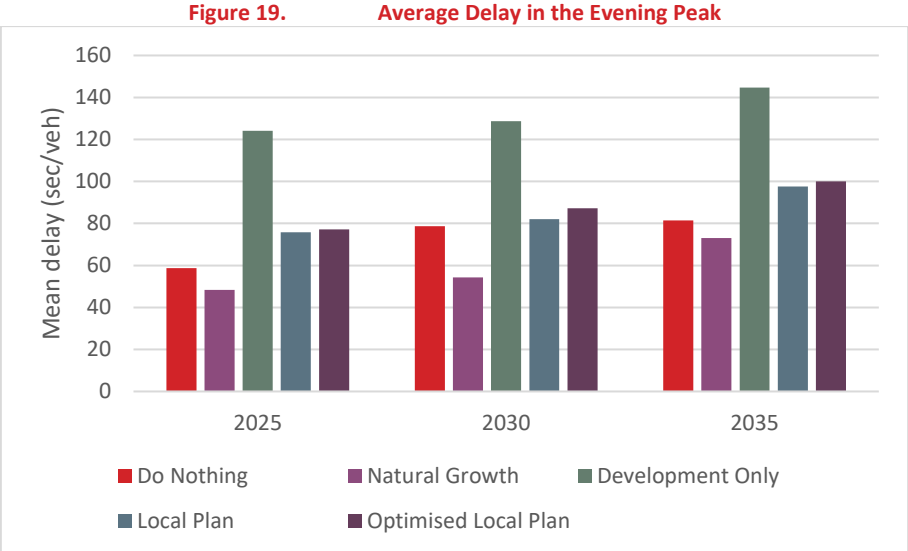
Average Delay

Figure 18. Average Delay in the Morning Peak



4.2.2 Figure 18 shows that in the AM when Local Plan traffic is added to the network, the package of mitigation schemes keeps the average delay per vehicle broadly comparable with conditions with no development included. By 2035 the average delay is around 20 seconds per vehicle greater than the equivalent Do Nothing scenario. The chart shows that in the AM without mitigation, by 2025 the average delay is significantly increased on the Do Nothing with an additional delay of up to 50 seconds per vehicle due to local plan traffic. The package of mitigation schemes substantially mitigates this increase.

Figure 19. Average Delay in the Evening Peak



4.2.3 Figure 19 shows, In the PM the average delay without mitigation increases constantly from 2025 to 2035, with substantial increases in average delay for the "development only" scenario.

4.2.4 The package of mitigation reduces the delays, keeping the delay per vehicle down to around 80-100 seconds in all years. It should be noted that even these delays are not substantially above what are forecast to be experienced in the "without development" scenarios.

4.2.5 A counter-intuitive outcome is that there is lower delay in the Do Nothing scenario that with the natural growth scenario. The reason for this is that the delay takes into account only trips that have successfully completed their journey, the following section discusses this through network throughput analysis.

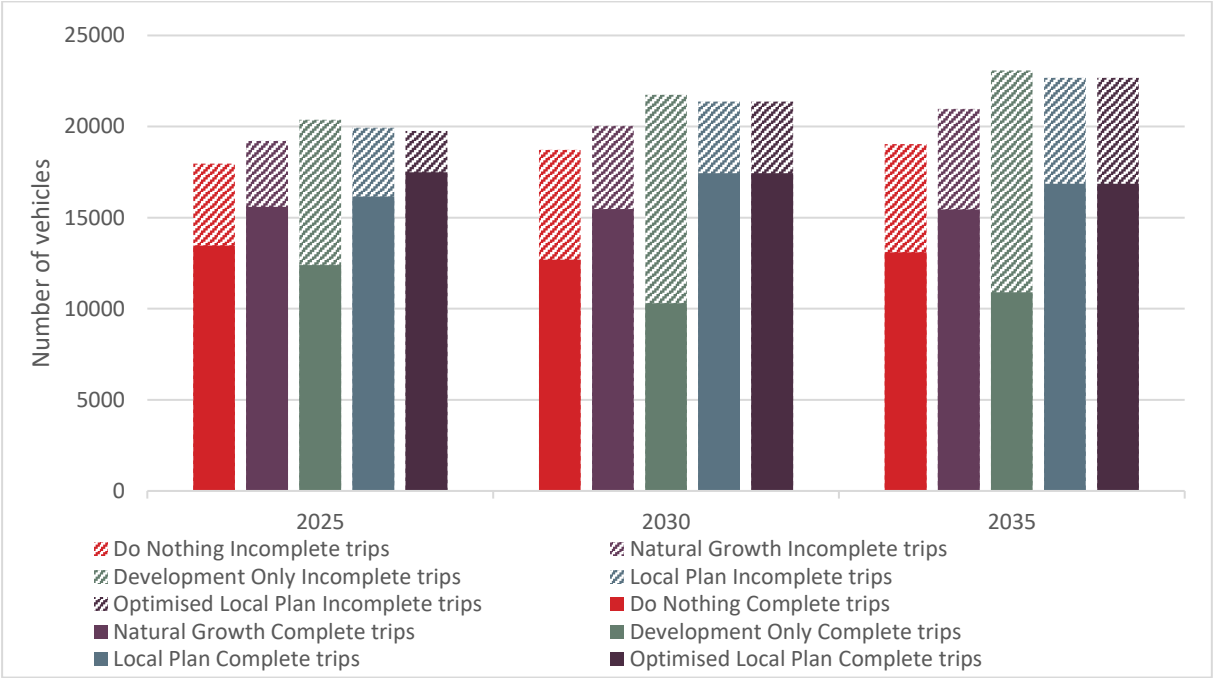
Network Throughput

4.2.6 Network throughput analysis displays all vehicles that have entered the network during the modelled time period, illustrating those that have completed their trips (in solid colour) and those whose trips remain incomplete by the end of the modelled period (the hatched section of each bar).

4.2.7 These incomplete trips are vehicles travelling on the road network at the end of the simulation, and in extreme cases vehicles waiting to enter the network due to congestion.

4.2.8 It should be noted that there will always be some vehicles that have not completed their journeys at the end of the model period. The aim is not to reduce the incomplete trips to zero, but to minimise them and enable the network to maximise the number of completed trips.

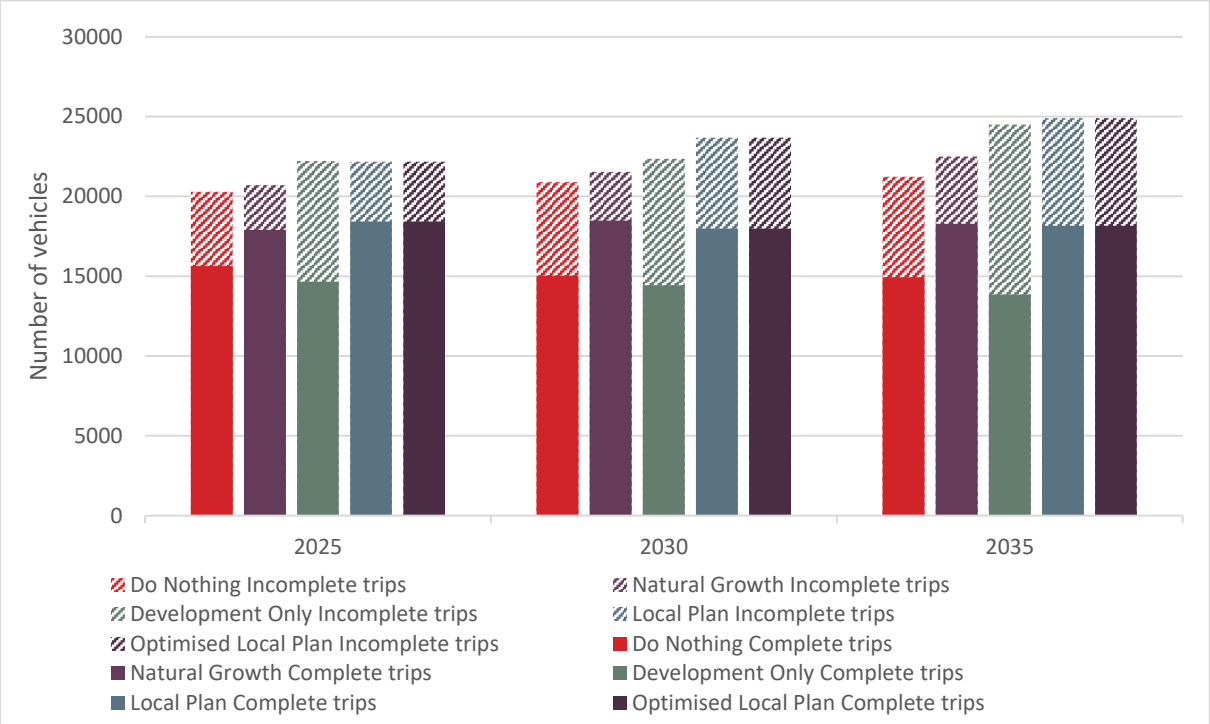
Figure 20. Network Throughput in the Morning Peak



4.2.9 Figure 20 shows that in the AM without mitigation schemes, the number of vehicles completing their journey drops between the Do Nothing and Development Only scenarios in each year. This is because of flow breakdown at key locations that reduces the overall capacity of the network. More trips attempt journeys but fewer journeys are completed.

4.2.10 With the package of mitigation included, more traffic is able to complete its journey, shown by the greater proportion of traffic in the solid bar. The number of incomplete trips is reduced for all years and all growth scenarios. This demonstrates that the mitigation measures are providing the extra capacity needed to unlock the local plan.

Figure 21. Network Throughput in the Evening Peak



4.2.11 Figure 21 shows the pattern of throughput in the PM is similar to that for the AM. For the scenarios (except natural growth) which do not include mitigation the number of vehicles completing their journey remains relatively constant, although with more variation than in the AM.

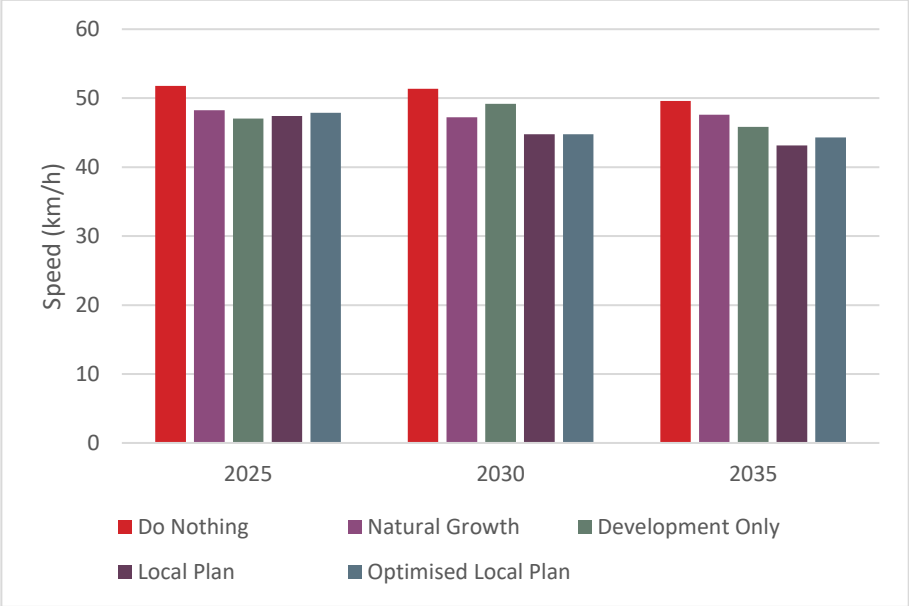
4.2.12 The Natural Growth scenario results can be explained due to the approach factoring the base year demand results in larger increases in trips on sections of road with spare capacity (such as the A1M).

4.2.13 With the package of mitigation included the number of vehicles completing their journey increases but remains relatively constant for all years.

4.2.14 This is indicative of access into the network from the town centre being of greater importance in the evening peak and is reflective of the general increase in average delay in the evening peak previously reported.

Average Speed

Figure 22. Average Speed in the Morning Peak



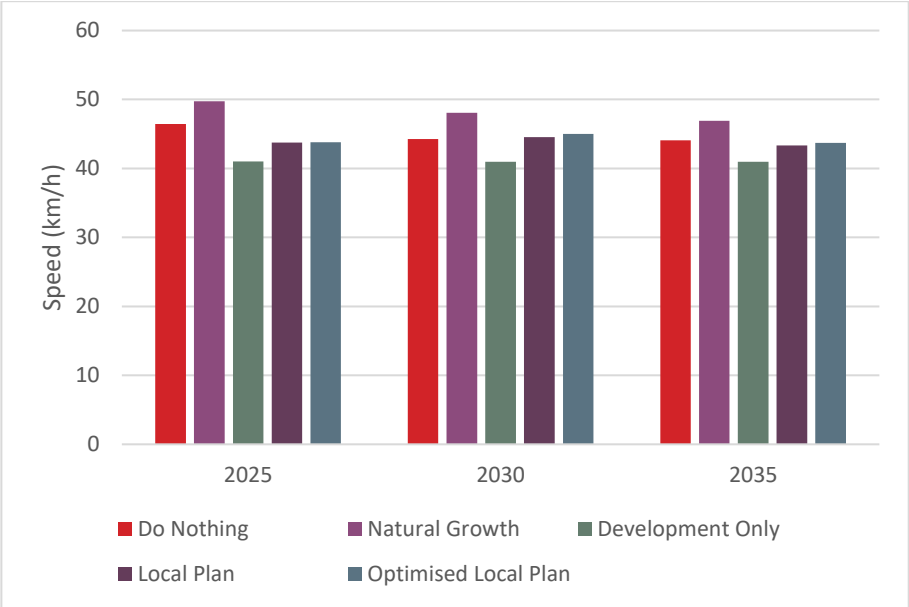
4.2.15 The average speed over the full network can be used as a measure of network performance, however there are a number of factors which should be borne in mind.

4.2.16 Firstly the average speed may change for scenarios including development traffic even if there is no additional delay. This is because the development traffic may have different characteristics from the existing traffic – for instance it may be more focussed on local 30mph roads rather than higher speed strategic routes, which would reduce the average speed. Also the speed also doesn't take account of traffic which has been unable to enter the network and as shown in the throughput graphs above for some of the scenarios this could be a significant effect.

4.2.17 Caution should therefore be applied but speed still provides a reasonable overview of the operation of the network.

4.2.18 Figure 22 shows that for all scenarios and forecast years, the network average speed remains above 40kmph in the AM peak.

Figure 23. Average Speed in the Evening Peak



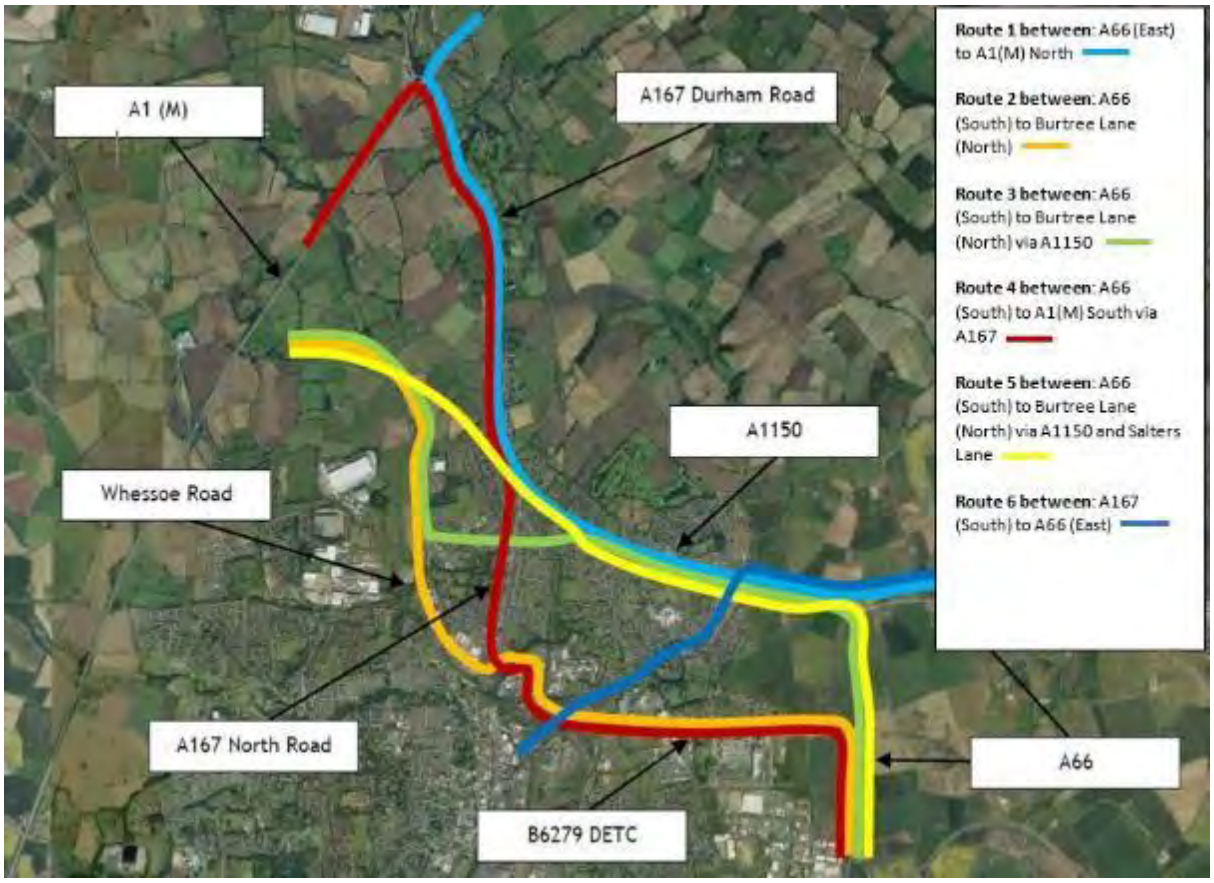
4.2.19 Figure 23 shows that in the PM the outcome is similar to the AM, the average speed is above 40kmph for all scenarios.

4.3 Corridor Journey Times

4.3.1 The reporting undertaken by Fore Consulting for Skerningham Estates Ltd included journey times for 6 routes as shown in **Figure 24** below.

4.3.2 Average journey times for these routes have also been collected for the Local Plan modelling, as they provide an overview of travel times into and around Darlington.

Figure 24. Journey Time Routes

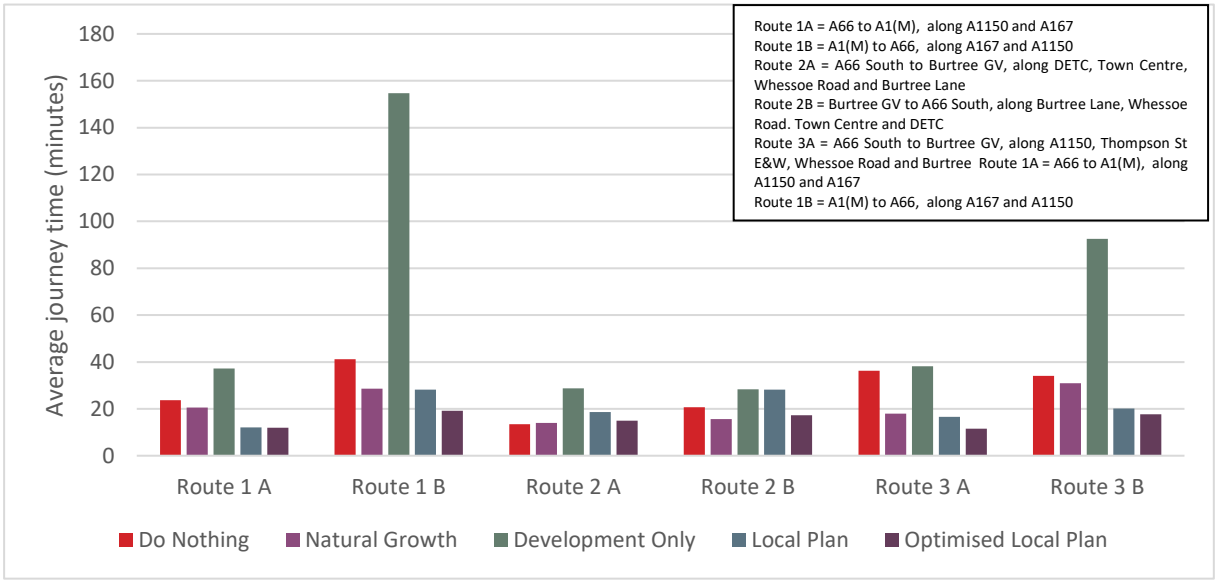


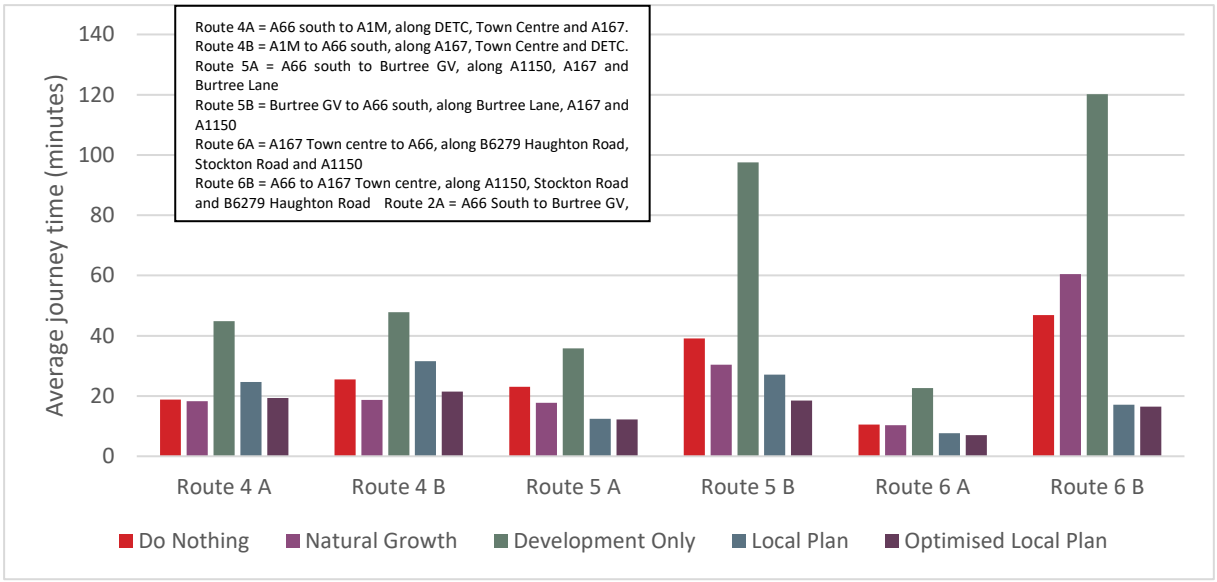
4.3.3 The graphs below show the average journey time in minutes for each route for all five modelled scenarios.

4.3.4 The following six figures illustrate the equivalent journey time analysis for forecast years 2025, 2030 and 2035 for morning and evening peaks respectively.

4.3.5 Figure 25 shows In the morning peak, the 2025 journey time charts demonstrate that the changes to the pattern and volume of trips through the local plan has significant impacts on the journey times by causing queues and blocking back from key pinchpoints in particular the A1150 / Haughton Road roundabout.

Figure 25. Journey times – 2025 AM Peak.

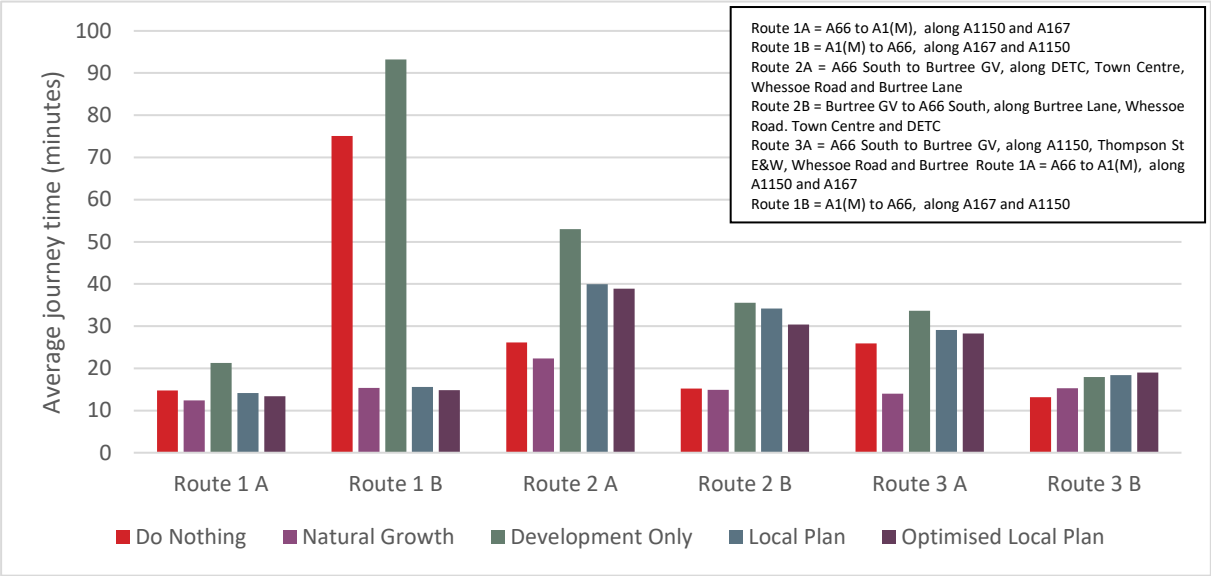


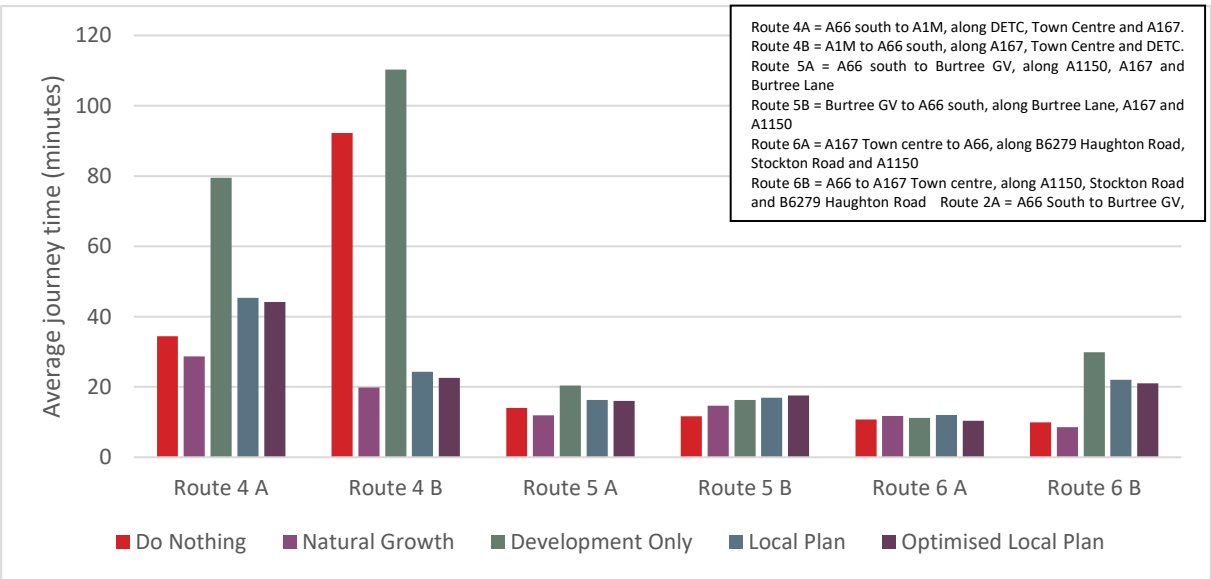


4.3.6 The introduction of mitigation measures results in a maintaining or bettering of journey times on most corridors compared to the scenarios without the plan and Tempro derived natural growth.

4.3.7 In the "Development Only" scenario there is a substantial increase in journey times on Route 1B, 3B, 5B and 6B. These stem from delays at Haughton Road / Whinfield Road / A1150, propagating along Whinfield Road and in the case of Route 1B further delays on the A167 North Road southbound.

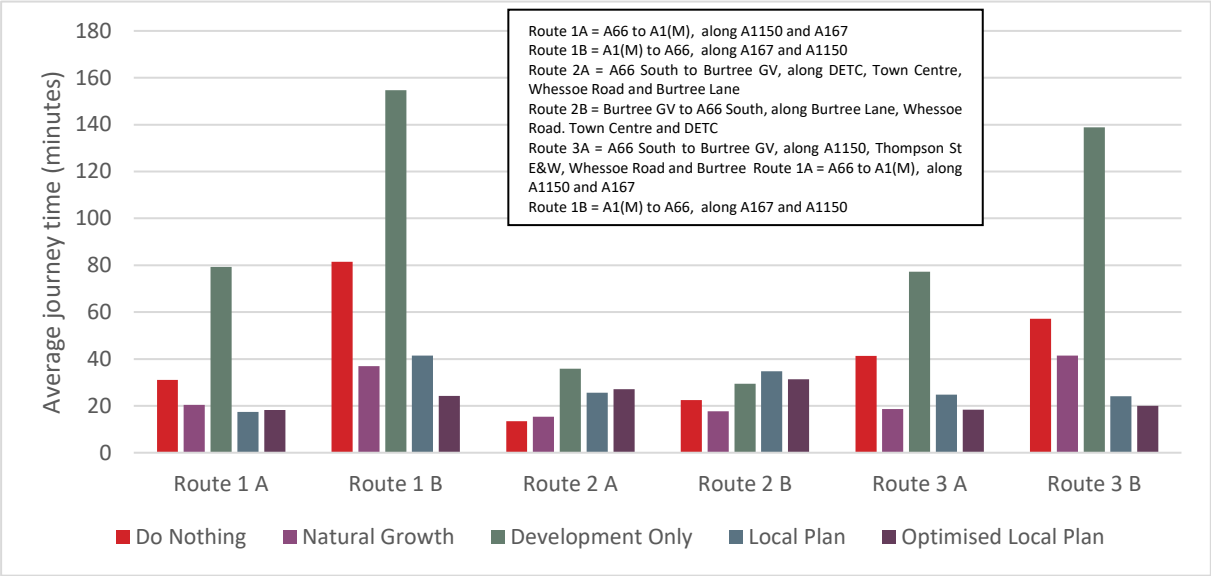
Figure 26. Journey times – 2025 PM Peak





4.3.8 Figure 26 shows that a similar pattern to the morning peak, albeit for different journey time routes, emerges in the evening peak. Routes 1B and 4B are impacted by delays on the A167 North Road southbound, while Route 4B is the A167 Durham Road northbound. Journey times in the mitigation scenario improve over the "Development Only" scenario though are sometimes worse than scenarios without development.

Figure 27. Journey times – 2030 AM Peak



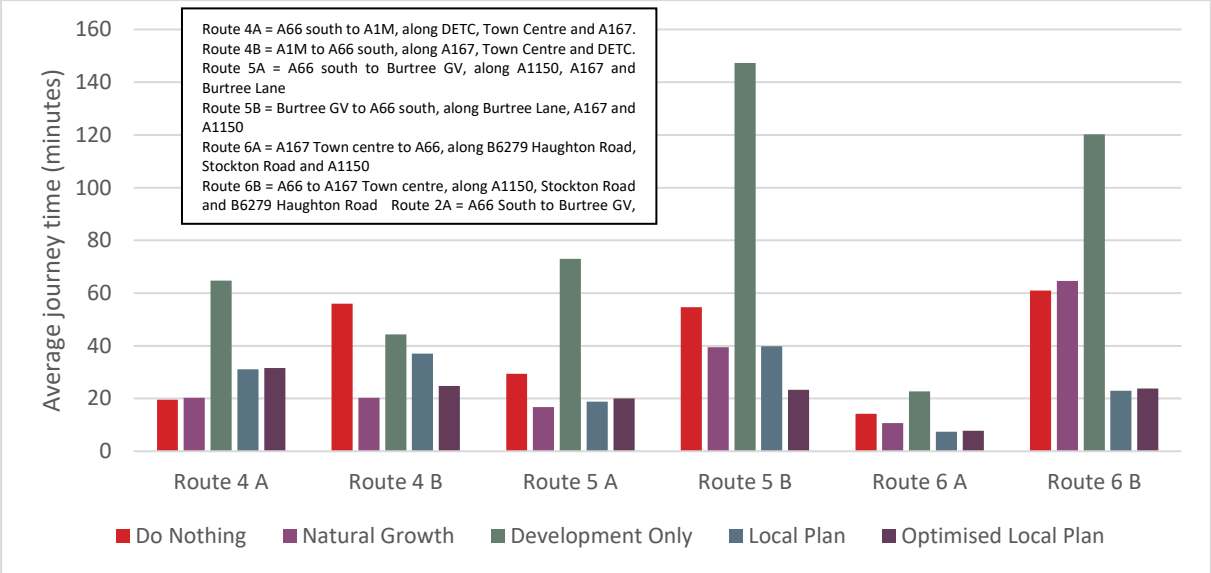
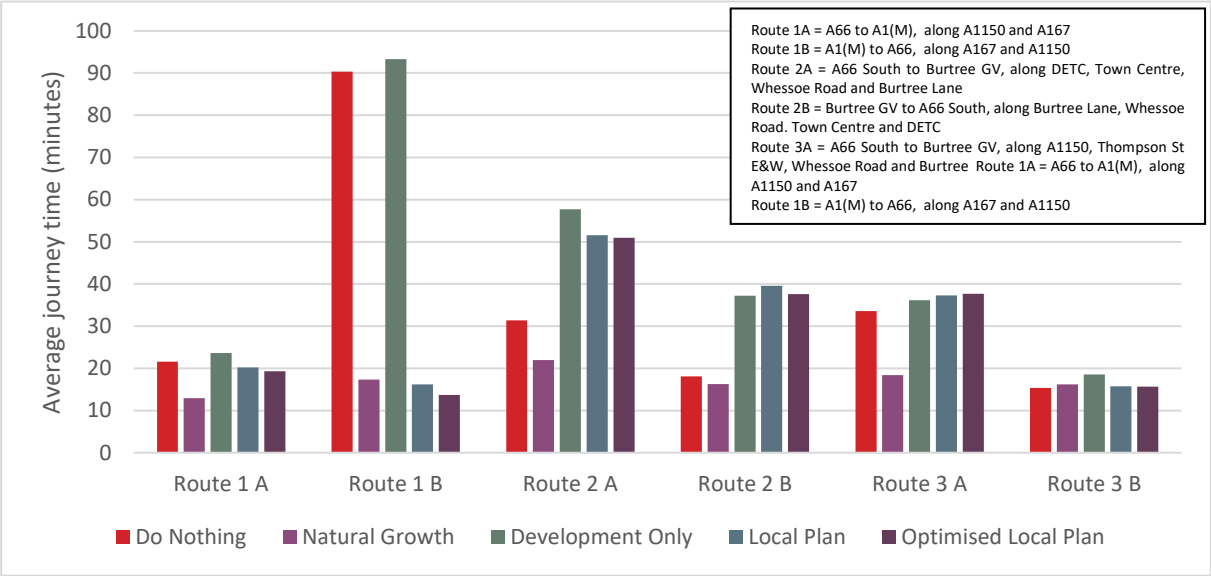
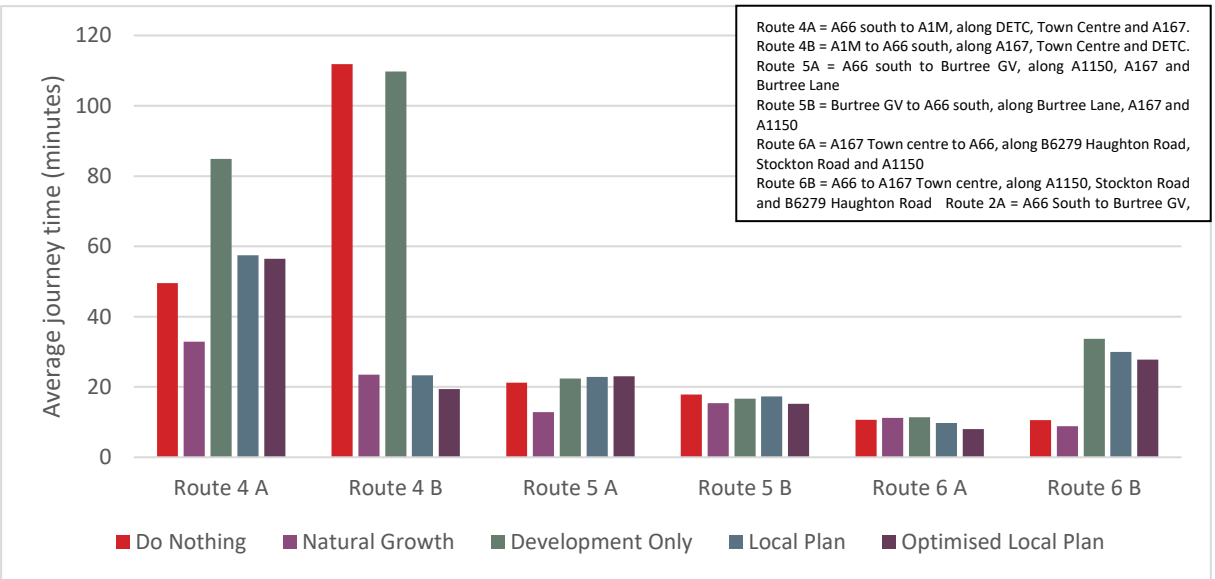


Figure 28. Journey times – 2030 PM Peak



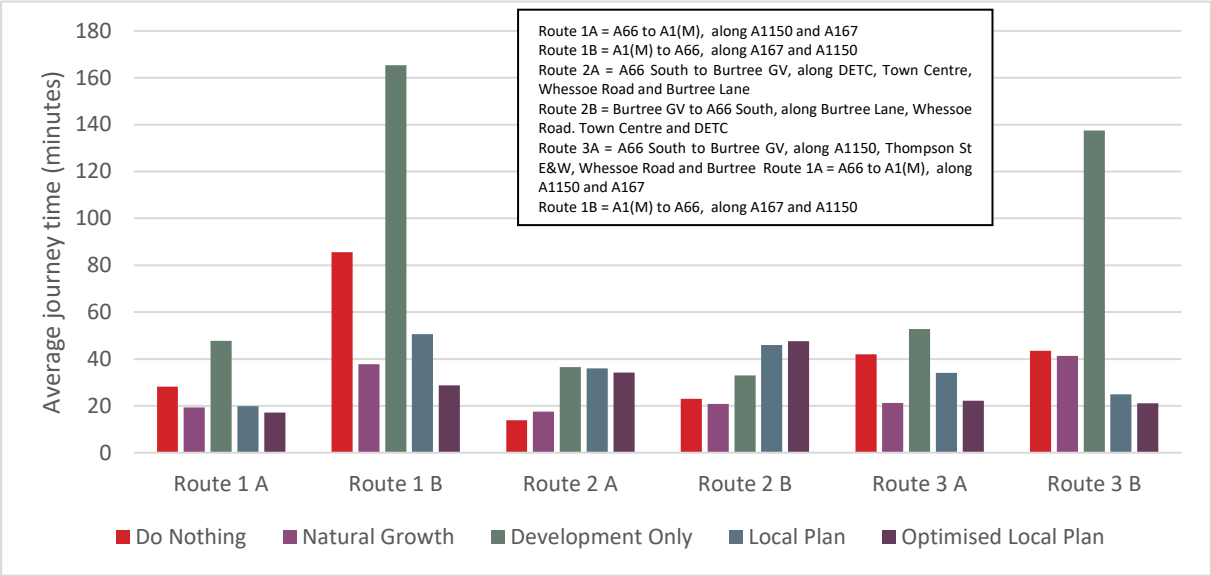


4.3.9 Figures 27 and 28 show that both the AM and PM Journey times improve through the mitigation measures compared with the natural growth scenario. There are still remaining journey time increases on Whessoe Road (route 2) and at isolated locations influencing other routes.

4.3.10 The analysis does demonstrate the significant improvements that the mitigations deliver across the network, improvements that enable the delivery of the local plan development that is in total over and above that of the natural growth scenario.

4.3.11 The majority of journey time routes are quicker in the mitigation scenario compared to those of the without mitigation (Development Only) scenario, with the remaining routes having broadly similar journey times.

Figure 29. Journey times – 2035 AM Peak



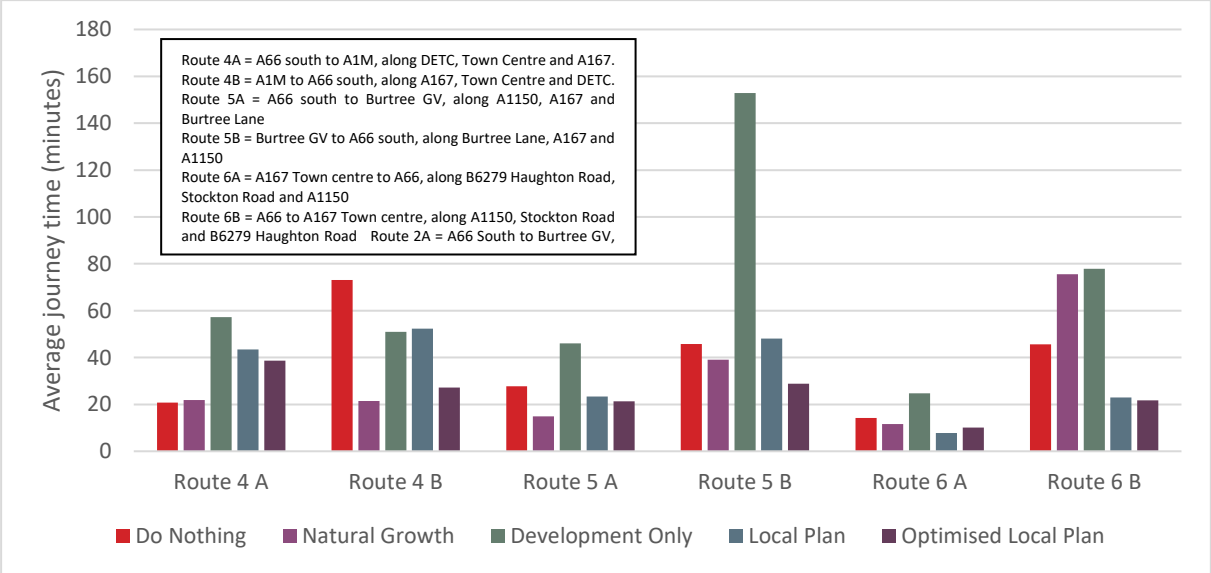
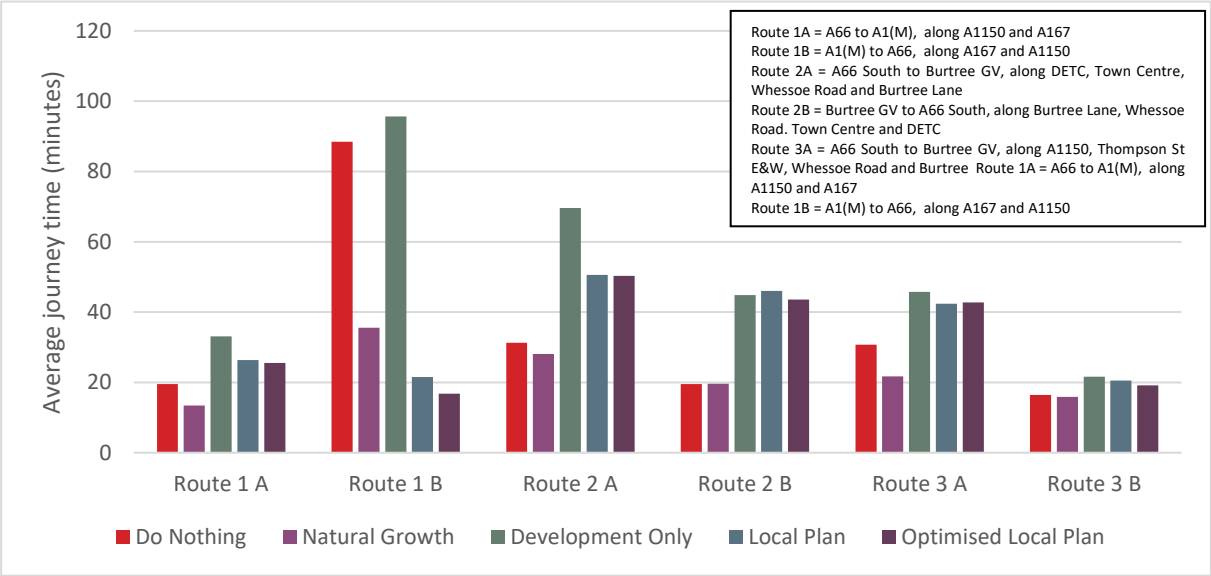
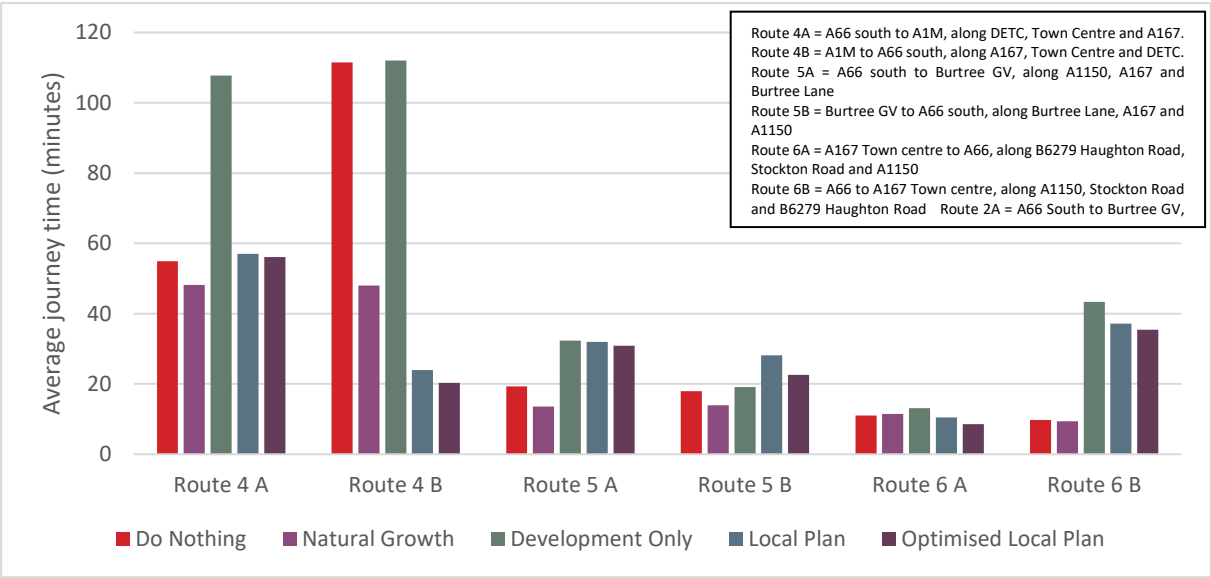


Figure 30. Journey times – 2035 PM Peak





4.3.12 Figures 29 and 31 shows The mitigation measures for 2035 result in journey times lower than for the natural growth scenarios with the exception of journey time routes using Whessoe Road in the morning peak.

4.3.13 In the evening peak, there are greater journey times that the natural growth scenario for the majority of routes reflecting the changing pattern of traffic through the local plan.

4.3.14 It has been demonstrated in earlier forecast years that these additional journey times are heavily influenced by specific junctions. Network management over the course of the plan period, and through the refresh of the local plan, is expected to generate additional localised mitigation measures.

4.4 Network Performance

4.4.1 This section provides analysis of network performance through Aimsun simulated density plots. Simulated density plots illustrate the average number of vehicles per km of road space. As such it is a useful indicator of road network performance though care should be taken during interpretation.

4.4.2 As simulated density is a function of the number of vehicles on a link expressed as vehicles per km, the length of the link influences the output value. Short links adjacent to signalised junctions are likely to be represented at a high density as queues due to red phases will inflate the density. A queue of the same length on a longer link will be a lower density. Nevertheless, the density plot provides a good indicator of network performance similar in output to the plots in the strategic modelling outputs.

4.4.3 For this section the results for the 'Development Only' and 'Optimised Local Plan & Mitigation' scenarios are presented to demonstrate the improvements in performance that the mitigations provide.

4.4.4 A full set of simulated density plots is provided in Appendix B.

4.4.5 The following four images below illustrate the simulated density for forecast year 2025, for the 'Development Only' and 'Optimised Local Plan & Mitigation' scenarios for morning and evening peak respectively.

Figure 31. Simulated Density – Morning Peak – 2025 Development Only scenario

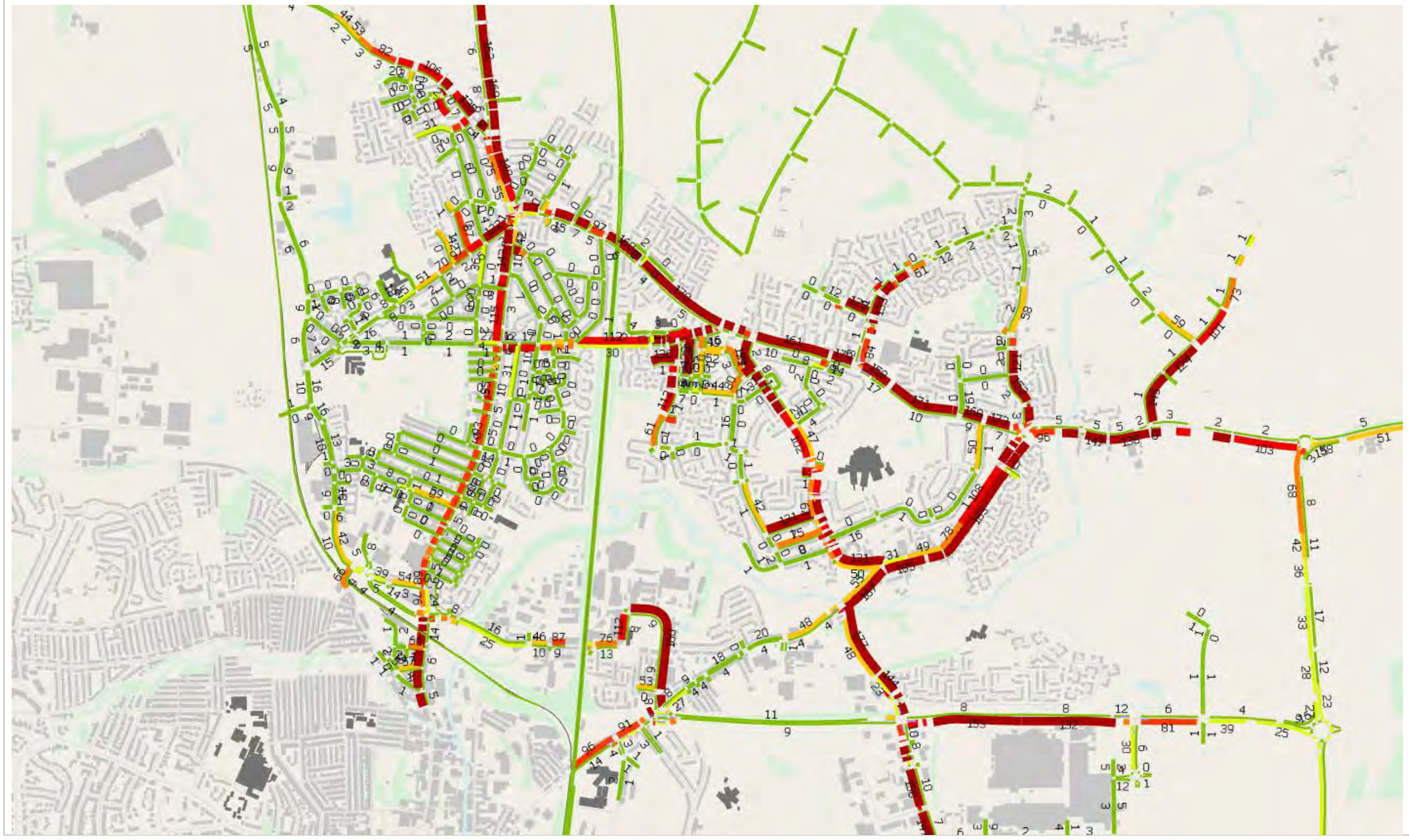


Figure 32. Simulated Density – Morning Peak – 2025 Optimised Local Plan & Mitigation scenario

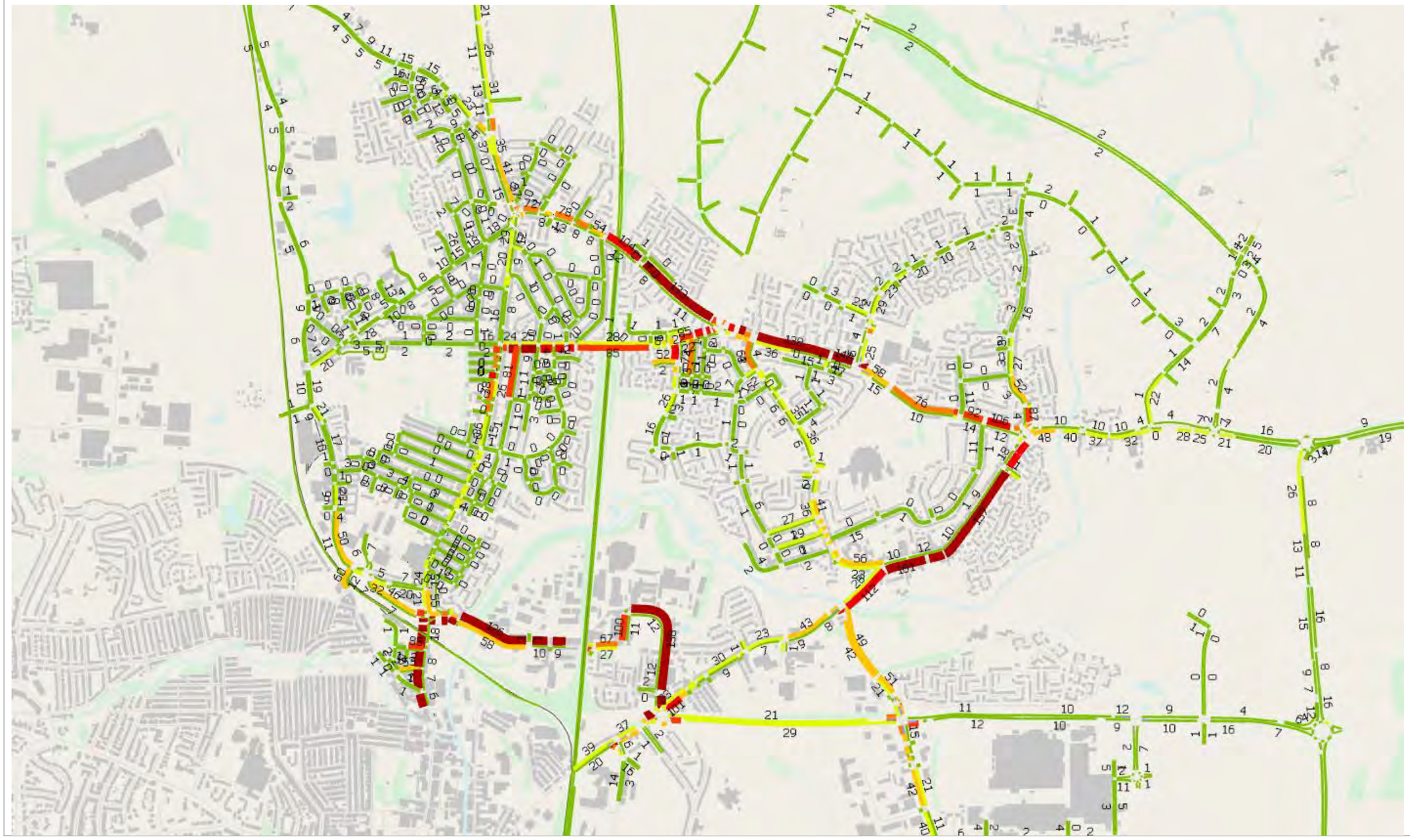


Figure 33. Simulated Density – Evening Peak – 2025 Development Only scenario

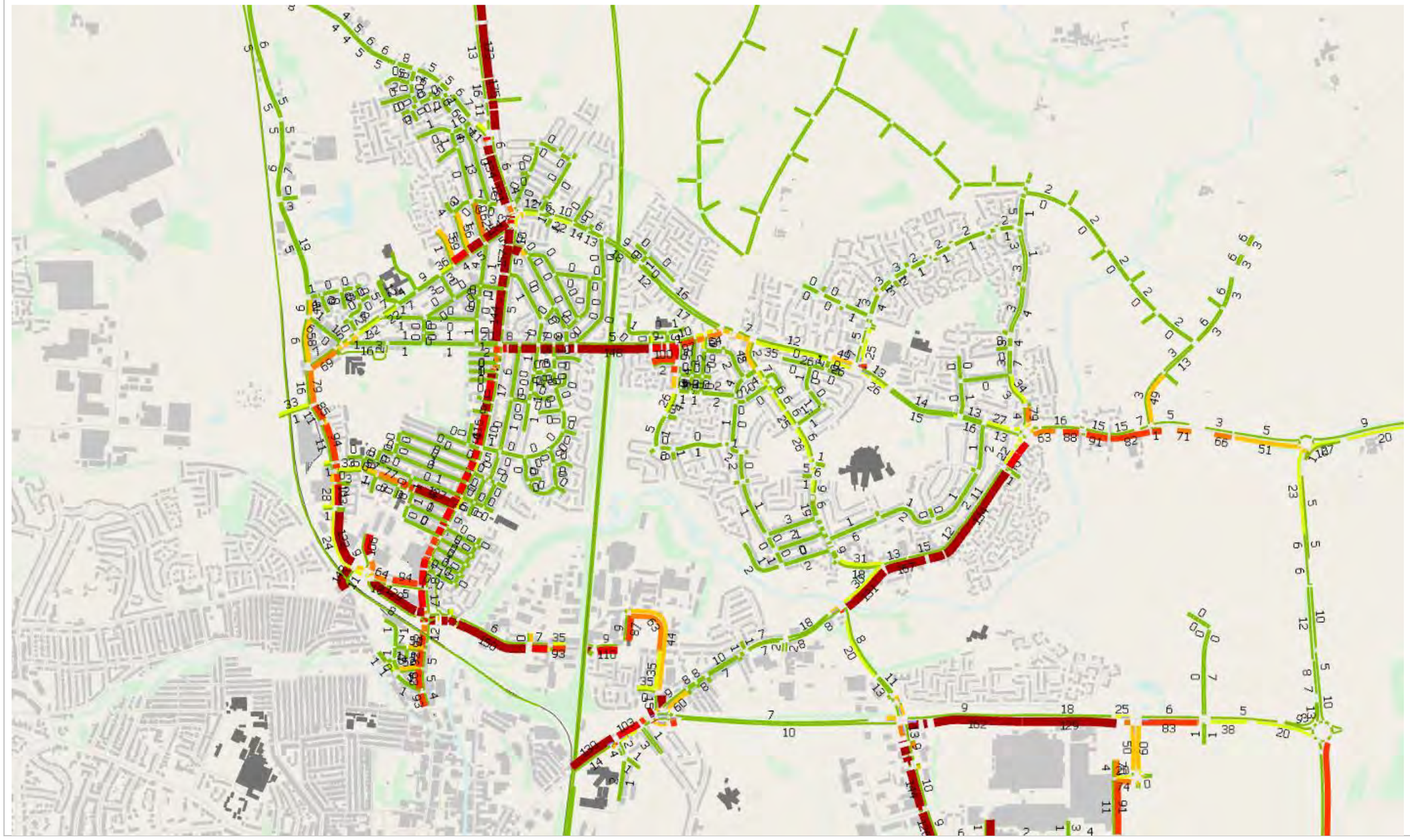
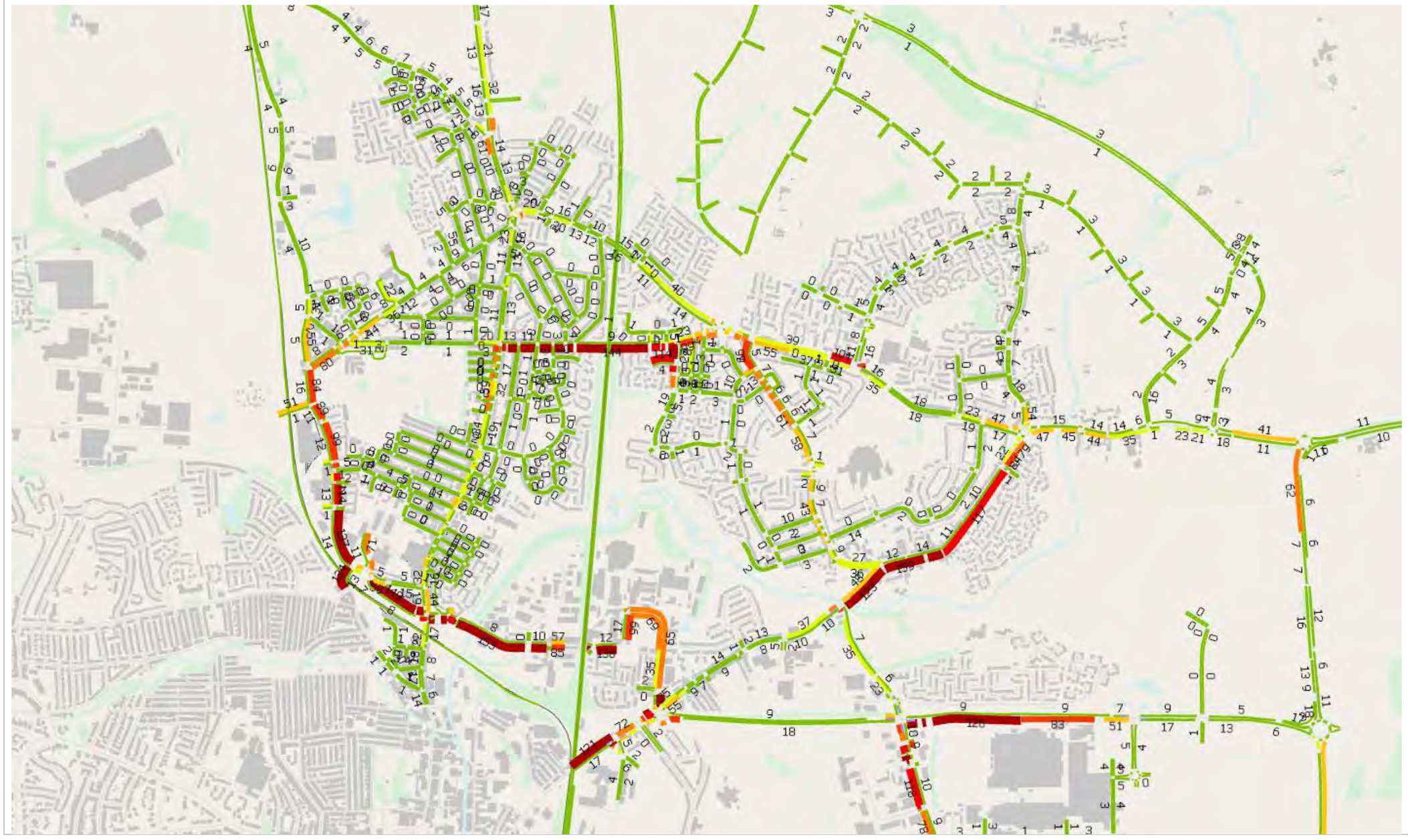


Figure 34. Simulated Density – Evening Peak – 2025 Optimised Local Plan & Mitigation scenario



4.4.6 In the 2025 morning peak with no mitigation the demand for travel arising from the local plan together with background traffic would present widespread congestion issues across north Darlington.

4.4.7 These issues arise from traffic blocking back from key pinchpoints, with mitigation measures identified for Tornado Way and Burtree Lane / A167 junction providing additional capacity sufficient to relieve the network in the morning peak.

4.4.8 In the evening peak major issues arise of the A167 corridor northbound and at Burtree Lane / A167 junction in the without mitigation scenario.

4.4.9 The proposed scheme at this location provides significant relief to this corridor.

4.4.10 A further issue in the without mitigation scenario is congestion at the junction of Haughton Road / McMullan road blocking back to the A1150.

4.4.11 Mitigation measures along Tornado Way provide the addition capacity to ensure that blocking back does to the A1150 does not occur though the junction of Haughton Road / McMullan Road remains close to operational capacity.

4.4.12 A key mitigation is the Skerningham Link Road that in 2025 provides an eastern access to the development from the A66 without over burdening the A1150 / Haughton Road roundabout.

4.4.13 An issue remains on Whessoe Road corridor in the evening peak that may require further mitigation to be identified.

4.4.14 The following four images below illustrate the simulated density for forecast year 2030, for the 'Development Only' and 'Optimised Local Plan & Mitigation' scenarios for morning and evening peak respectively.

Figure 35. Simulated Density – Morning Peak – 2030 Development Only scenario

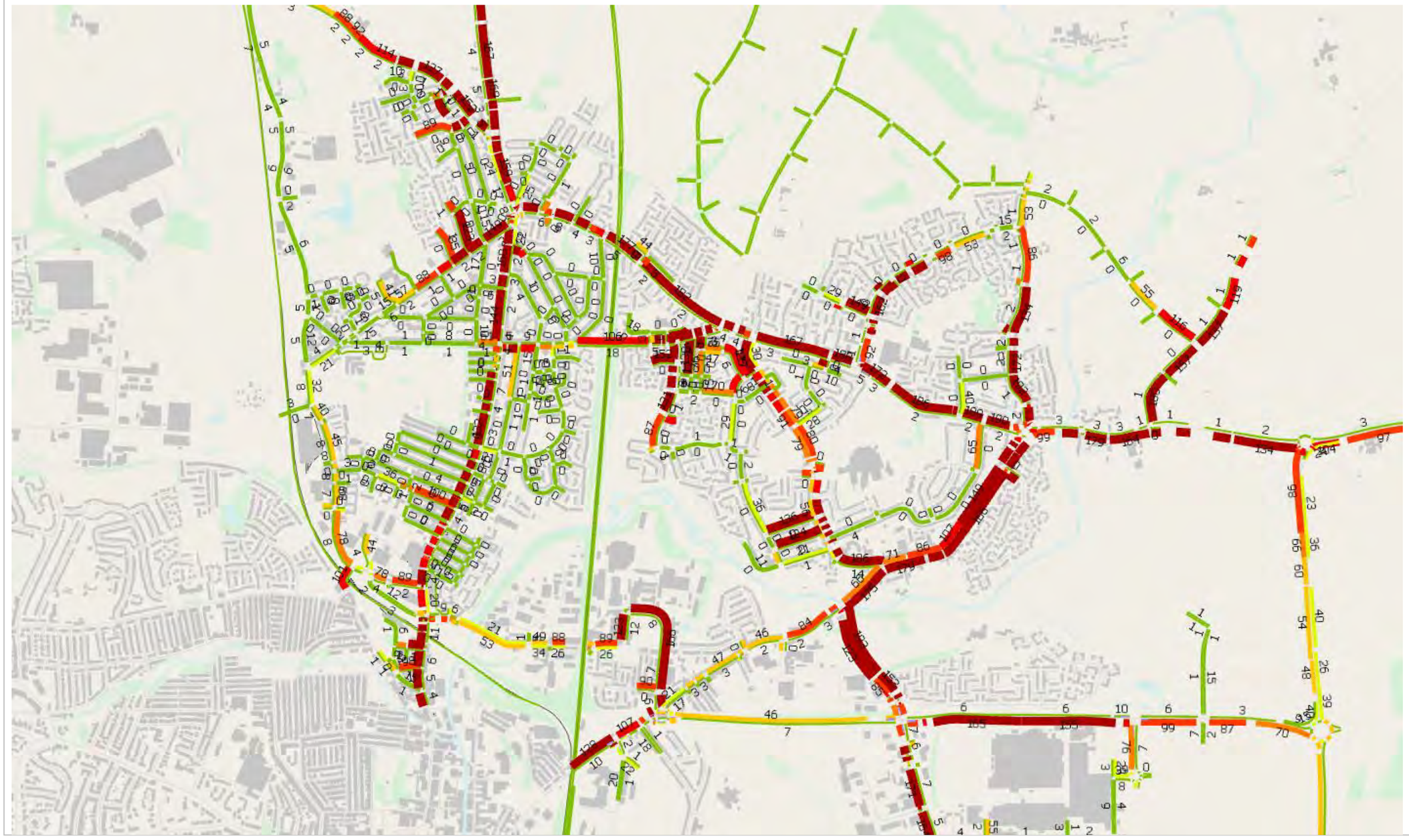


Figure 36. Simulated Density – Morning Peak – 2030 Optimised Local Plan & Mitigation scenario

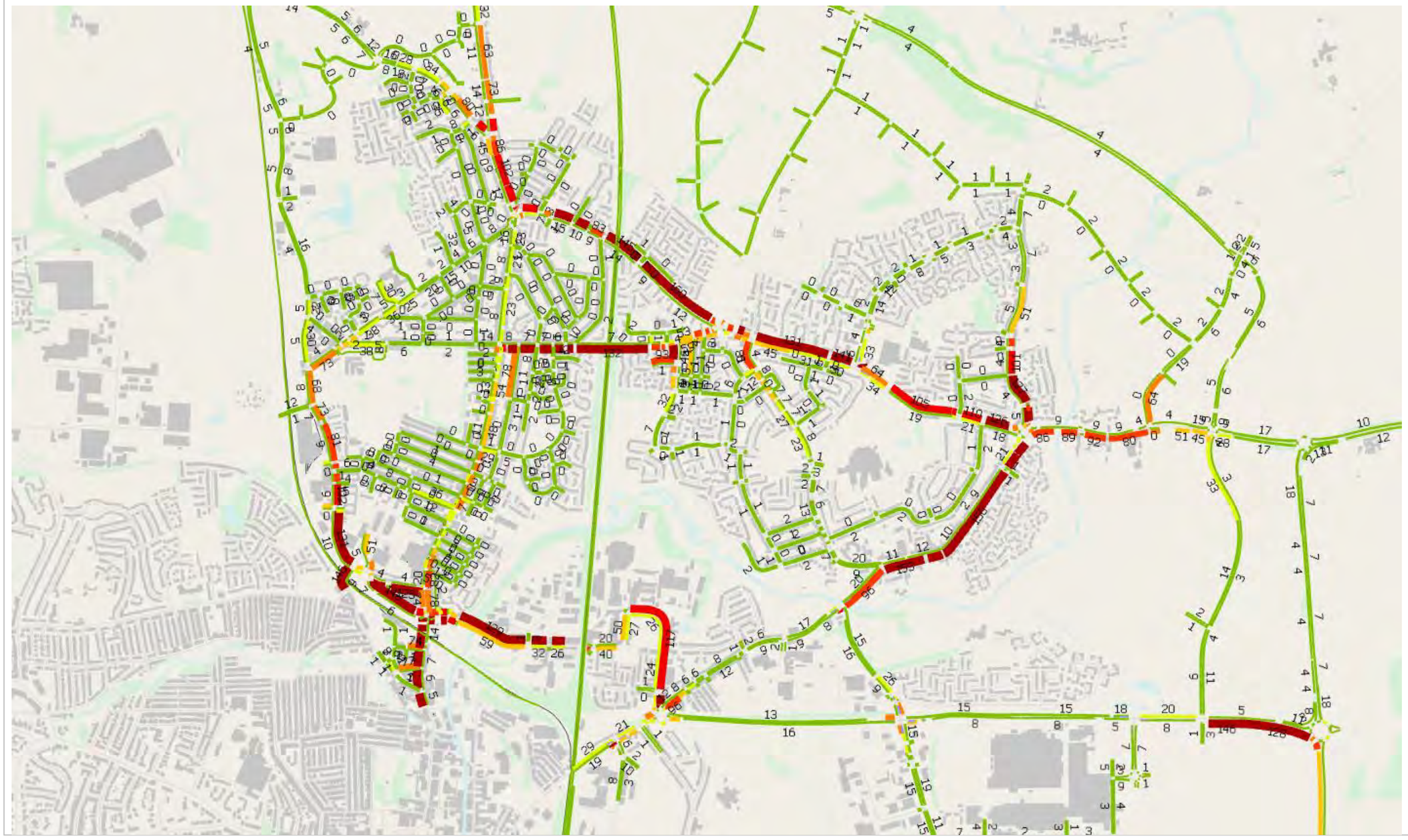


Figure 37. Simulated Density – Evening Peak – 2030 Development Only scenario

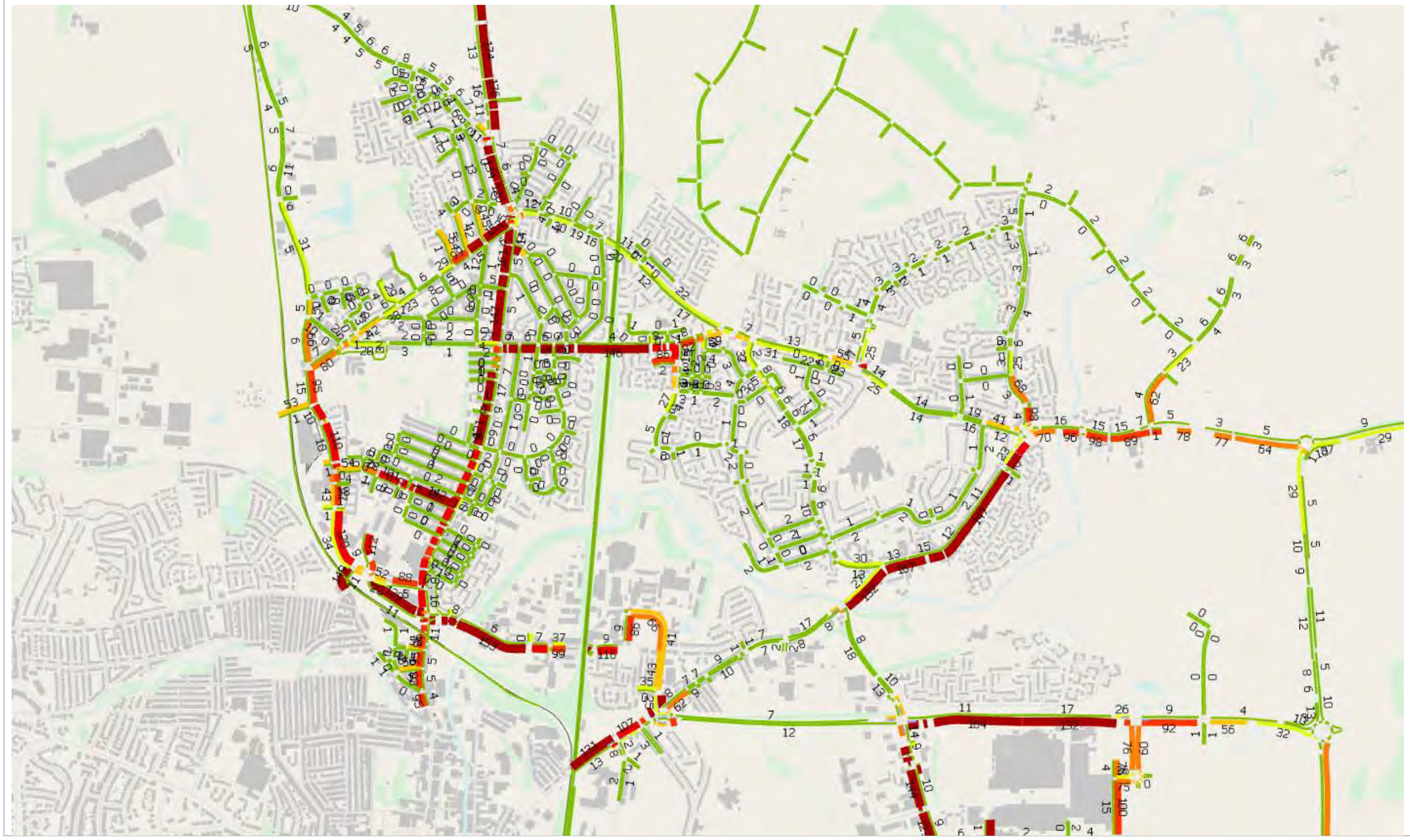
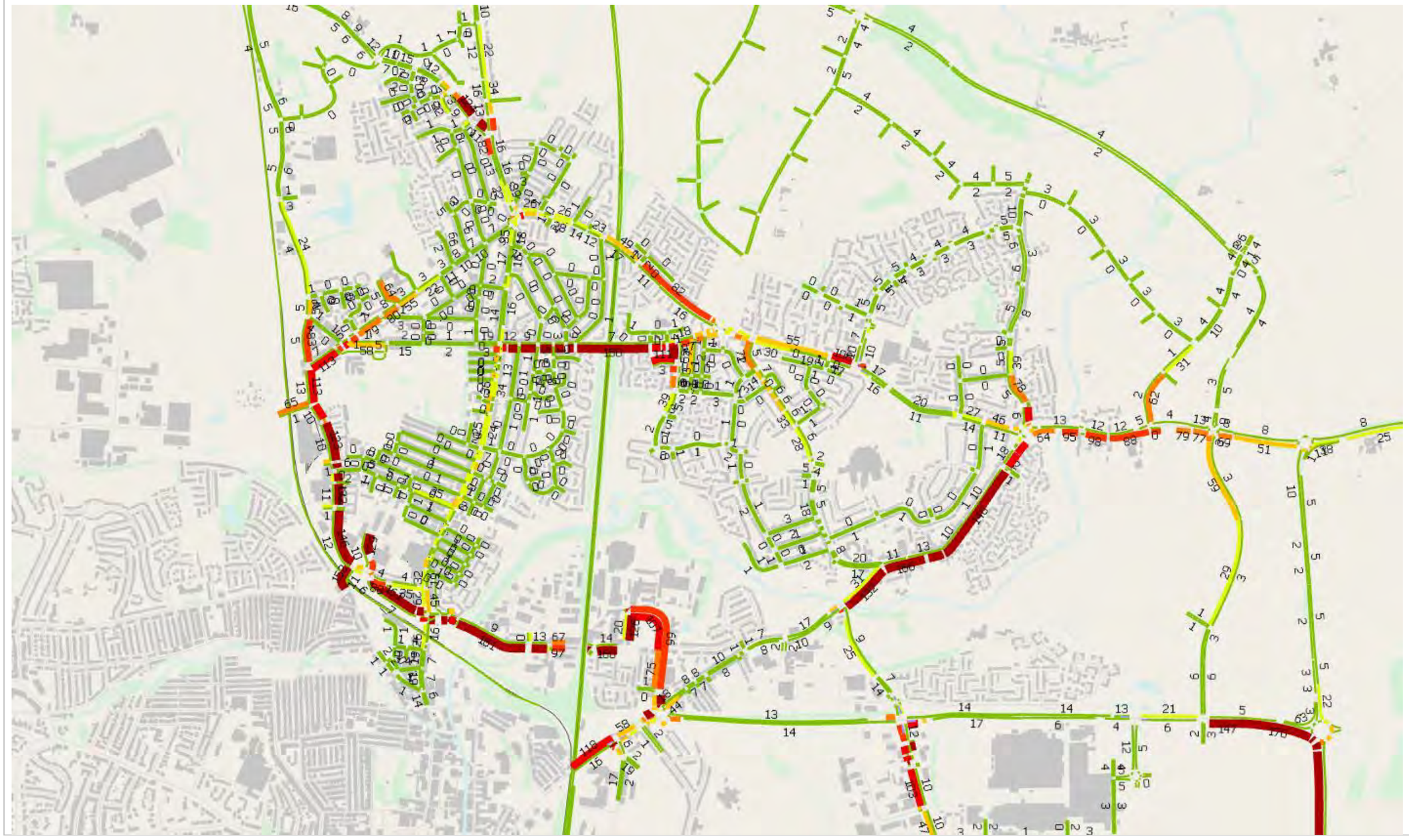


Figure 38. Simulated Density – Evening Peak – 2030 Optimised Local Plan & Mitigation scenario



4.4.15 With no mitigation measures 2030 exhibits widespread congestion and corresponding journey time unreliability in both time periods.

4.4.16 Mitigation measures delivered by 2030 provide significant relief with network performance returning to 2025 levels.

4.4.17 The Skerningham Link Road provides the capacity to allow for traffic to reroute away from the A1150 Haughton Road junctions, particularly for the additional vehicles from Skerningham Garden Village accessing the A66 corridor.

4.4.18 The following four images below illustrate the simulated density for forecast year 2035, for the 'Development Only' and 'Optimised Local Plan & Mitigation' scenarios for morning and evening peak respectively.

Figure 39. Simulated Density – Morning Peak – 2035 Development Only scenario

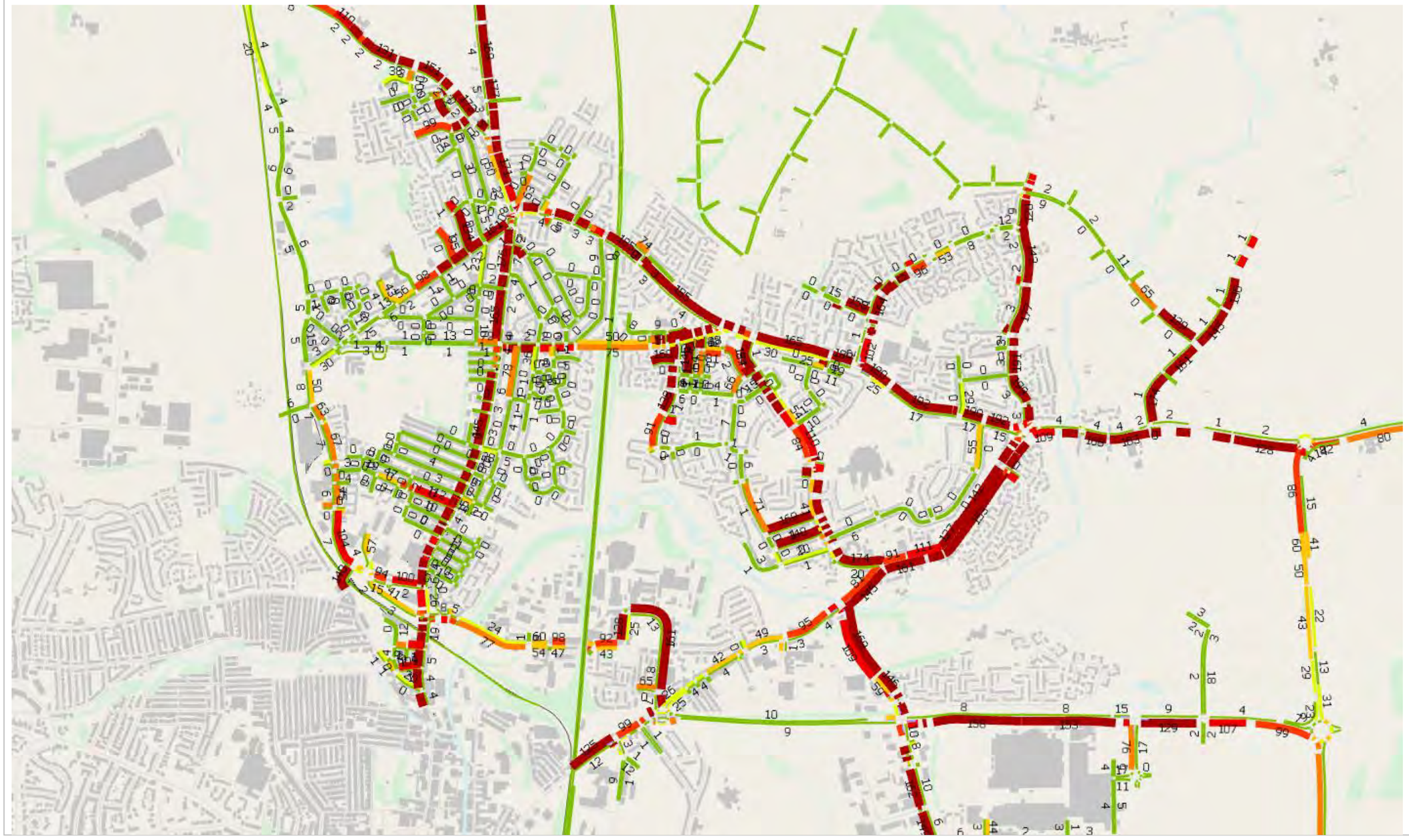


Figure 40. Simulated Density – Morning Peak – 2035 Optimised Local Plan & Mitigation scenario

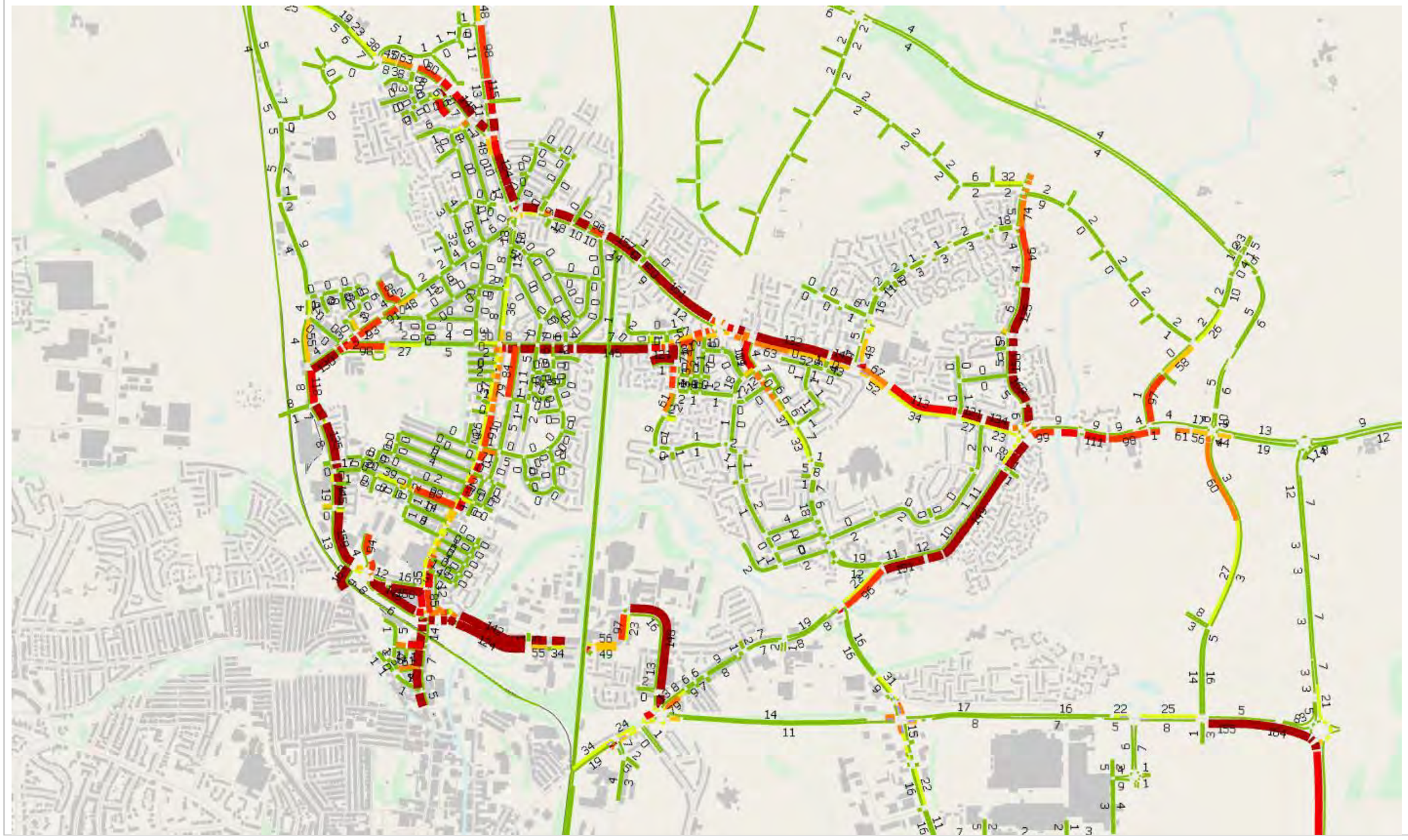


Figure 41. Simulated Density – Evening Peak – 2035 Development Only scenario

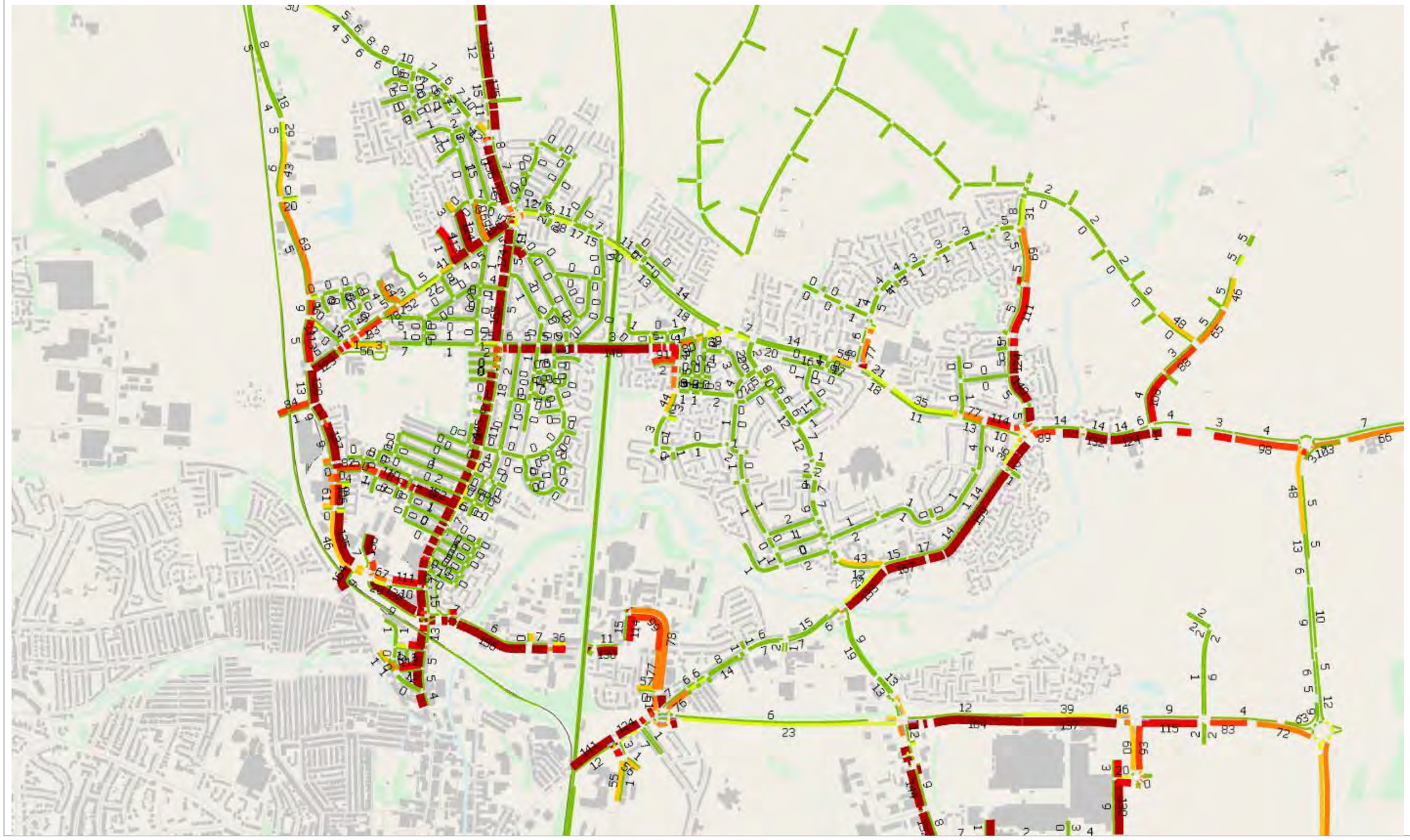
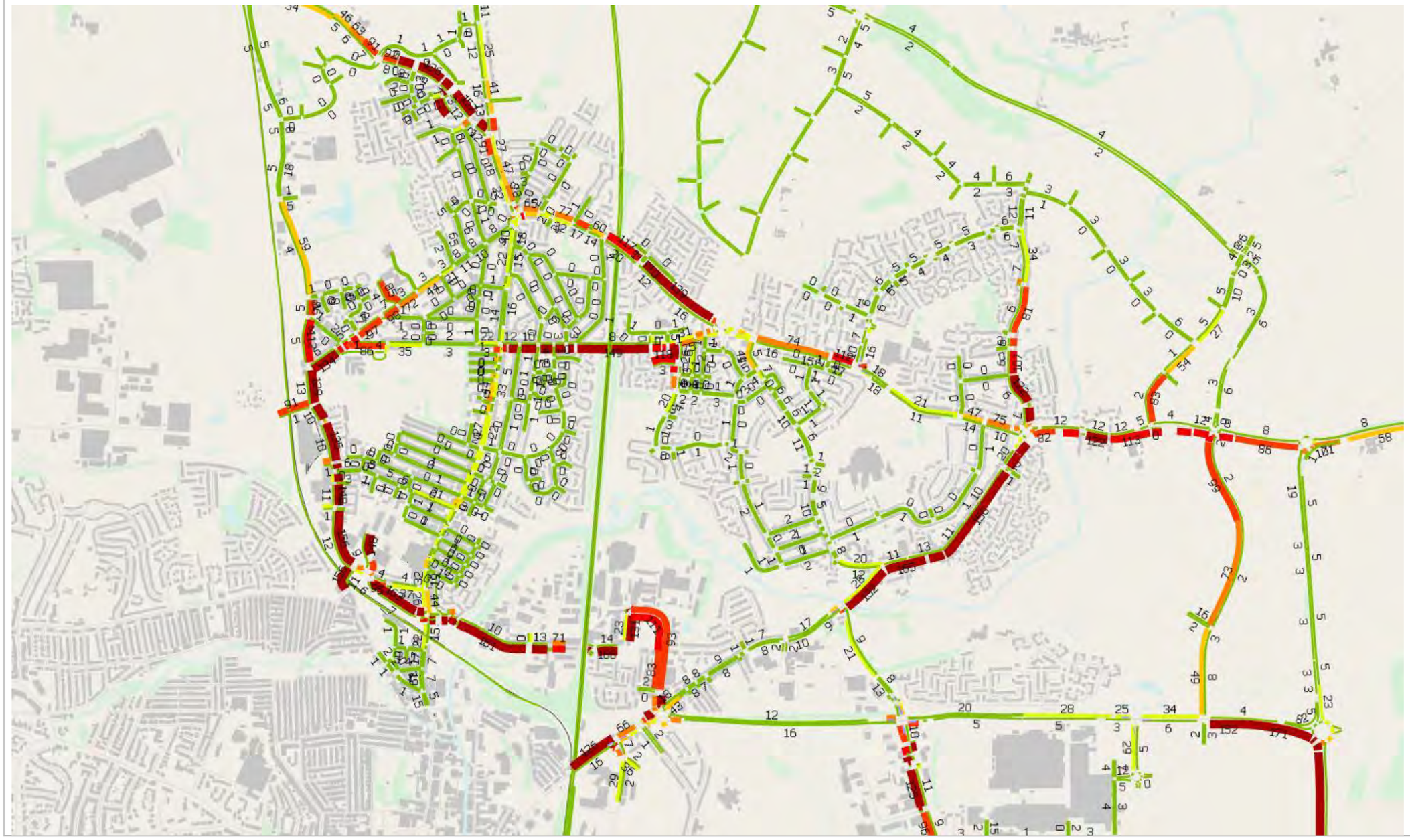


Figure 42. Simulated Density – Evening Peak – 2035 Optimised Local Plan & Mitigation scenario



4.4.19 By 2035 network performance even with the identified mitigations in place is beginning to deteriorate across northern Darlington, with issues on the A1150 corridor and Haughton Road corridor.

4.4.20 Although no further mitigations for this period have been specified within the model, additional capacity could be provided for example:

- If the Darlington Northern Relief Road came forward in the Local Plan period– providing additional capacity for A1150 corridor and strategic movements using the A66 corridor;
- Burtree Link Road to enable more usage of the Skerningham Link Road– providing additional capacity for A1150 corridor;
- UTC active management of key junctions across Darlington, particularly Tornado Way and Haughton Road corridors; and
- Further specific junction improvements.

4.4.21 While performance is deteriorating, it should be noted that these are longer term forecasts and if additional mitigation options should prove necessary they can be introduced through the review of the plan.

4.5 Junction Operation

4.5.1 This section provides a comparison of the junction operation between the No Development, Natural Growth (Tempro), Development Only and optimised Local Plan & Mitigation scenarios, using screenshots obtained from the Aimsun model scenarios. The analysis focuses on the following junctions:

- A167 North Road / A1150 Salters Lane North mini roundabout;
- A1150 Whinfield Road / Stockton Road / Barmpton Lane roundabout; and
- A167 North Road / Bonomi Way / Albert Road signalised junction.

4.5.2 These were identified from the models as the main locations within the modelled network where the development traffic leads to a large increase in congestion.

4.6 2020 Forecast Year Scenario

4.6.1 Given the impact of Covid 19 on 2020 the impact on the network has been significantly less than expected. Nevertheless the planned mitigation measures for delivery in 2020 scenarios are shown below. All these measures have been included within the strategic modelling. Detailed analysis on the network is only considered from 2025.

Table 9. 2020 Mitigation Measures

2020 MITIGATION MEASURES	
E1	**Haughton Road Through-about Improvements**
E2	**McMullen Road Junction Improvements**
E3	Lingfield Way to Tornado Way Link Road
E4	McMullen Road / Yarm Road Roundabout
E5	**Lingfield Way Traffic Signal Control Junction**
E6	A66 Morton Palms Roundabout Improvements
E7	Ingenium Parc Phase 1
NW1	A68 / Rotary Way Roundabout Improvements
NW2	West Park / Newton Lane Link Road
NW3	Cockerton Roundabout Improvements
NW4	Woodland Road Roundabout Improvements

4.7 2025 Forecast Year Scenario

4.7.1 Mitigation measures, in addition to those planned for 2020, included in the 2025 scenarios are shown below.

Table 10. 2025 Mitigation Measures

2025 MITIGATION MEASURES	
E8	Redhall Hall/ Burdon Hill Link Road
E9	Burdon Hill Northern Access
E10	A66 / Little Burdon Improvements
E11	Tornado Way Junction Improvements
E12	Ingenium Parc Phase 2
N1	**A167 / Burtree Lane Junction Improvements**
N2	**A1150 / Thompson Street East Roundabout Improvements**

N3	**Skerningham Link Road**
NW5	Faverdale Link Road Phase 1

Figure 43. A167 North Road / A1150 Salters Lane North – 2025 AM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.7.2 A prominent congestion pinchpoint identified in the strategic modelling assessment was the section of the A167 between Burtree Lane and the A1150 Salters Lane corridor, as illustrated through the simulation model in the above Figure 43.

4.7.3 In the AM Peak, there is significant congestion in all scenarios without mitigation. This is greater for the development scenario with the local plan but no mitigation demonstrating the need for the Burtree Lane improvement.

4.7.4 With this improvement, the operation of this section of the network improves considerably.

Figure 44. A167 North Road / A1150 Salters Lane North – 2025 PM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.7.5 Figure 44 shows in the PM Peak, a similar pattern is observed with significantly reduction in queuing on arms with the exception of the heavily trafficked A167 corridor out of Darlington.

Figure 45. A1150 Whinfield Road / Stockton Road / Barmpton Lane – 2025 AM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.7.6 A further congestion pinchpoint identified in the strategic modelling assessment was the section of the A1150 at its junction with Haughton Road.

4.7.7 Figure 45 shows In the AM Peak, with either Tempro or Local Plan traffic but no mitigation the queuing extends on all arms at this junction, in part due to congestion along the Haughton Road corridor.

4.7.8 Blocking back of traffic on the Haughton Road corridor into the A1150 Whinfield Road / Stockton Road / Barmpton Lane roundabout substantially reduces the operational performance of the network.

4.7.9 Improvements to the Tornado Way / Haughton Road roundabout improves conditions on the Haughton Road corridor providing relief to the A1150 Whinfield Road / Stockton Road / Barmpton Lane roundabout, enabling development access to the Skerningham site in particular via Barmpton Lane.

Figure 46. A1150 Whinfield Road / Stockton Road / Barmpton Lane – 2025 PM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.7.10 Figure 46 shows that the tidal nature of traffic means there is no blocking back on Haughton Road in the PM peak, thus conditions in all scenarios do not approach those of the corresponding AM peak.

Figure 47. A167 North Road / Bonomi Way / Albert Road – 2025 AM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.7.11 Figure 47 shows that in 2025 this junction is busy and approaching capacity. Improvements at the Tornado Way / Haughton Road roundabout draw more traffic along Cleveland Street with the capacity of the shuttle working section under the East Coast

Main Line close to being reached. The model forecasts around 1250 two way trips using this section in both morning and evening peak hours.

Figure 48. A167 North Road / Bonomi Way / Albert Road – 2025 PM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.7.12 Figure 48 shows In the PM the traffic departing Darlington results in congestion along the A167 corridor that at times blocks back into this junction reducing throughput.

4.7.13 With mitigations elsewhere, the junction performance here is improved but as with the morning peak, the capacity of the Cleveland Street shuttle working section is close to being reached.

4.8 2030 Forecast Year Scenario

4.8.1 Mitigation measure, in addition to those planned for 2025, included in the 2030 scenarios are shown below.

Table 11. 2030 Mitigation Measures

2030 MITIGATION MEASURES	
E13	**A66 Morton Palms to Little Burdon Dualling;**
E16	Ingenium Parc Phase 3

E17	Burdon Hill Link
NW6	Newton Lane to Staindrop Road Link Road
NW7	Staindrop Road to A67 Coniscliffe Link Road
NW8	Faverdale Link Road Phase 2
NW9	A68 Burtree Lane Roundabout

Figure 49. A167 North Road / A1150 Salters Lane North – 2030 AM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.8.2 Figure 49 shows that the operation of the A167 / A1150 Salters Lane North area is broadly similar between 2025 and 2030 in all scenarios, with the proposed mitigation able to accommodate the increased traffic in the 2030 morning peak.

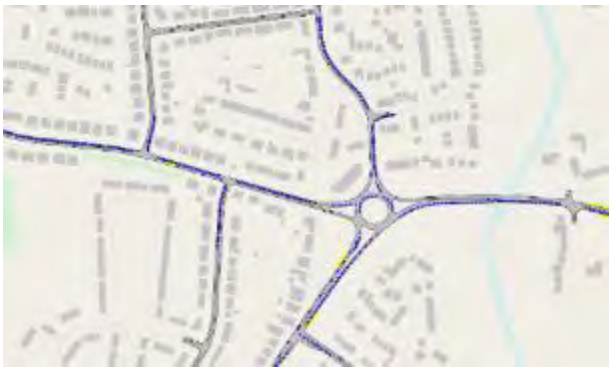
Figure 50. A167 North Road / A1150 Salters Lane North – 2030 PM Peak

	
Do Nothing	Natural Growth
	
Development Only	Optimised Local Plan & Mitigation

4.8.3 Figure 50 shows the proposed improvements at Burtree Lane release the delays and allow the network to operate effectively with only localised and short-lived queuing on the A167 northbound.

Figure 51. A1150 Whinfield Road / Stockton Road / Barmpton Lane – 2030 AM Peak

	
Do Nothing	Natural Growth



Development Only

Optimised Local Plan & Mitigation

Figure 52. A1150 Whinfield Road / Stockton Road / Barmpton Lane – 2030 PM Peak

Do Nothing

Natural Growth

Development Only

Optimised Local Plan & Mitigation

4.8.4 Figure 52 shows that while the outcomes are broadly similar in 2030 to the earlier 2025 scenario, the network is beginning to show signs of stress in the mitigation scenario.

4.8.5 As for the without mitigation case this is due to a mixture of the usage of the A1150 for east<->west traffic and also the congestion on Haughton Road blocking back into the junction.

4.8.6 The former could be addressed by greater use of the Skerningham link road and the latter could be addressed through the additional capacity released through UTC based operation of signalised junctions on the Tornado Way corridor.

Figure 53. A167 North Road / Bonomi Way / Albert Road – 2030 AM Peak

	
Do Nothing	Natural Growth
	
Development Only	Optimised Local Plan & Mitigation

4.8.7 In 2030, this junction operates within capacity for no development / Tempro scenarios and approaches capacity with the local plan scenario in the morning peak.

4.8.8 Mitigations elsewhere, draw traffic along Cleveland Street leading to the capacity of the shuttle-worked section being reached in 2030 with at some point the potential for blocking back to the A167 / Bonomi Way / Albert Road junction.

Figure 54. A167 North Road / Bonomi Way / Albert Road – 2030 PM Peak

	
Do Nothing	Natural Growth
	
Development Only	Optimised Local Plan & Mitigation

4.8.9 In the evening peak the junction performs much better in the mitigation scenario as the additional capacity at the junction relives the A167 northbound traffic departing the town centre.

4.8.10 The Development Only screenshots evidences that the problems at the junction mainly arise from local plan traffic heading north.

4.9 2035 Forecast Year Scenario

4.9.1 No additional mitigations are currently planned for the 2030 to 2035 period at this stage but this will be subject to the 5 year review process od the Local Plan.

Figure 55. A167 North Road / A1150 Salters Lane North – 2035 AM Peak

	
Do Nothing	Natural Growth
	
Development Only	Optimised Local Plan & Mitigation

Figure 56. A167 North Road / A1150 Salters Lane North – 2035 PM Peak

	
Do Nothing	Natural Growth

Development Only

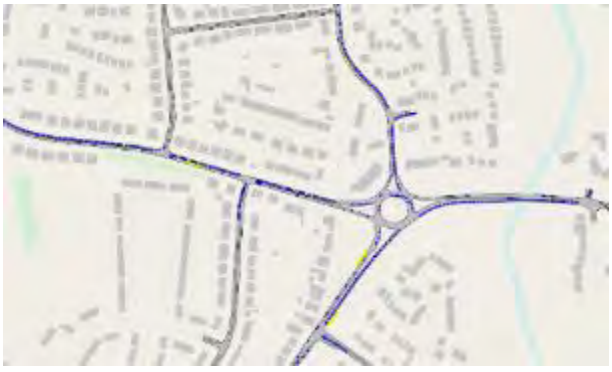
Optimised Local Plan & Mitigation

4.9.2 Figures 55 and 56 demonstrate that the proposed mitigation measures are effective at the A167 North Road / A1150 Salters Lane North junction through the 2035 plan period.

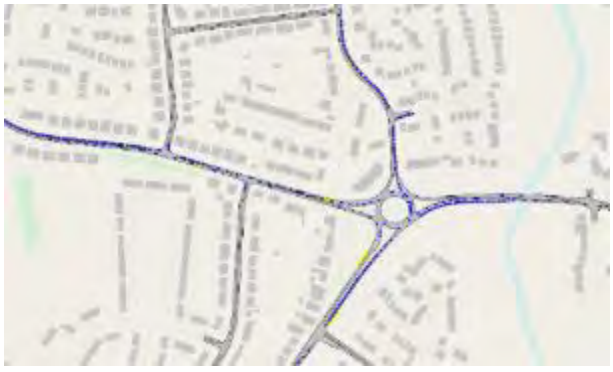
Figure 57. A1150 Whinfield Road / Stockton Road / Barmpton Lane – 2035 AM Peak

Do Nothing

Natural Growth

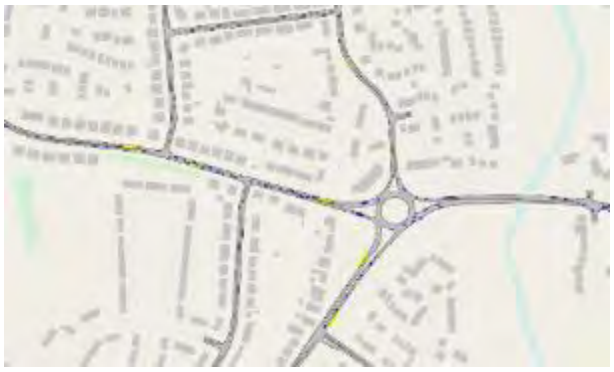


Development Only



Optimised Local Plan & Mitigation

Figure 58. A1150 Whinfield Road / Stockton Road / Barmpton Lane – 2035 PM Peak

	
Do Nothing	Natural Growth
	
Development Only	Optimised Local Plan & Mitigation

4.9.3 Figures 57 and 58 above reinforce that additional measures may be required to address the A1150 corridor for the period from 2030 through to 2035.

4.9.4 Whilst not dependent, measures such as the strategic northern relief road, enhancement of the Skerningham link road and UTC-based active management of Haughton Road and Tornado Way have been identified as potential enhancements to investigate over the plan period that could enhance network performance.

4.9.5 A further consideration is the potential for traffic right turning from the A1150 to Haughton Road to access job opportunities south of Tornado Way. The provision of the Burdon Hill Link road will enable drivers to continue along the A1150 and then turn right and head south to the opportunities via Lingfield Way.

4.9.6 The Aimsun model has not been developed to include this option and so the results above for 2035 represent a worst case with regard to right turning.

Figure 59. A167 North Road / Bonomi Way / Albert Road – 2035 AM Peak

	
Do Nothing	Natural Growth
	
Development Only	Optimised Local Plan & Mitigation

Figure 60. A167 North Road / Bonomi Way / Albert Road – 2035 PM Peak

	
Do Nothing	Natural Growth

	
Development Only	Optimised Local Plan & Mitigation

4.9.7 Figures 59 and 60 show that additional measures may be required to address the Cleveland Road shuttle-worked section for the period from 2030 through to 2035.

4.9.8 Increased congestion is expected at the shuttle worked section under the East Coast Main Line. Measures such as providing additional cross railway capacity elsewhere and UTC-based active management of the shuttle worked section have been identified as potential solutions to investigate over the plan period.

5. CONCLUSIONS

5.1.1 SYSTRA has undertaken microsimulation modelling using the North Darlington Aimsun model, in order to assess the impact that traffic generated by Darlington Local Plan land allocations will have on the local road network. The following scenarios have been analysed up to 2035:

- Do Nothing: No additional homes or jobs are created post 2015 and no schemes are delivered;
- Natural Growth: Growth calculated from assumed TEMPro growth factors as per standard Transport Application methodology;
- Development Only: The impact of the developments included within the local plan, with no mitigation schemes; and
- The Local Plan: The impact of the development and the associated infrastructure based mitigation schemes that are included in the local plan.
- A fifth scenario of the local plan with additional signal optimisation on Tornado Way / Haughton Road / McMulland Road triangle to represent ongoing network management.

5.1.2 The quantum of developments considered as part of the local plan is shown in **Table 9**:

Table 12. Darlington Local Plan Development Quantums 2020-2035

PLAN PERIOD	2020	2025	2030	2035
Dwellings	2,728	6,116	9,214	11,810
Jobs	5,119	7,465	8,763	9,950

5.1.3 This development quantum is taken from the development database which provides an annual development profile for individual sites. This allows for a 20% buffer of the housing land supply, which is required by NPPF to ensure choice and competition in the market and to recognise that some sites may not come forward as quickly as anticipated. The modelled scenarios are therefore extremely robust and allow significant headroom in terms in terms of the local plan housing and employment targets.

5.1.4 The identified sites include headroom over and above the housing need for Darlington ensuring that the results presented in this report are robust.

5.1.5 A series of mitigation schemes have been identified by Darlington Council for introduction on the network throughout the lifespan of the current plan. These have been identified through a mixture of measures required to support the delivery of individual planning applications as well as more strategic interventions. These have been used in the assessment of the 'with mitigation' scenarios.

5.1.6 The microsimulation results show that:

- Mitigation measures at Haughton Road / Tornado Way, together with a signing strategy to reduce right turning traffic from Haughton Road to McMullan Road are required early in the plan;
- Improvements to Burtree Way / A167 junction are necessary to provide capacity for aspirations to the north west of Darlington;
- Improvements to the A1150 can be delivered through the use of the Skerningham link road for longer distance cross town movements, even without the Burtree Link Road.

5.1.7 Issues have been identified as re-emerging on the A1150 during the later years of the plan, together with the underpass of the East Coast Main line through the shuttle worked Cleveland Street section reaching capacity. However, there are further mitigations that could be developed

5.1.8 Whilst not dependent, if the Darlington Northern Link Road came forward during the Plan period this would provide additional capacity for the A1150 corridor.

5.1.9 Greater use of the Skerningham Link Road as an orbital route to absorb some A1150 movements could be considered. Currently in 2030, the link road is forecast to be delivering 750 two way trips for the peak hour at its western end and 675 two way trips for the peak hour at its eastern end. This indicates considerable available capacity .

5.1.10 UTC based solutions are currently being investigated for Tornado Way and adjacent junctions and potential use of these relatively low cost active management solutions could provide additional capacity for Cleveland Street if required.

5.1.11 Additional mitigation measures have also been developed by the promotors of Skerningham Garden Village in support of the accelerated delivery of their development that could provide further relief if required.

5.1.12 Overall, while queueing and journey times at some locations do worsen the impact post introduction of the identified mitigation measures, is not considered to be severe and additional mitigation options are available should this prove necessary and can be introduced through the review of the plan.

Appendix A - Darlington Scheme Mitigation Plan

Appendix B – Simulated Density Plots

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

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DARLINGTON LOCAL PLAN - NORTH DARLINGTON AIMSUN MODELLING

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DARLINGTON LOCAL PLAN SUPPORT

DARLINGTON LOCAL PLAN - NORTH DARLINGTON AIMSUN MODELLING

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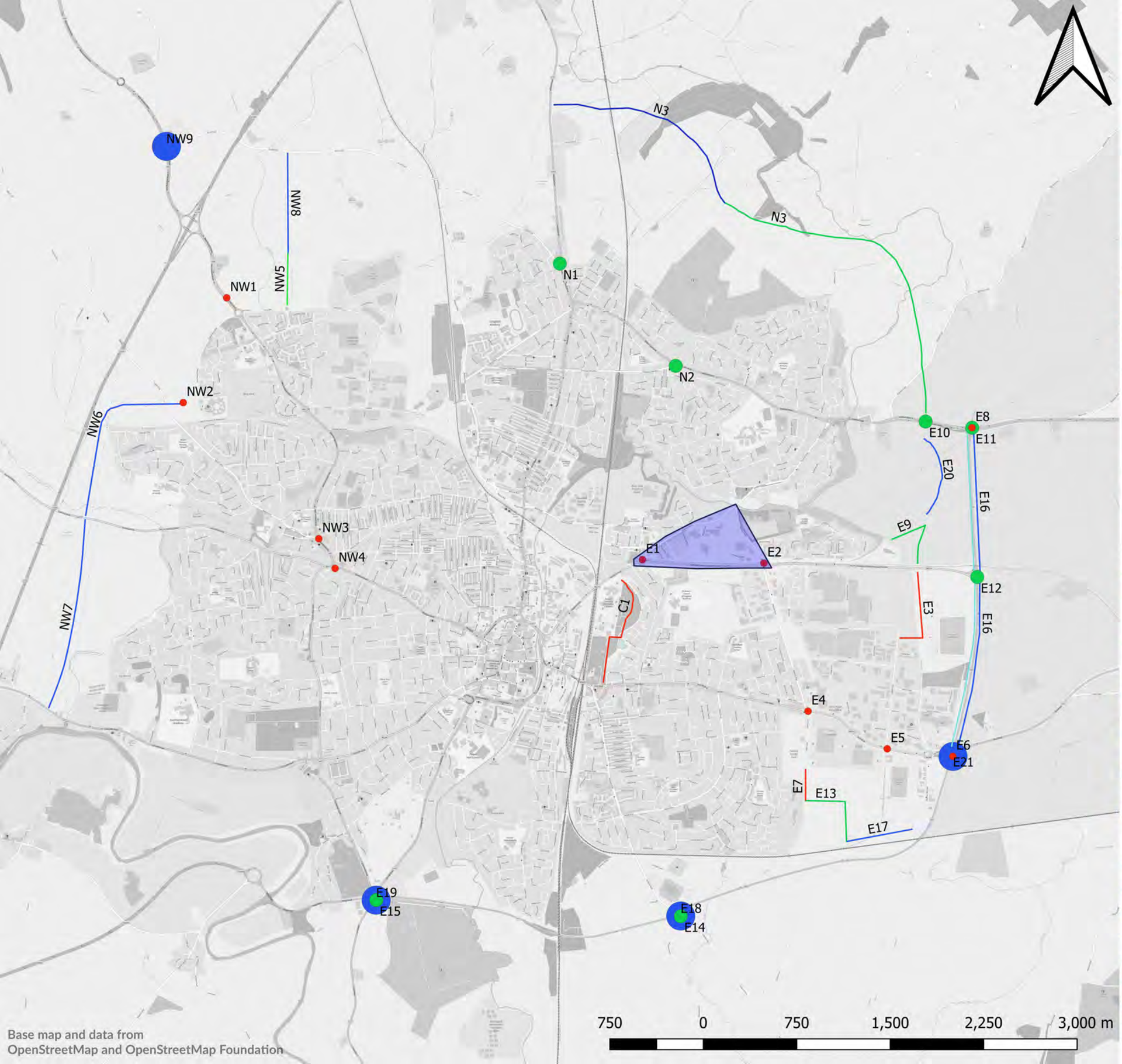
APPROVAL

Version	Name		Position	Date	Modifications
1	Author	Sandra Hill-Smith Kevin Dulin	Principal Transport Planner Senior Consultant	12/06/2020	Internal draft for client review
	Checked by	Paul Gray	Associate Director	15/06/2020	
	Approved by	Steve Pickard	Project Director	15/06/2020	
2	Author	Sandra Hill-Smith Kevin Dulin	Principal Transport Planner Senior Consultant	18/01/2021	Final document for Local Plan
	Checked by	Paul Gray	Associate Director	18/01/2021	
	Approved by	Steve Pickard	Project Director	18/01/2021	

Appendix A - Darlington Scheme Mitigation Plan



2020 Road Junctions

- *E1 Haughton Road Through-about Improvements*
- *E2 McMullen Road DETC Junction Road Improvements*
- *E4 McMullen Road / Yarm Road Roundabout Improvements*
- *E5 Lingfield Way Traffic Signal Controlled Junction*
- *E6 A66 Morton Palms Roundabout Improvements*
- *E8 Little Burdon left turn filter*
- *NW1 A68 / Rotary Way Roundabout Improvements*
- *NW2 West Park / Newton Lane Link Road*
- NW3 Cockerton Roundabout Improvement
- NW4 Woodland Road Roundabout Improvement

2020 Road Schemes

- C1 Central Link Road
- *E3 Lingfield Way to DETC Link Road*
- *E7 Ingenium Parc Phase 1*

2025 Road Junctions

- E10 Burdon Hill Northern Access
- E11 A66 / Little Burdon Circulatory Upgrade
- E12 DETC Junction Improvements
- E14 Neasham Road Improvements Phase 1
- E15 Blands Corner Improvements Phase 1
- N1 A167 / Burtree Lane Junction Improvement
- N2 A1150 / Thompson Street East Roundabout Improvement

2025 Road Schemes

- E13 Ingenium Parc Phase 2
- E9 RedHall Hall / Burdon Hill Link Road
- N3 Skerningham Link Road
- NW5 Faverdale Link Road Phase 1

2030 Road Junctons

- E18 Neasham Road Improvements Phase 2
- E19 Blands Corner Improvements Phase 2
- E21 Morton Palms Larger Roundabout
- NW9 A68 Burtree Lane Roundabout

2030 Road Schemes

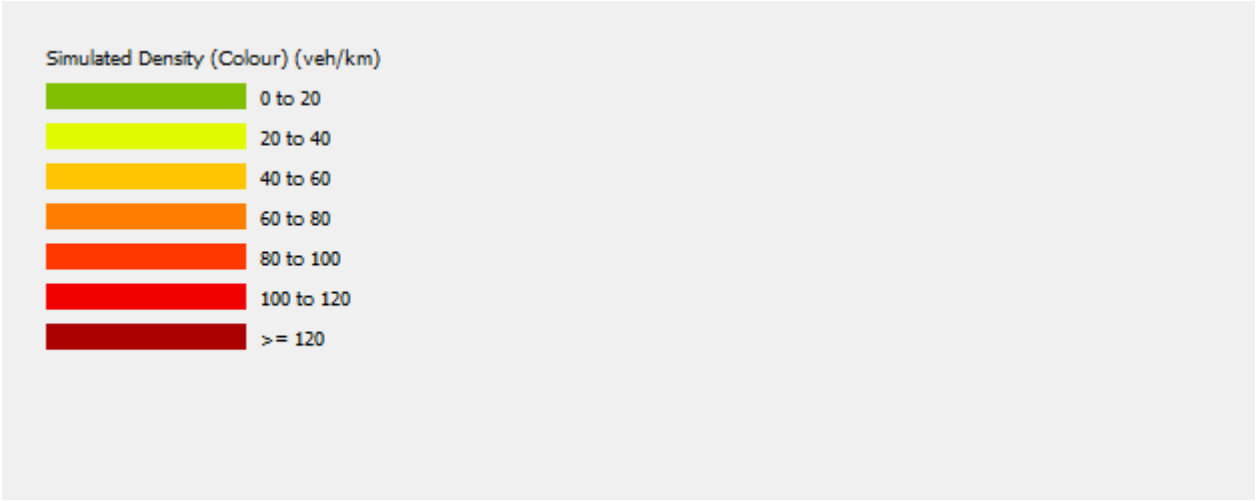
- E16 A66 Morton Palms to Little Burdon Dualling
- E17 Ingenium Parc Phase 3
- E20 Burdon Hill Link
- N3 Skerningham Link Road
- NW6 Newton Lane to Staindrop Road Link
- NW7 Staindrop Road to A67 Coniscliffe Road
- NW8 Faverdale Link Road Phase 2
- Signal Optimisation

Italicised schemes have been delivered

Appendix B – Simulated Density Plots

1. APPENDIX B: DENSITY PLOTS

Density plots for each scenario have been output from the Aimsun model to demonstrate the level of congestion experienced throughout the study area. This allows for congestion hot spots to be identified and the impact of different mitigation schemes and traffic flows and the operation of the highway network as a whole. The key for each of the plots is shown below.



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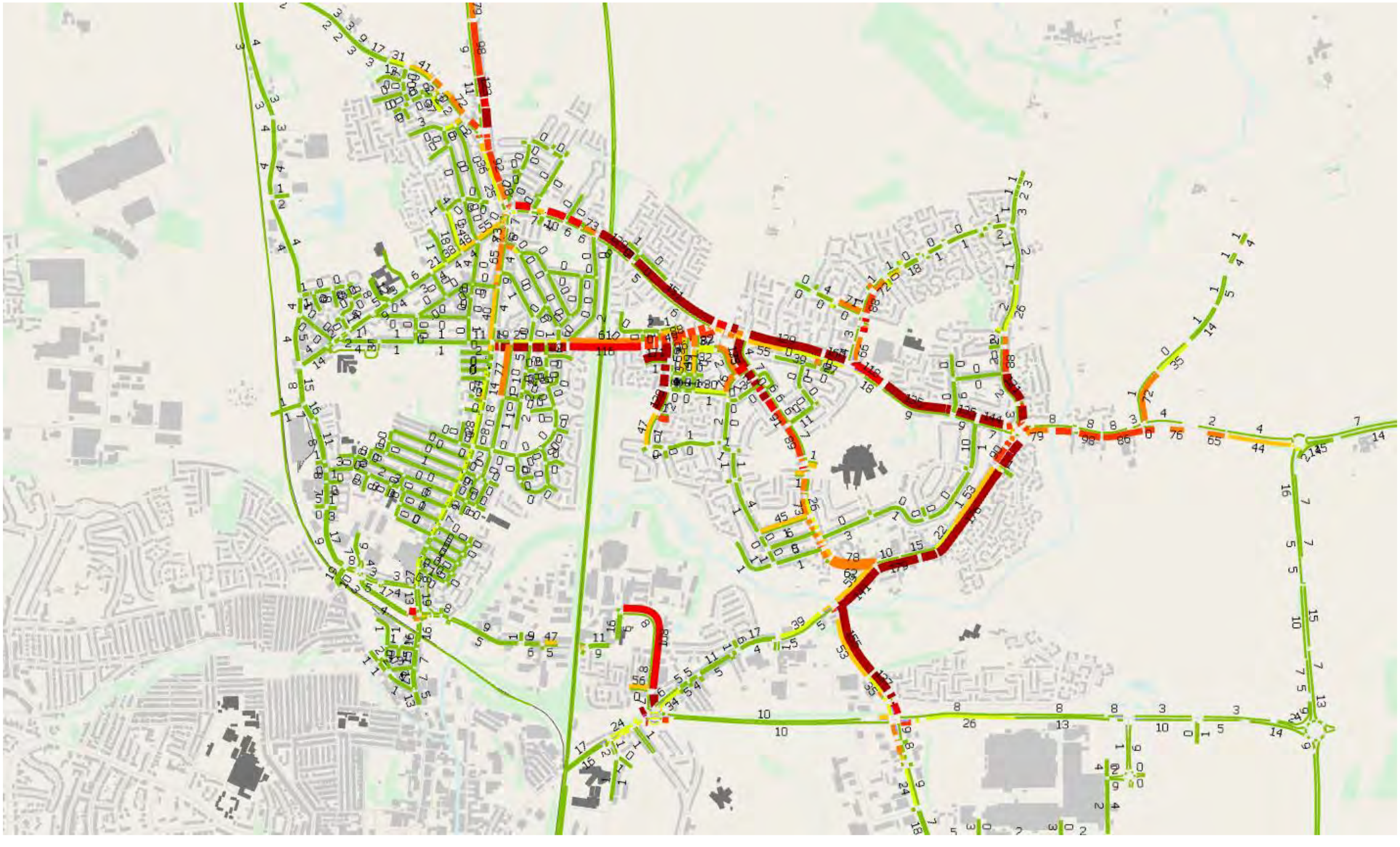

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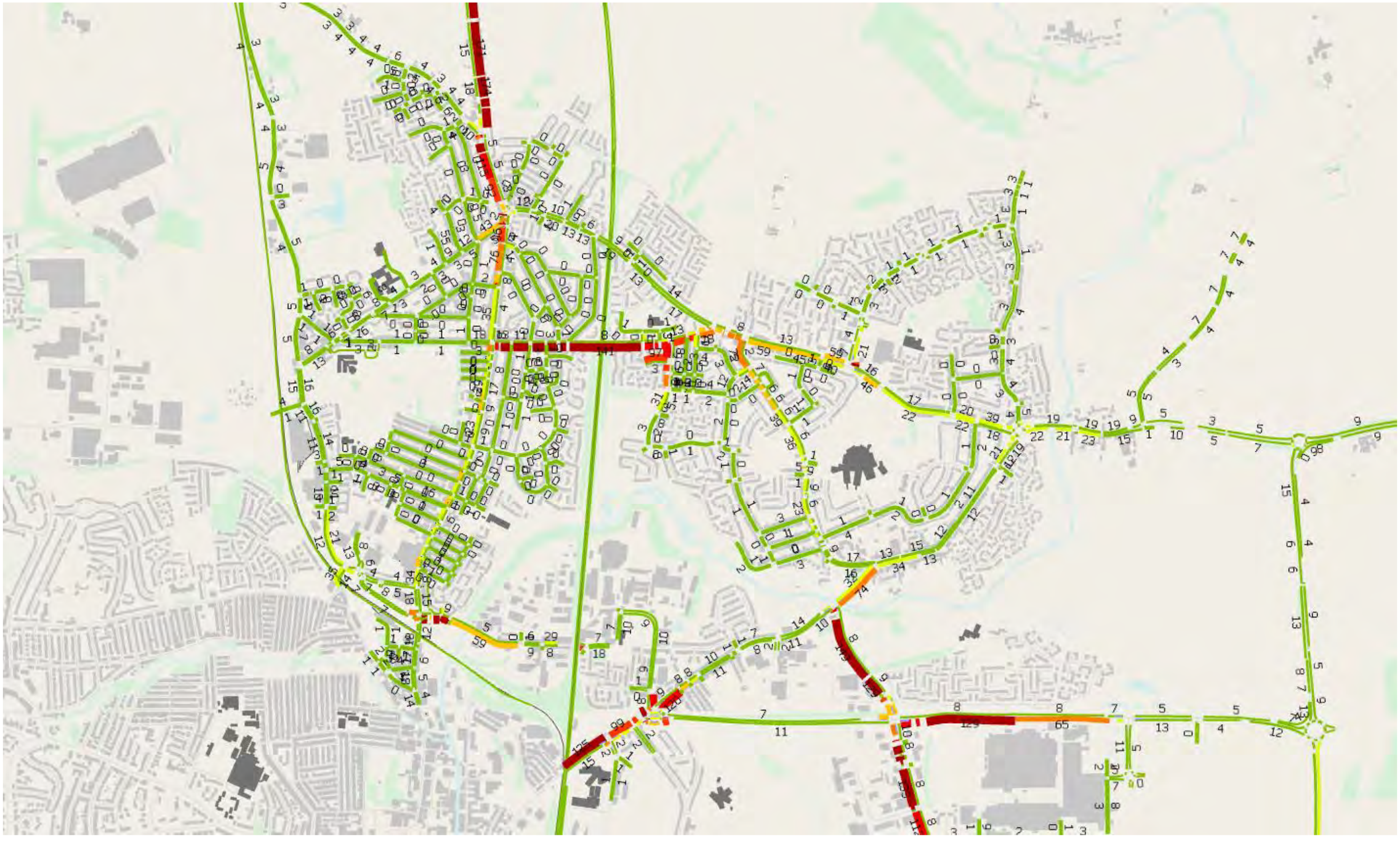

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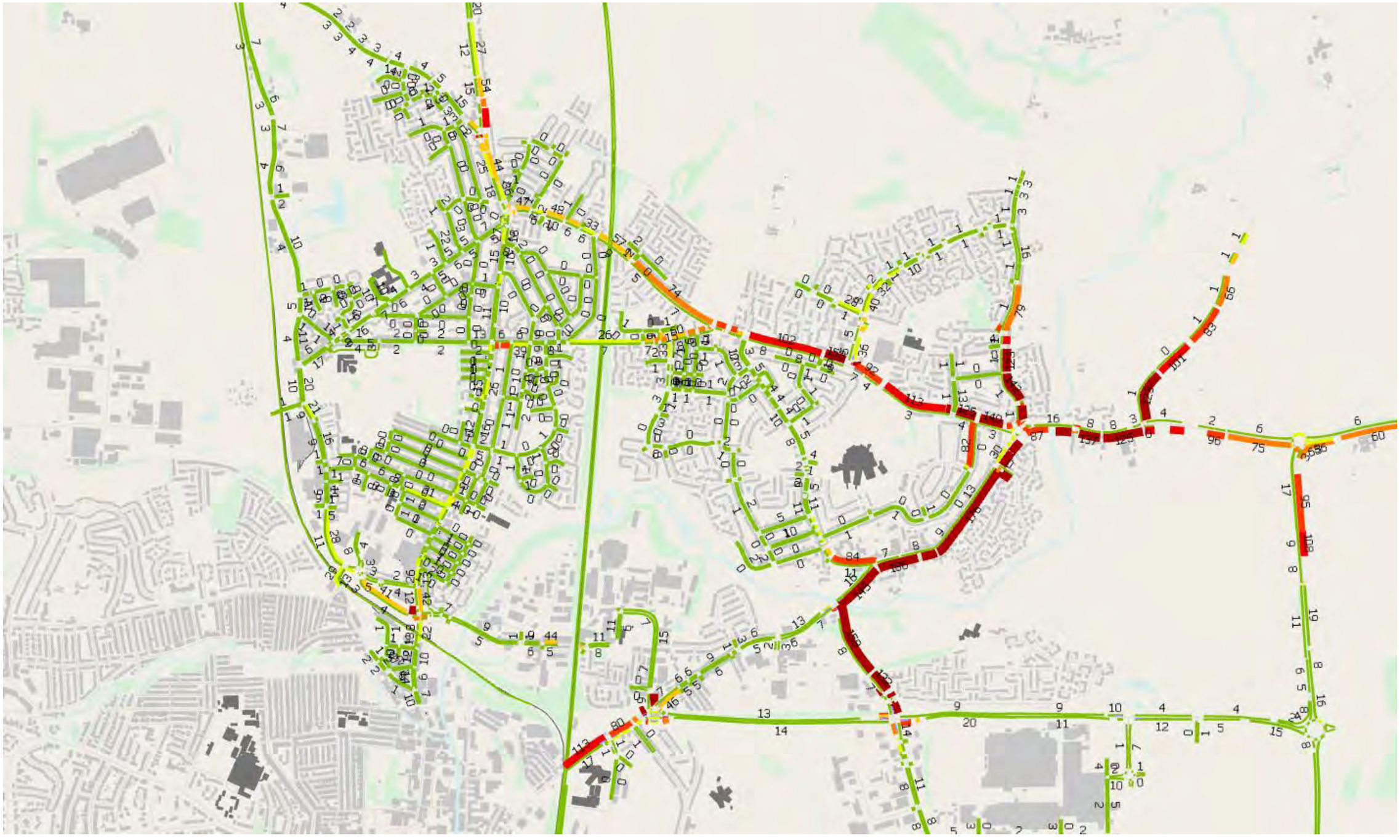

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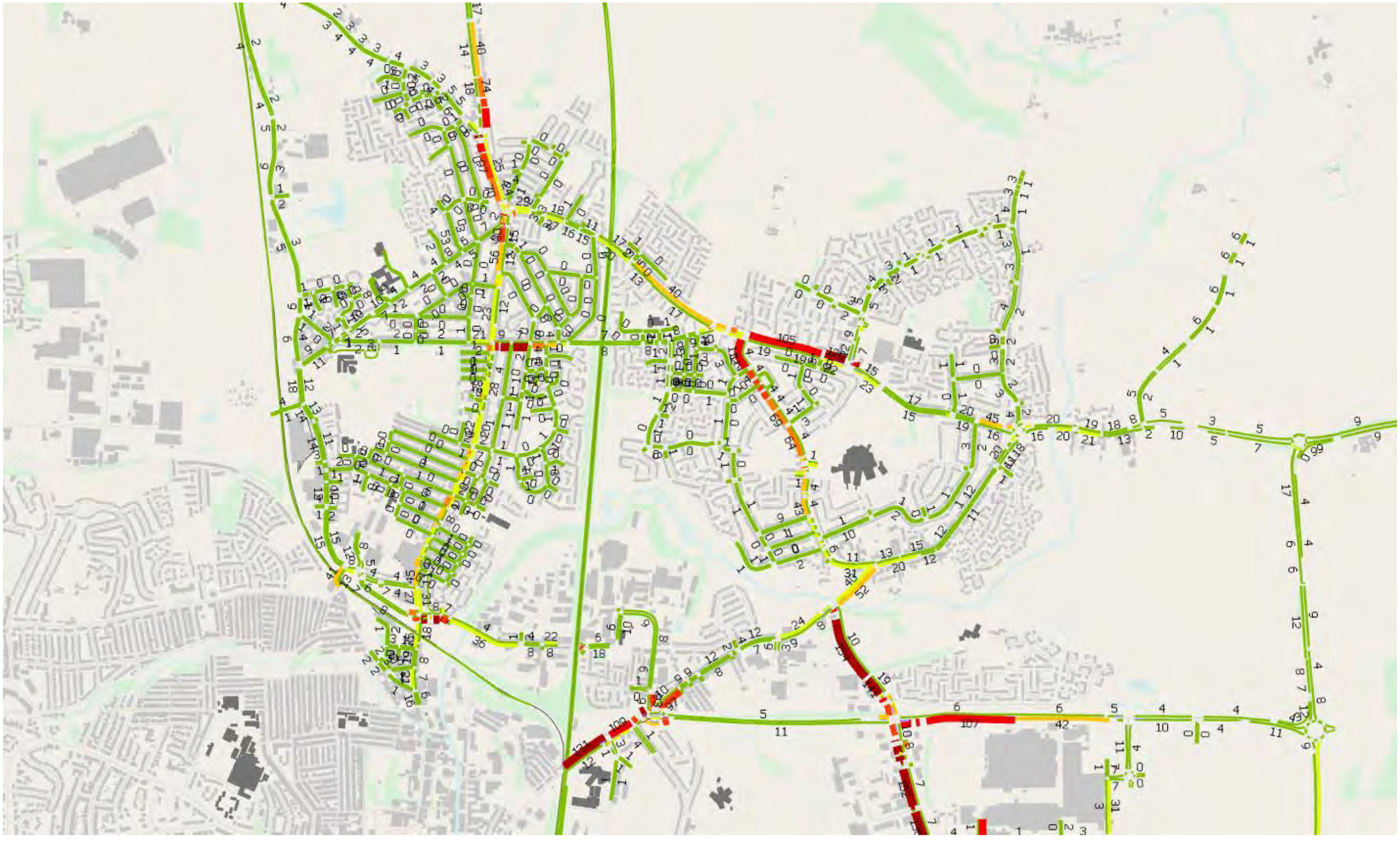

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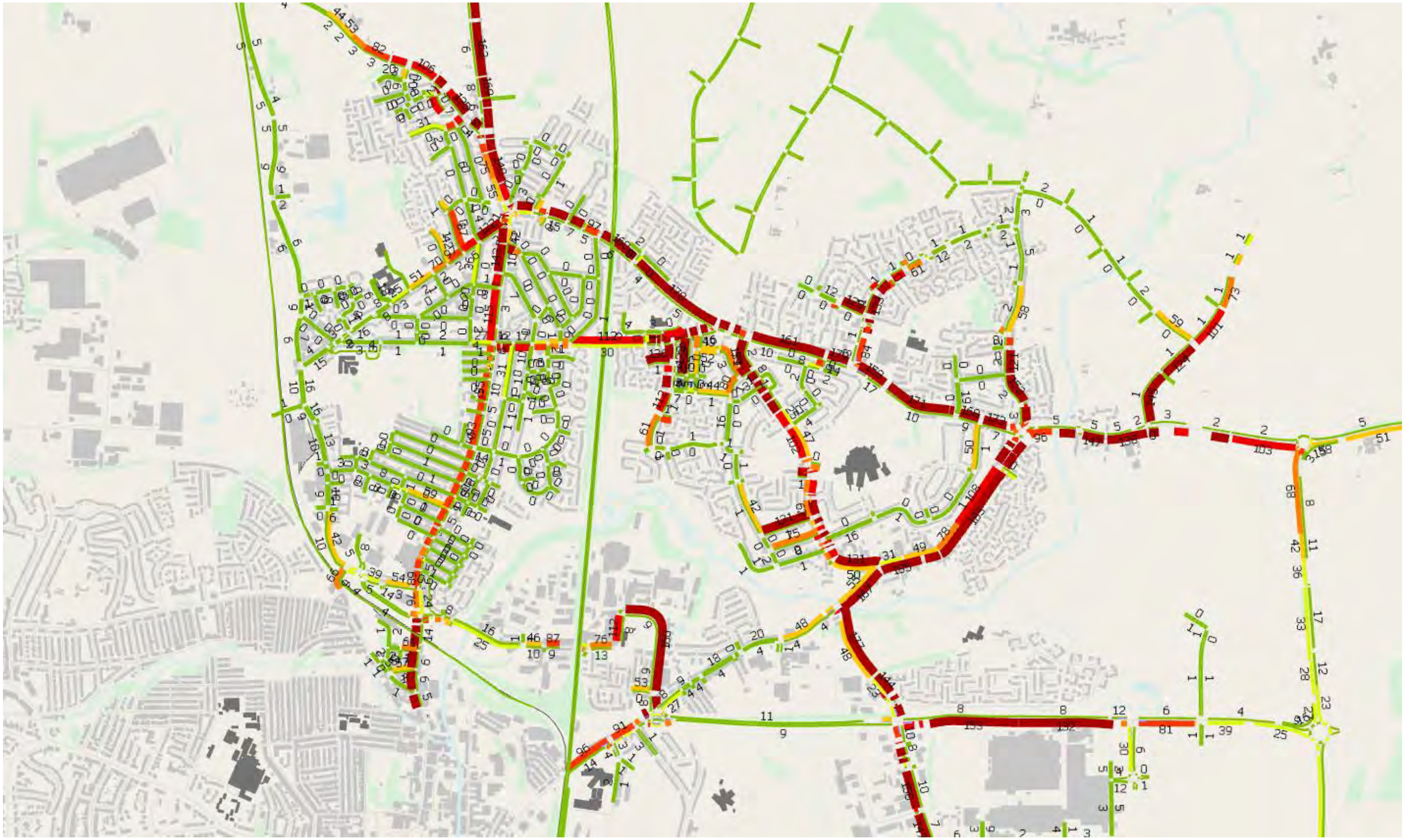

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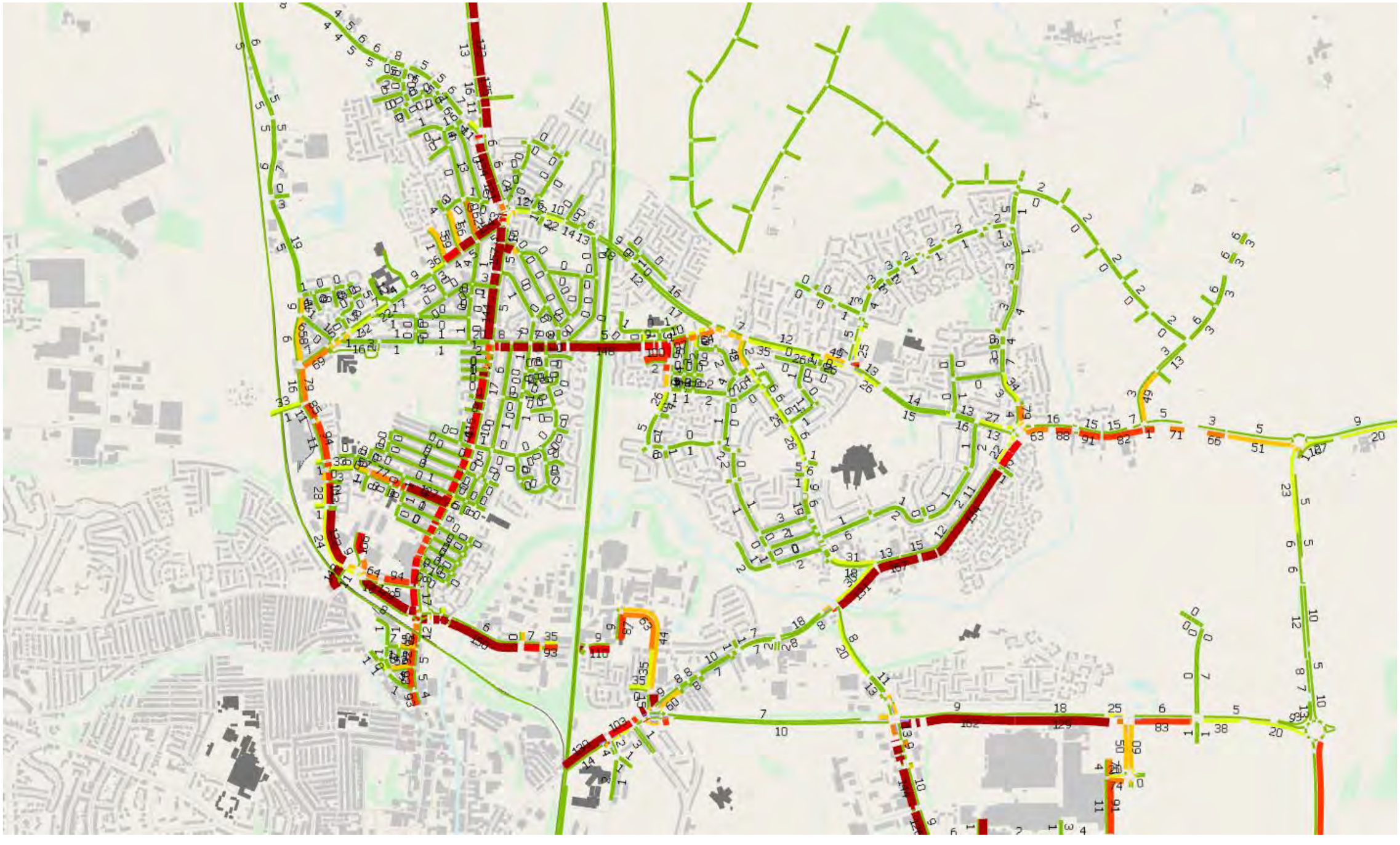

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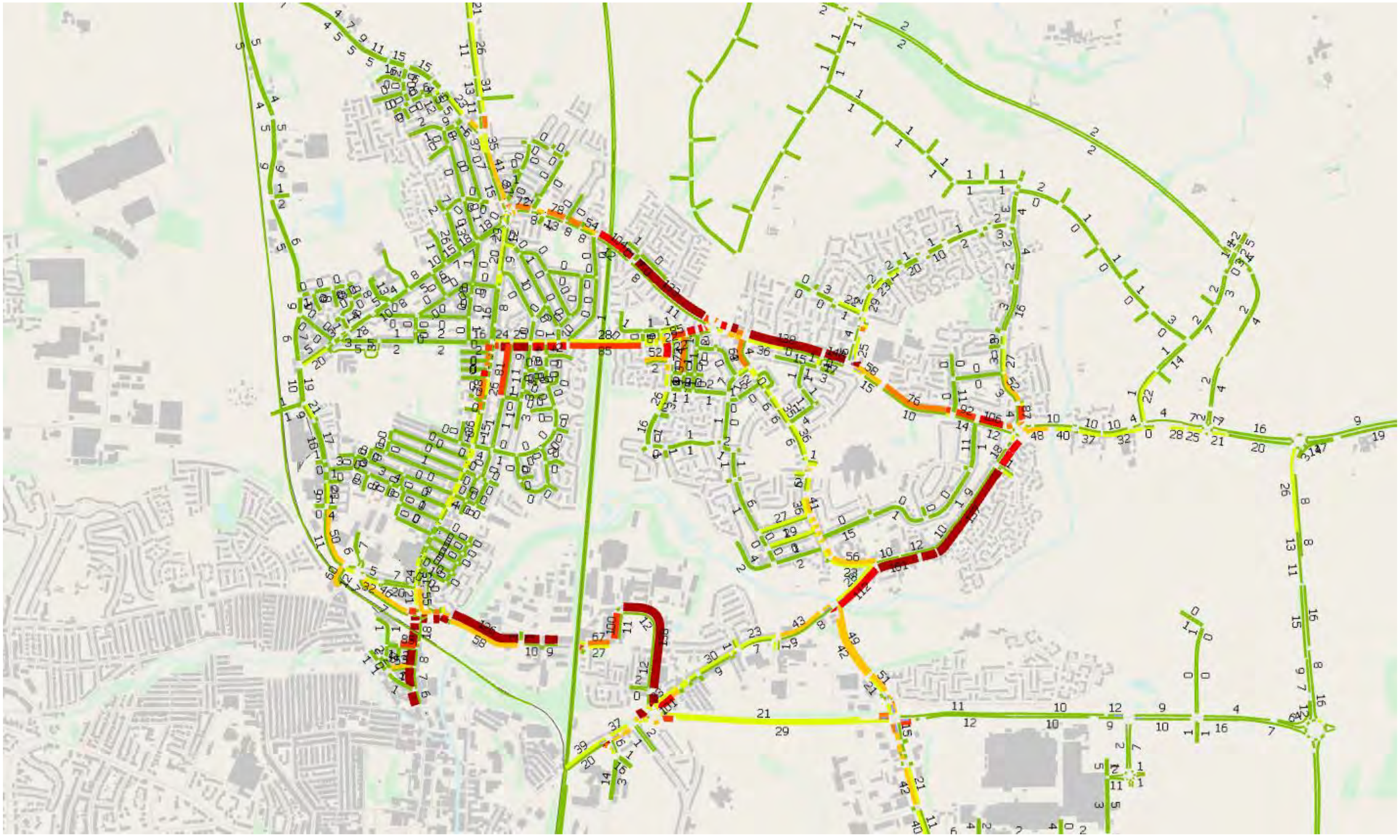

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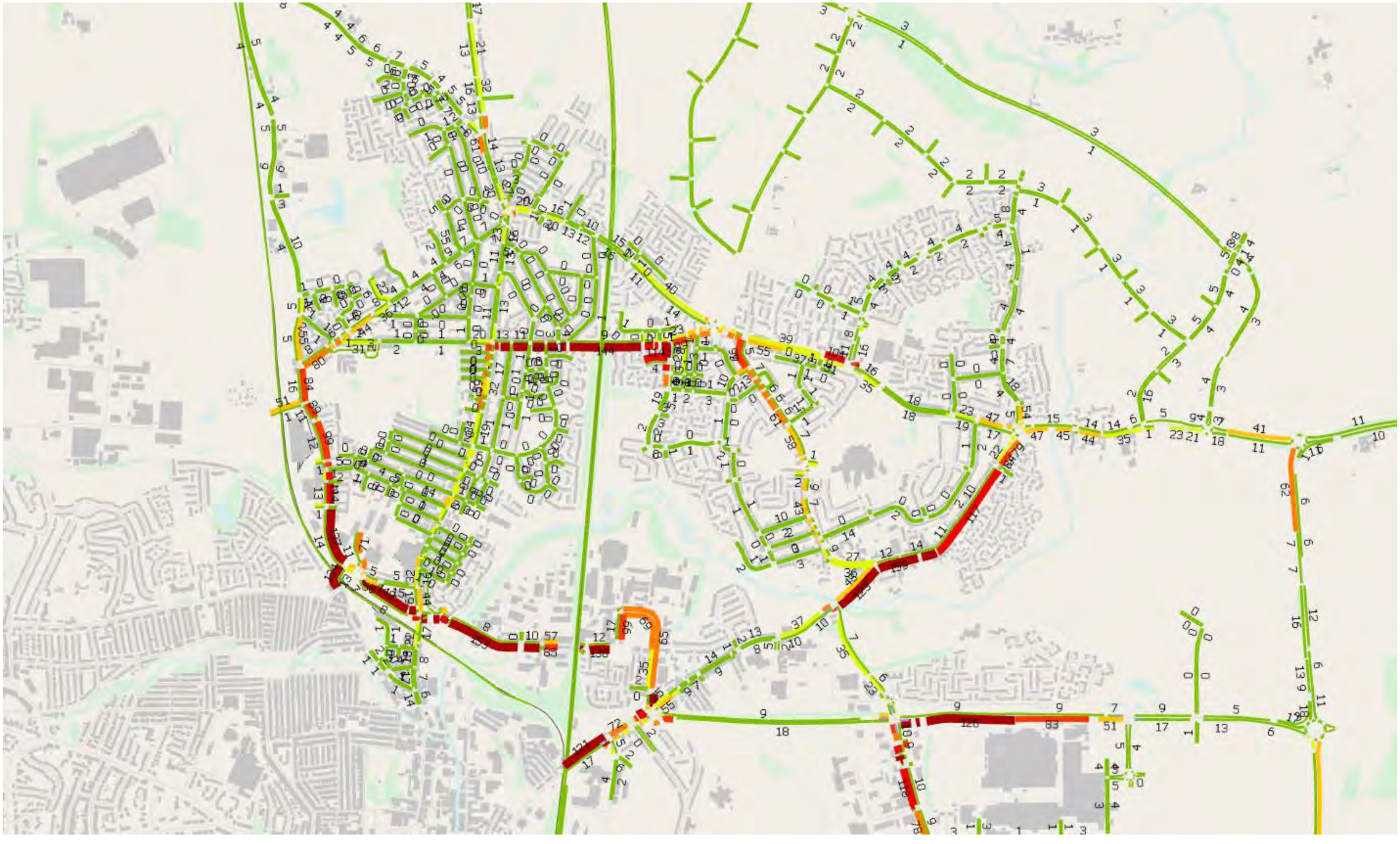

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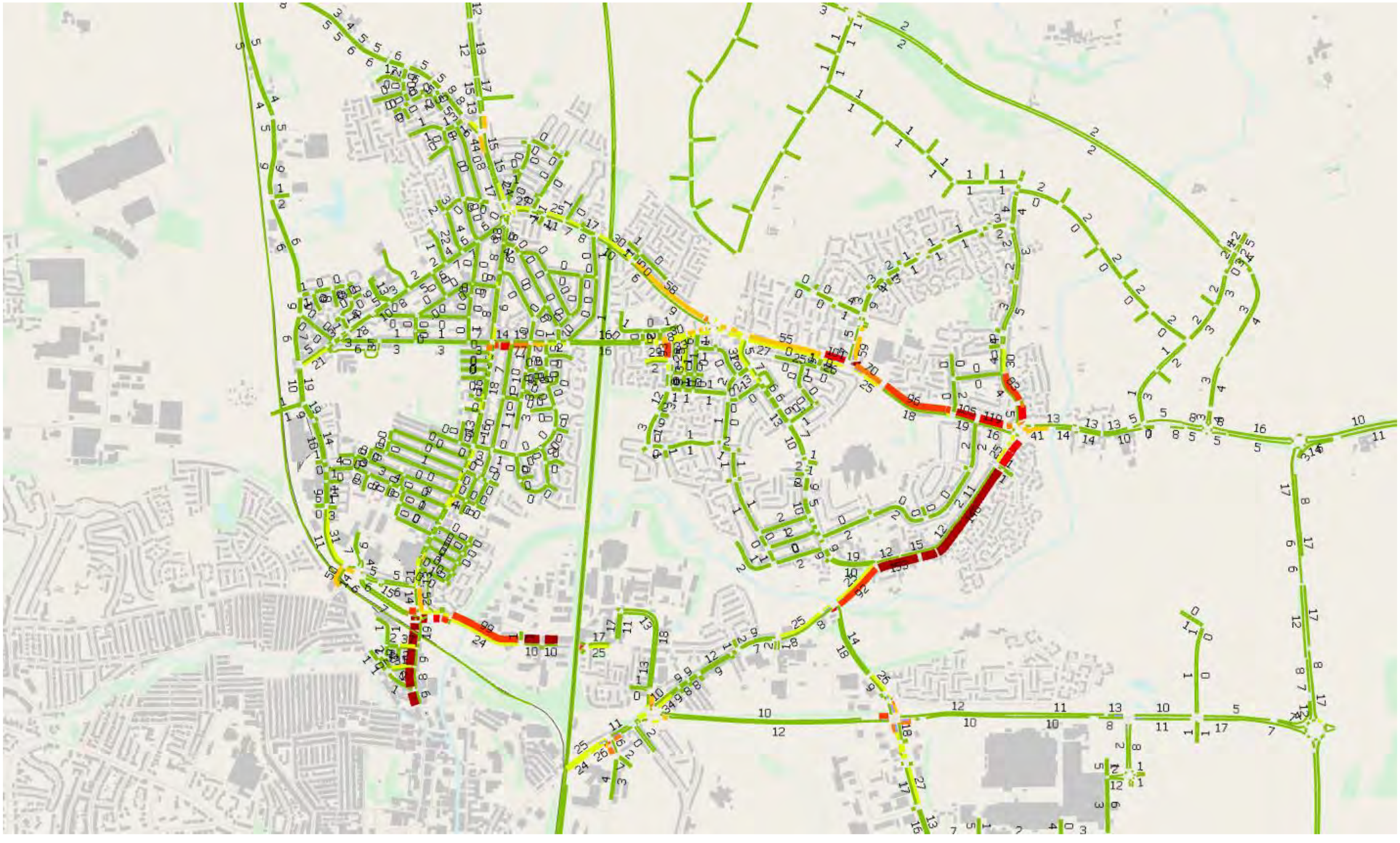

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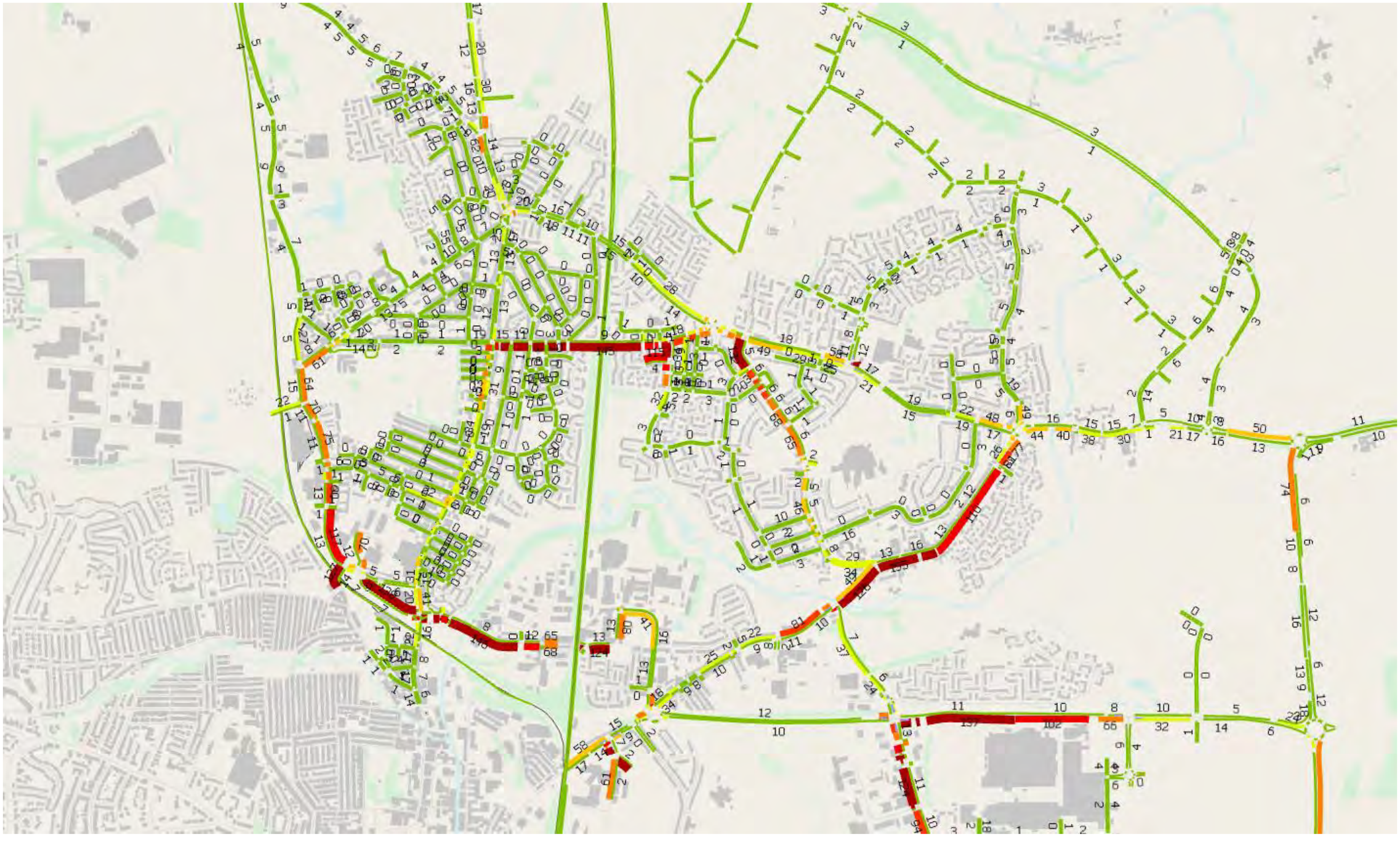

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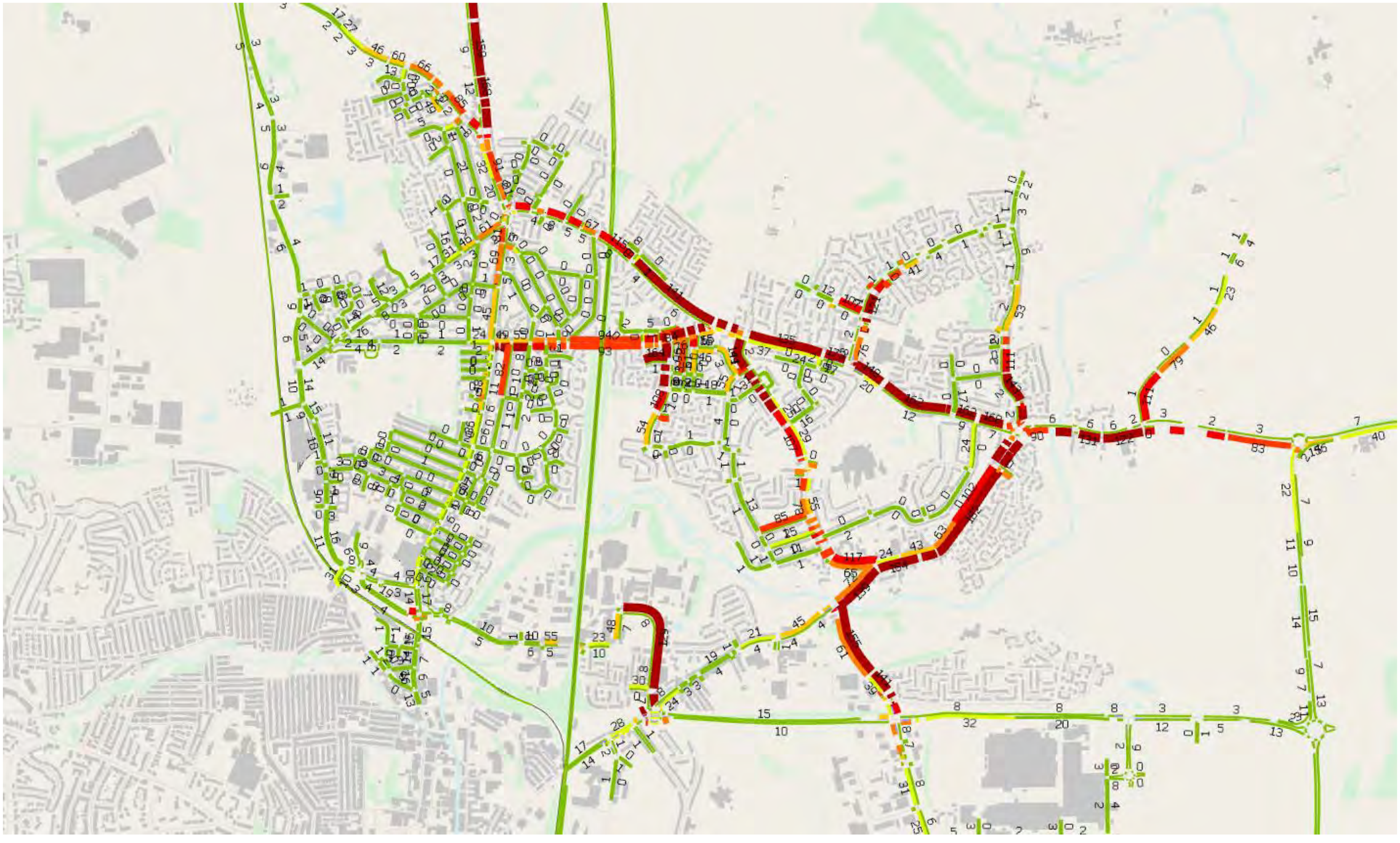

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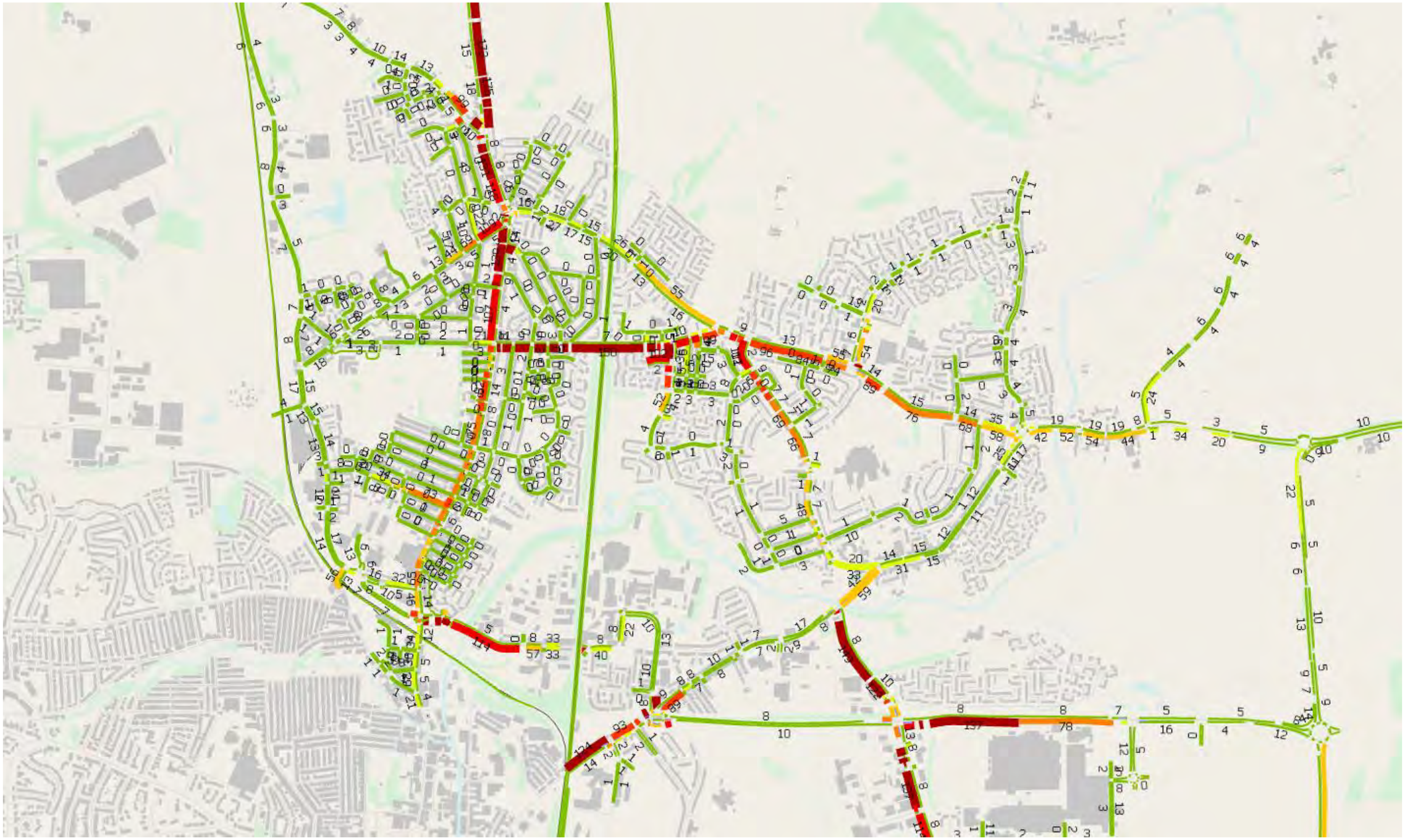

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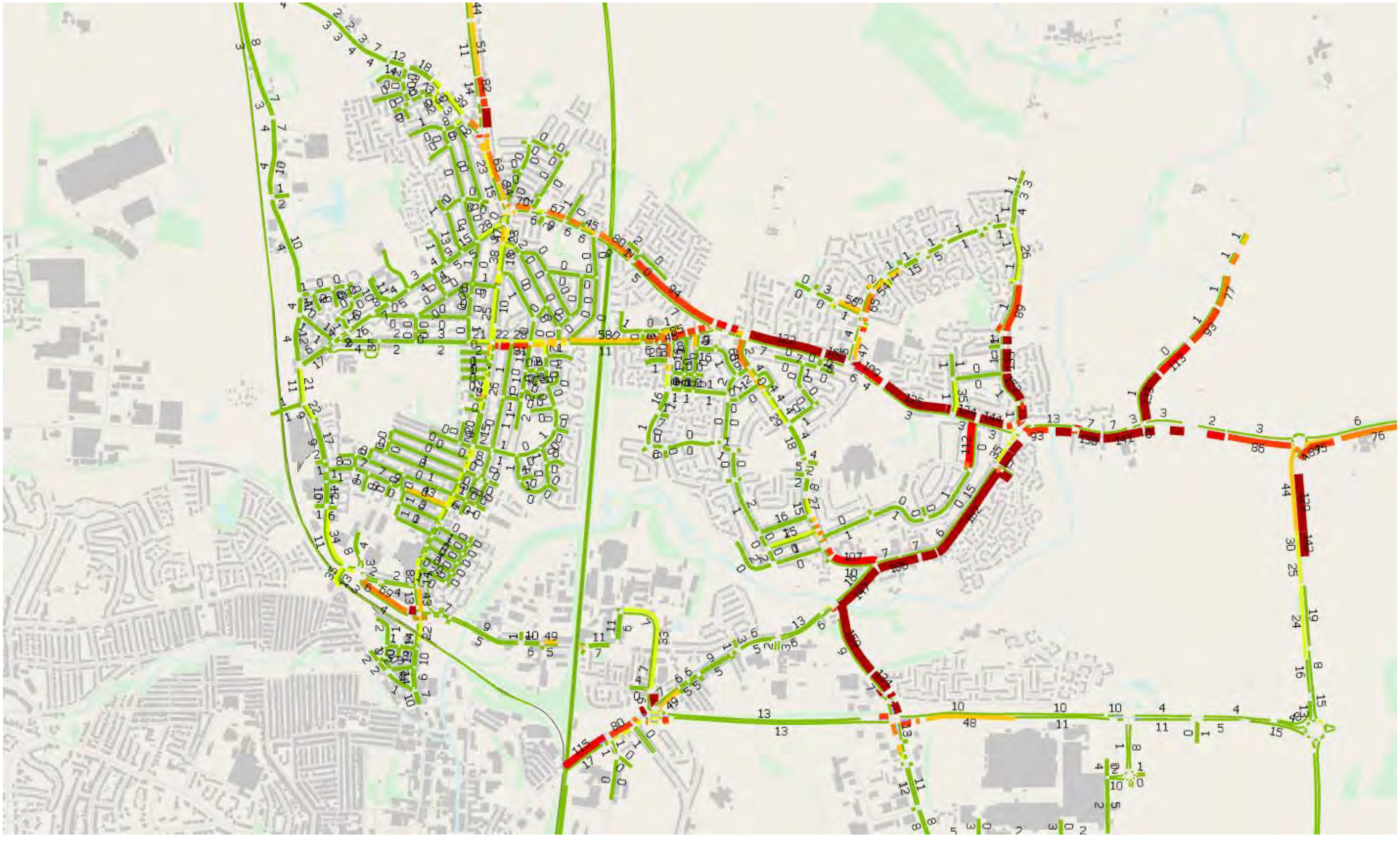

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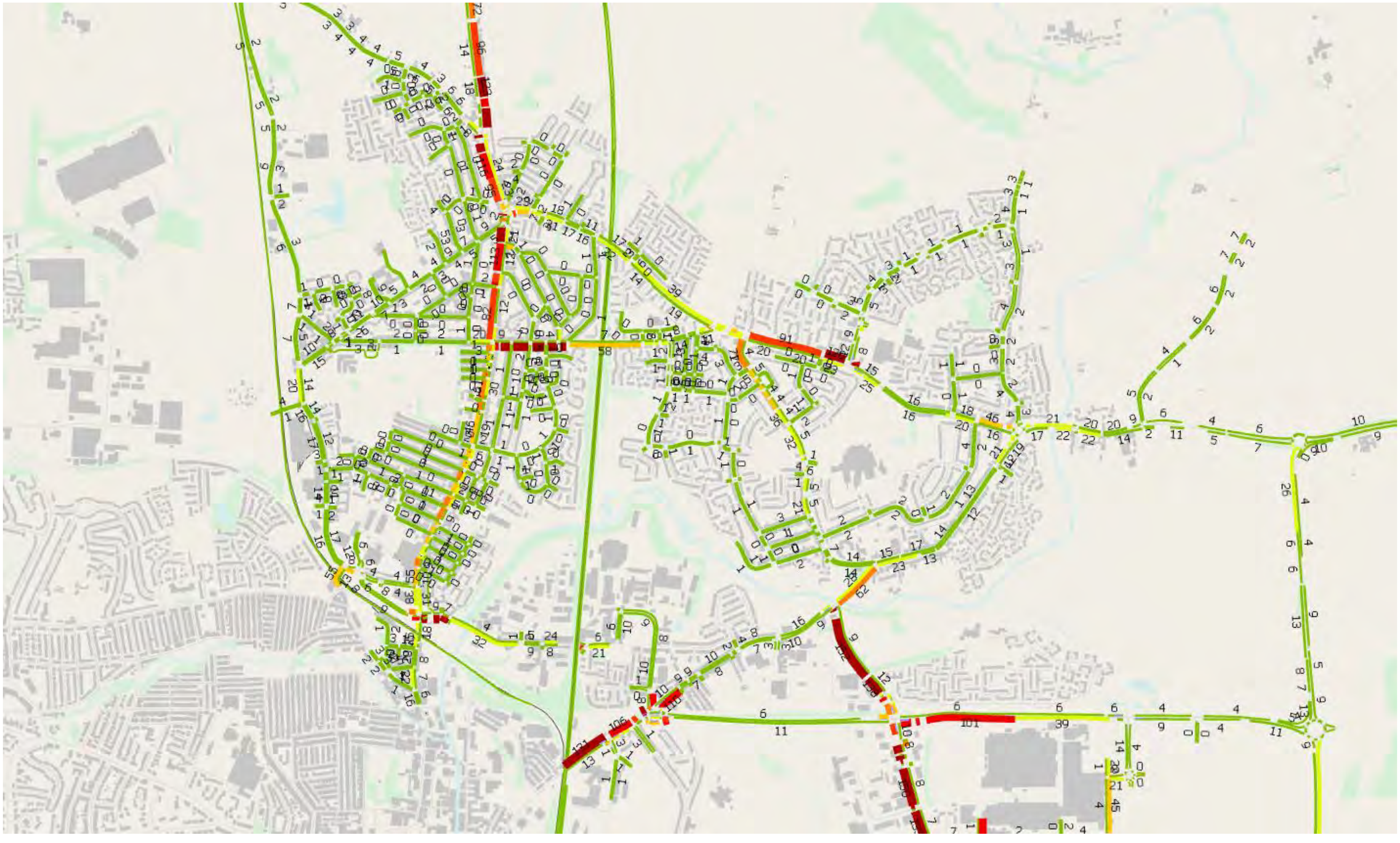

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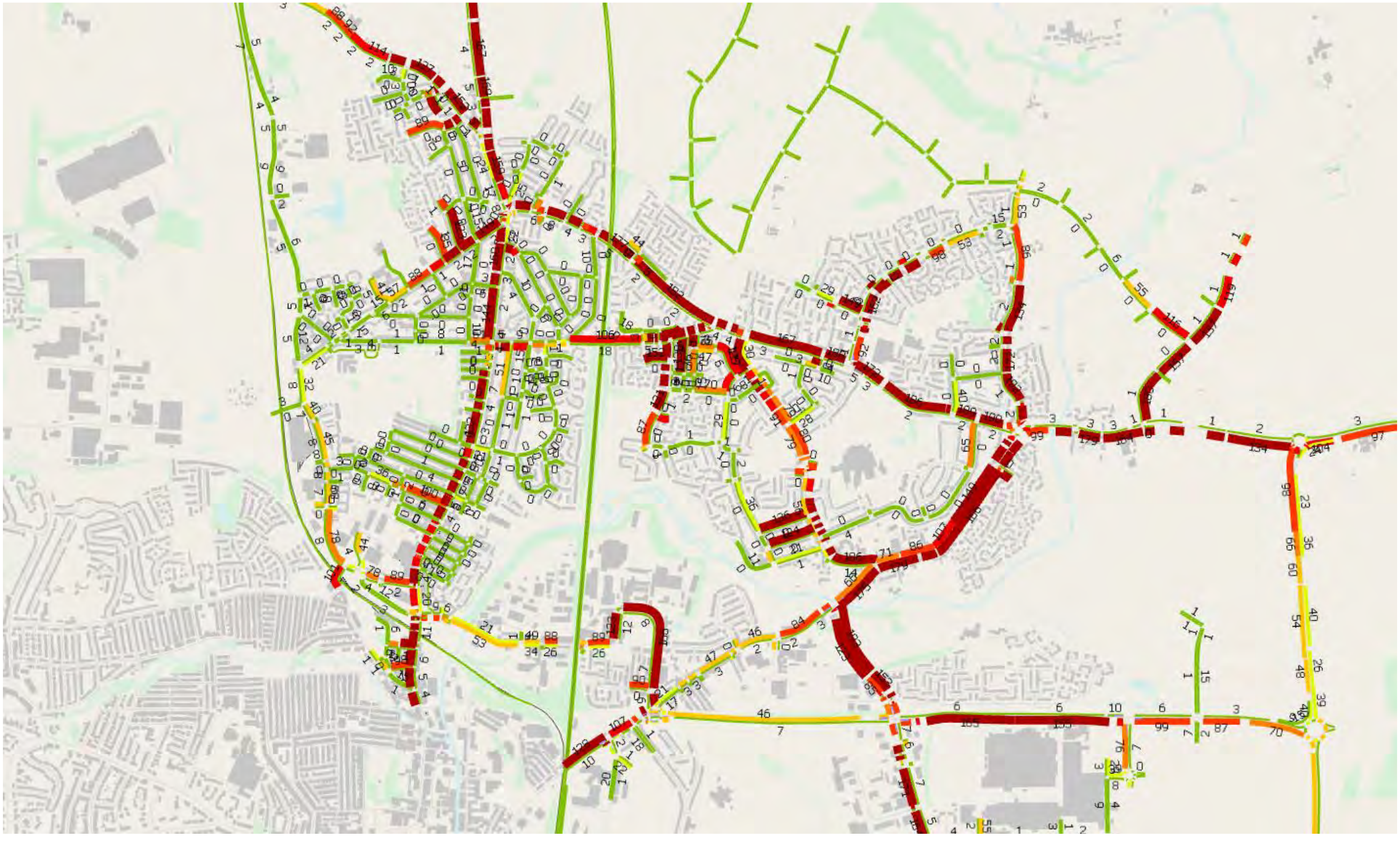

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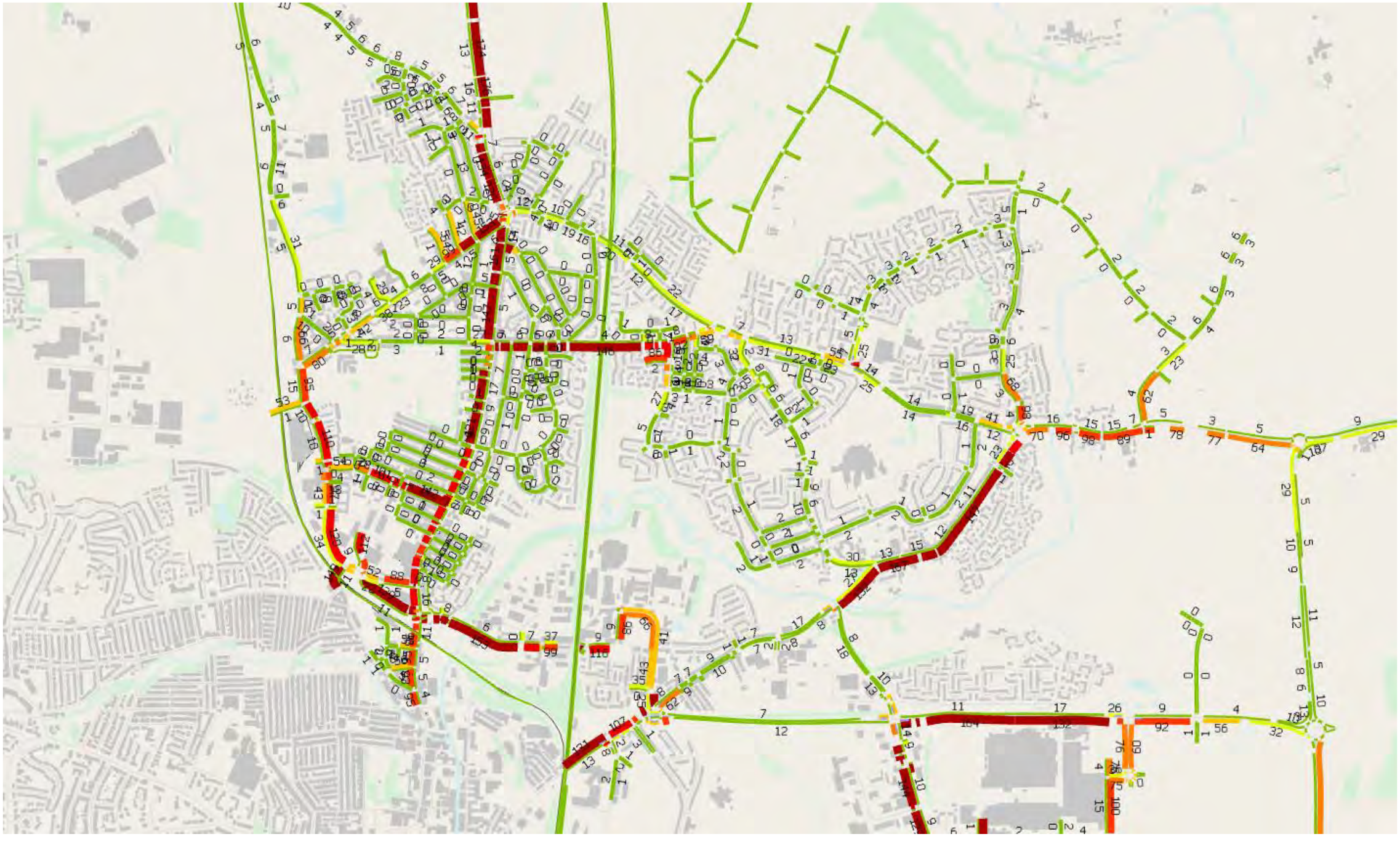

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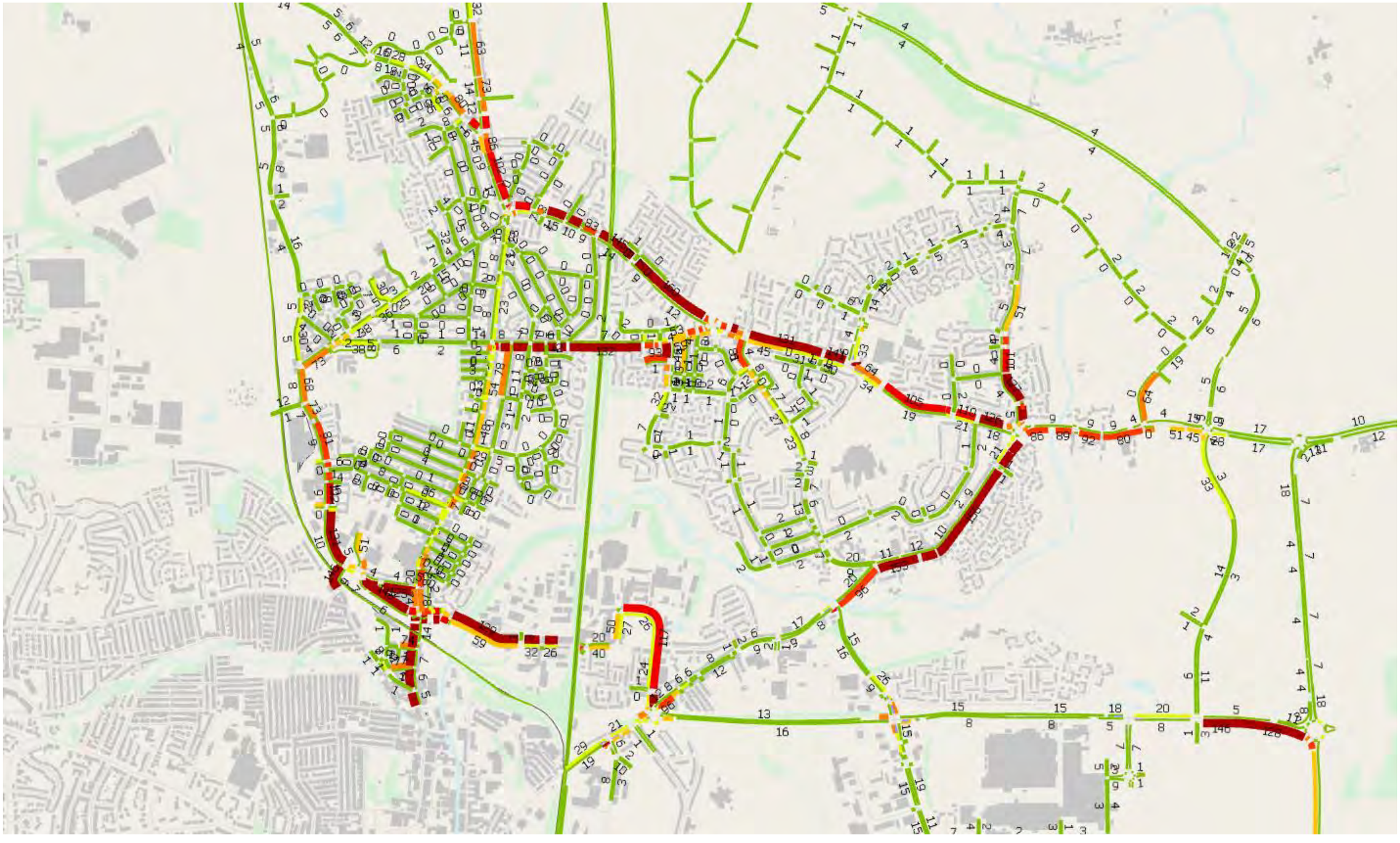

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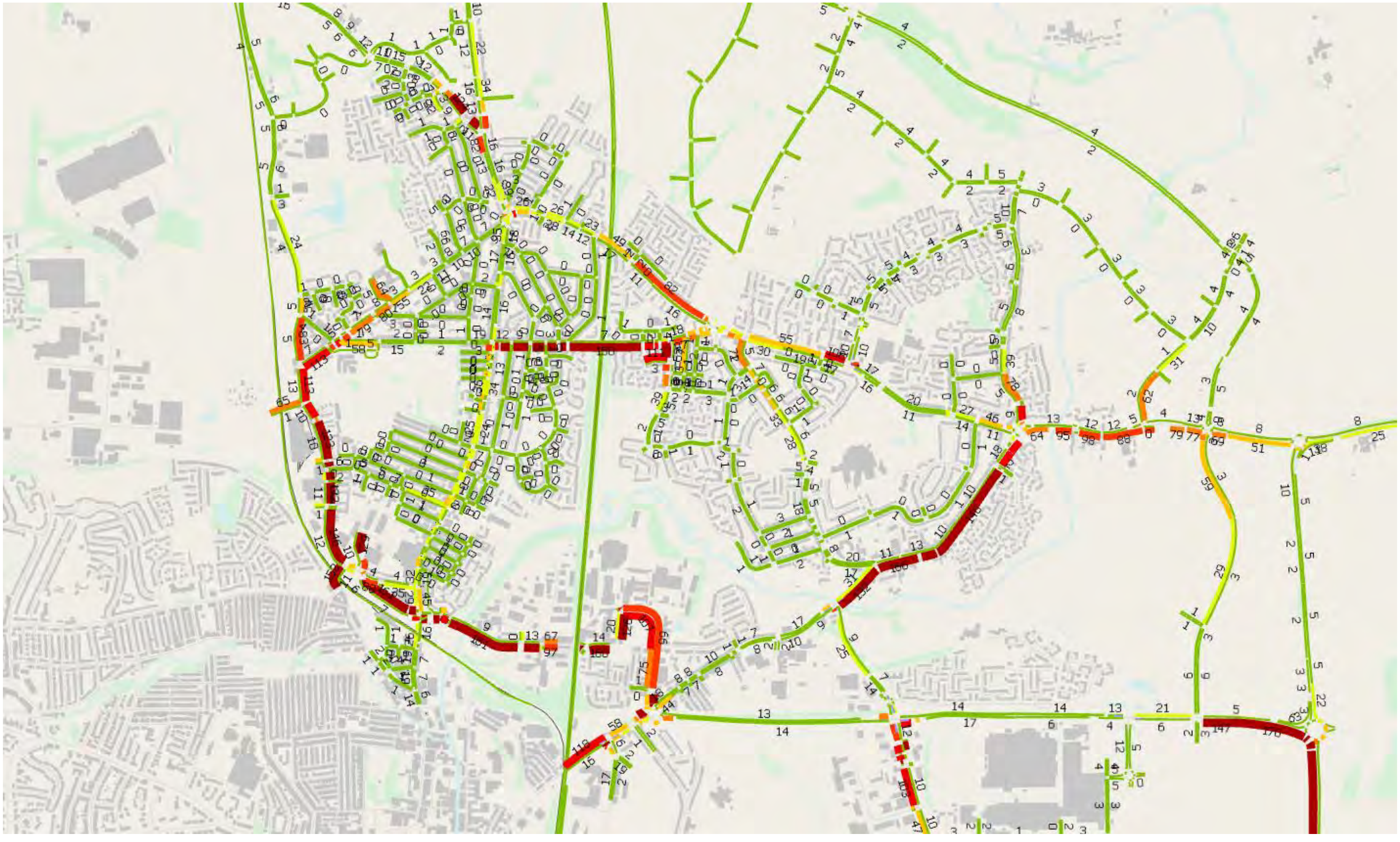

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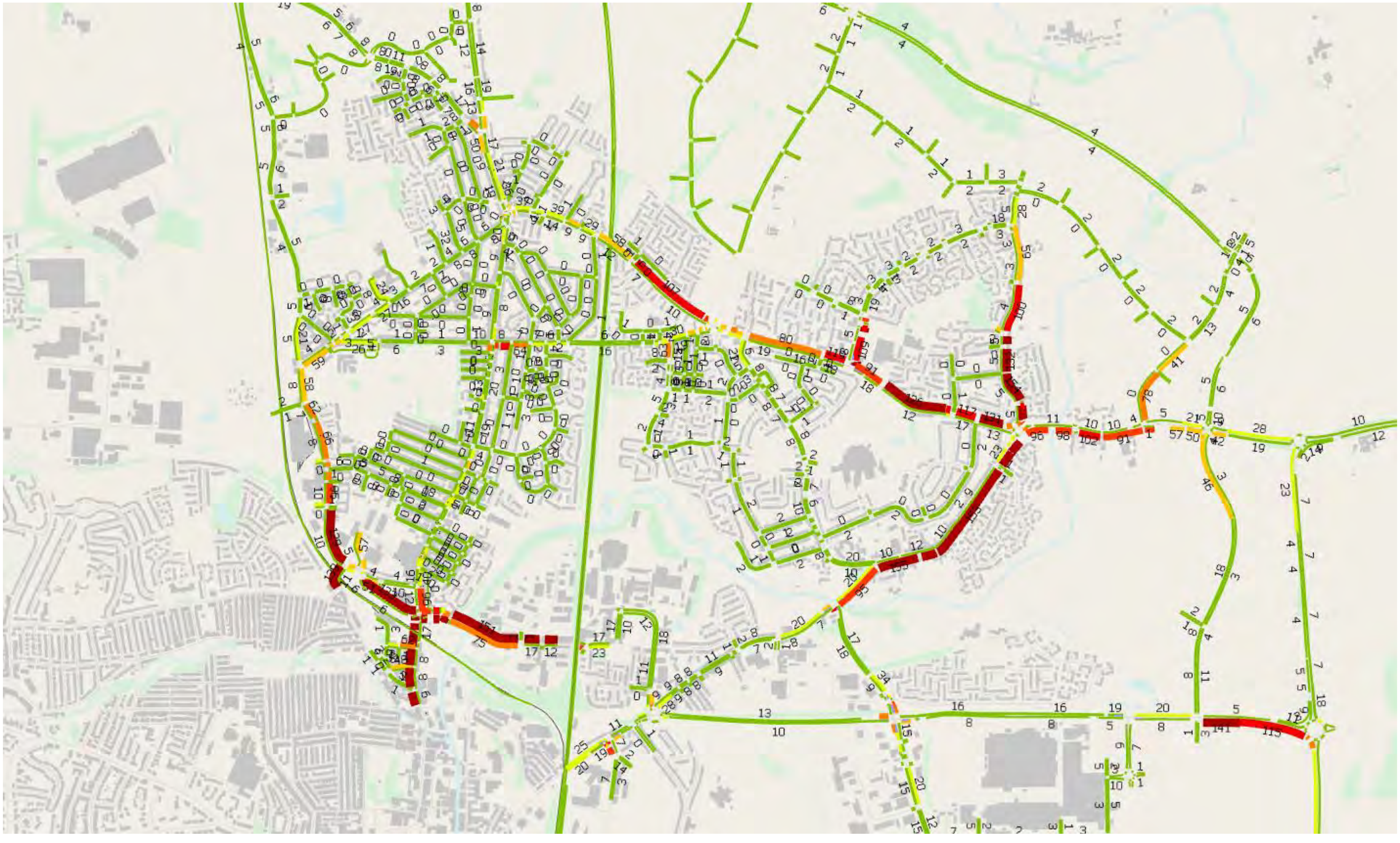

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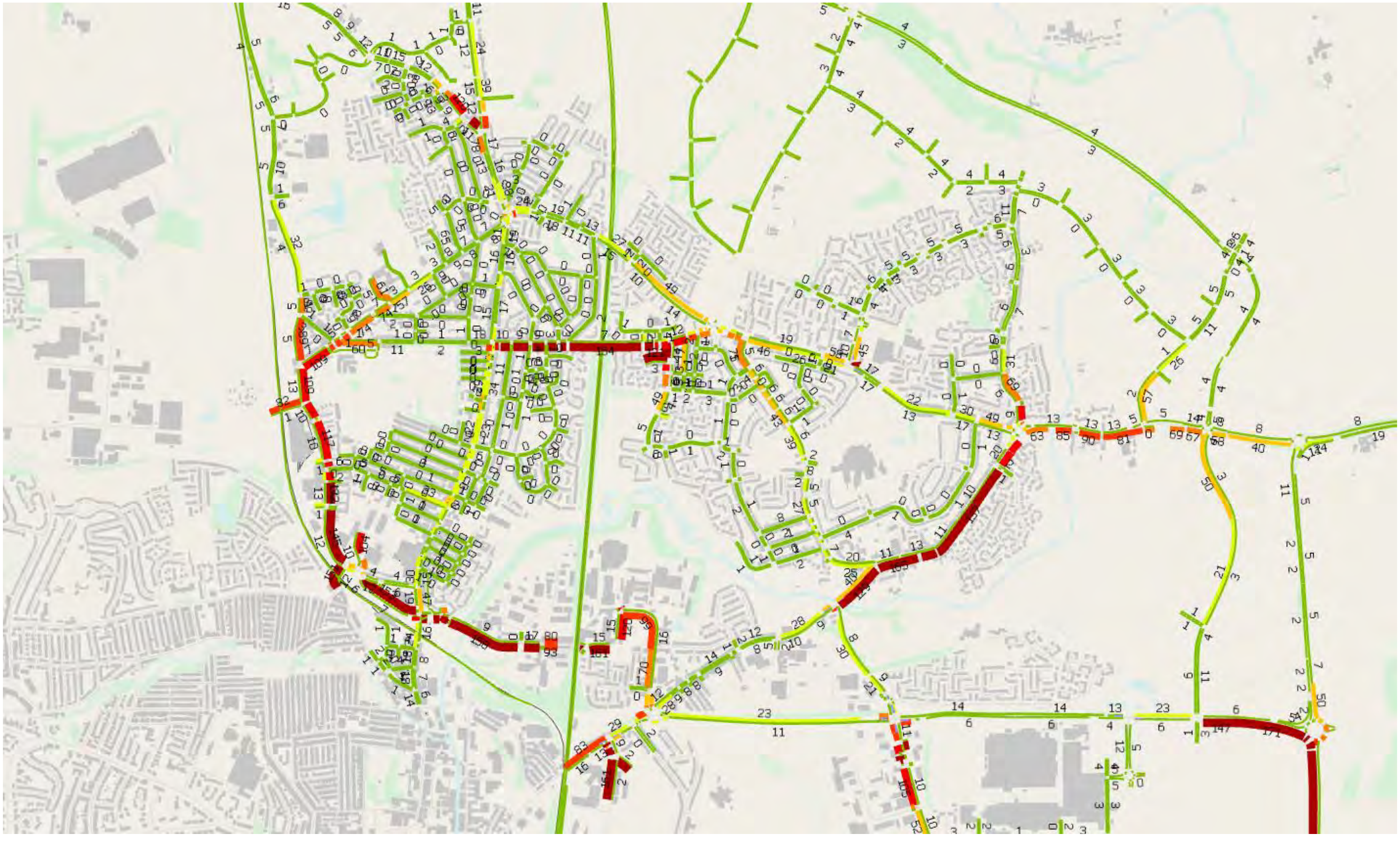

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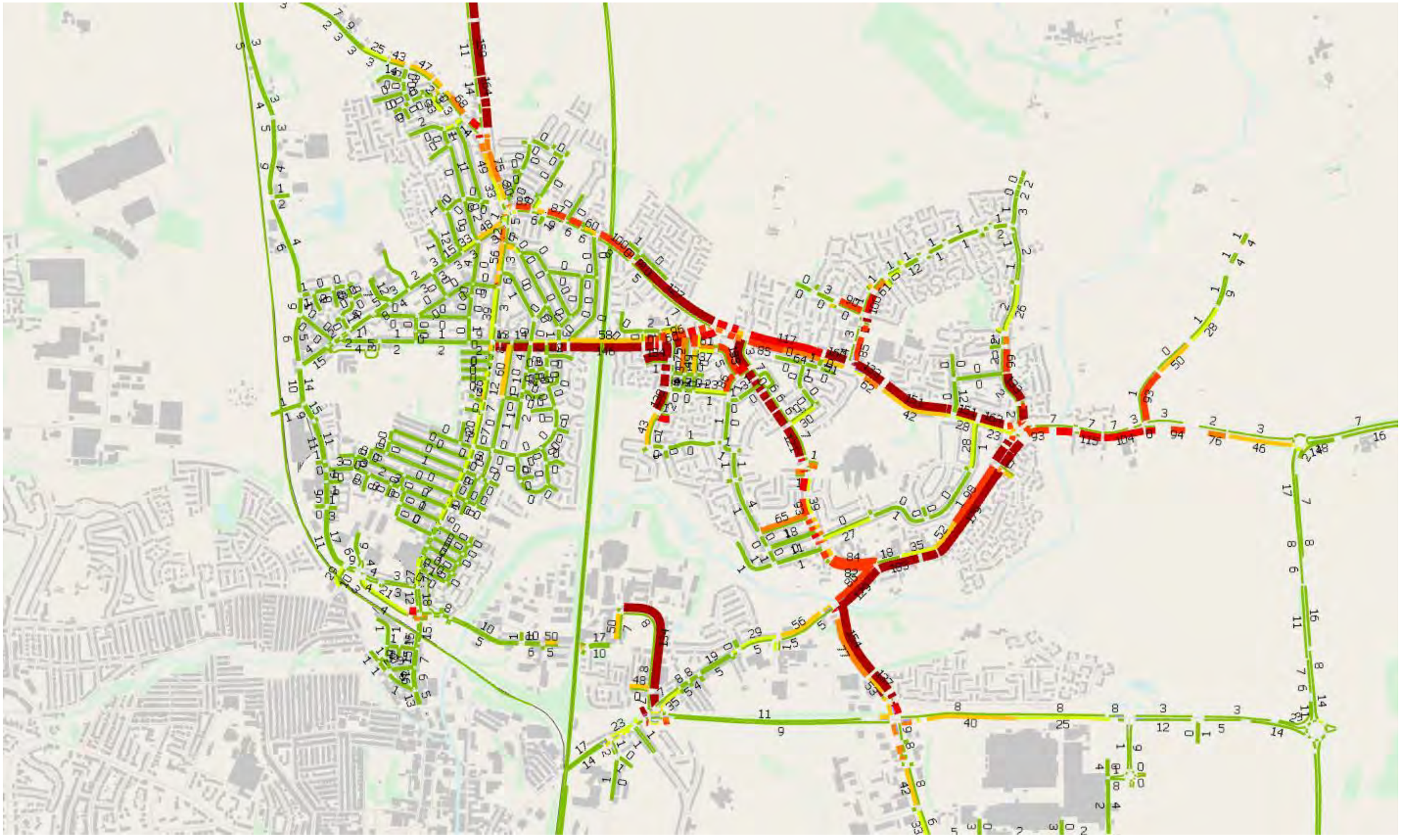

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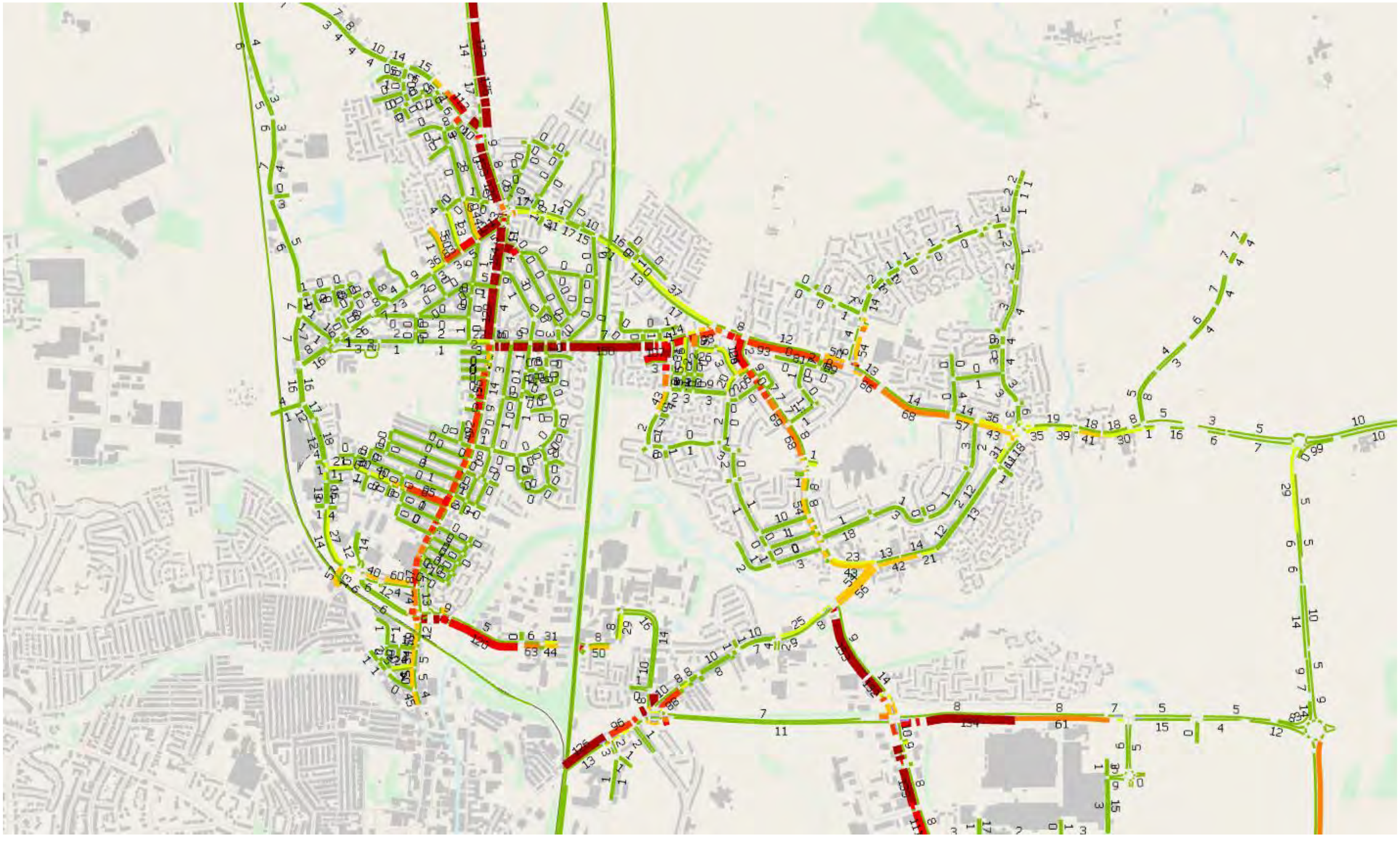

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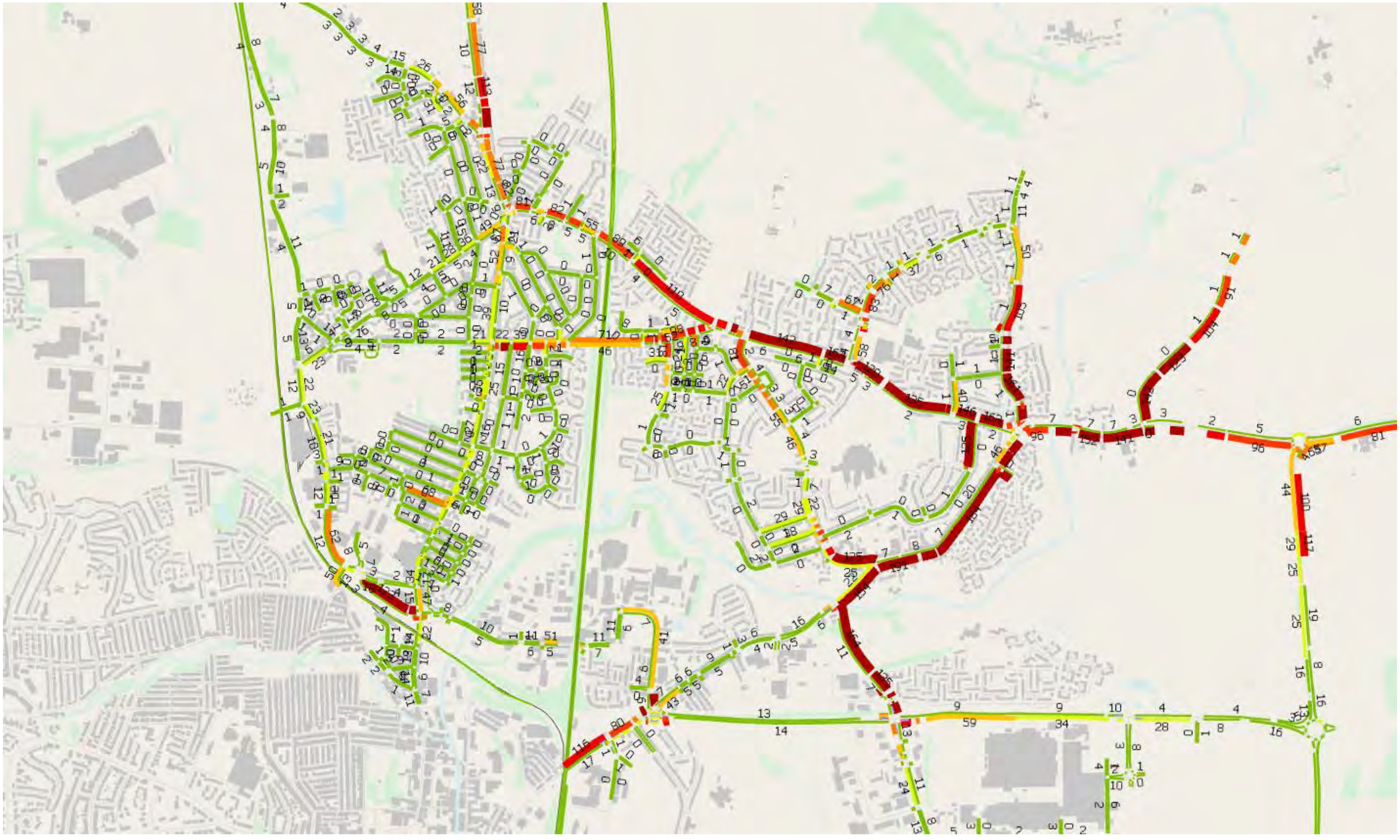

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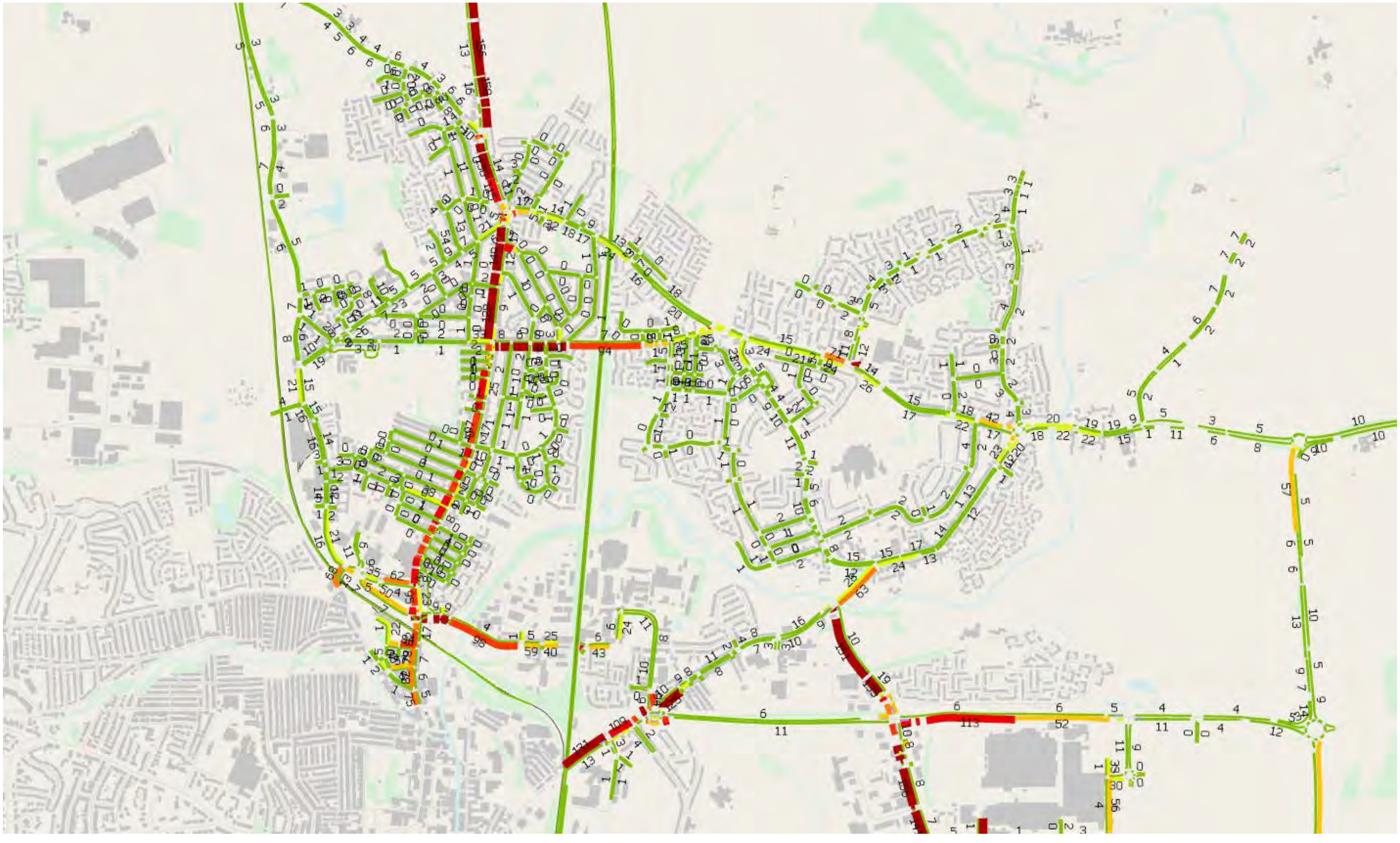

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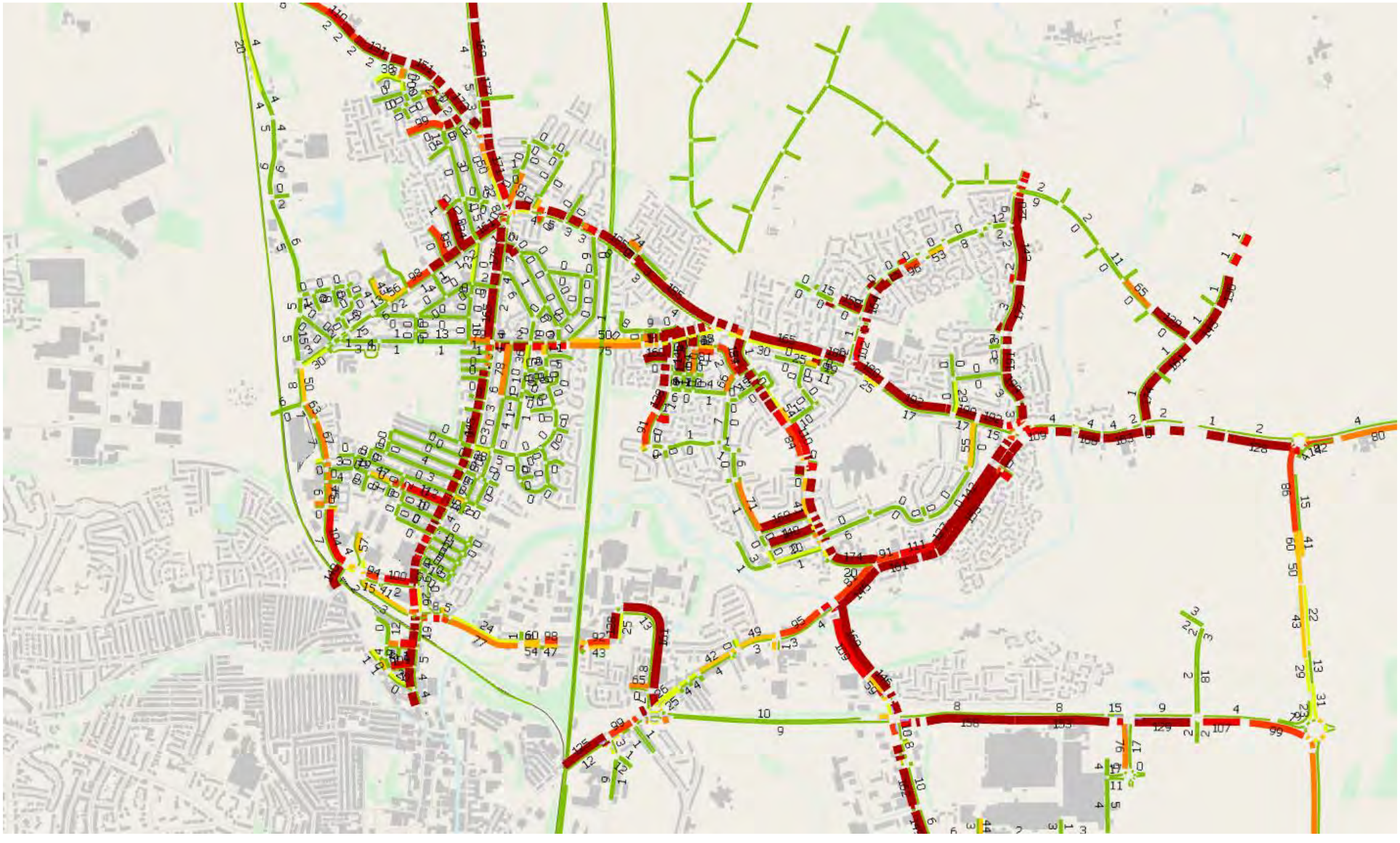
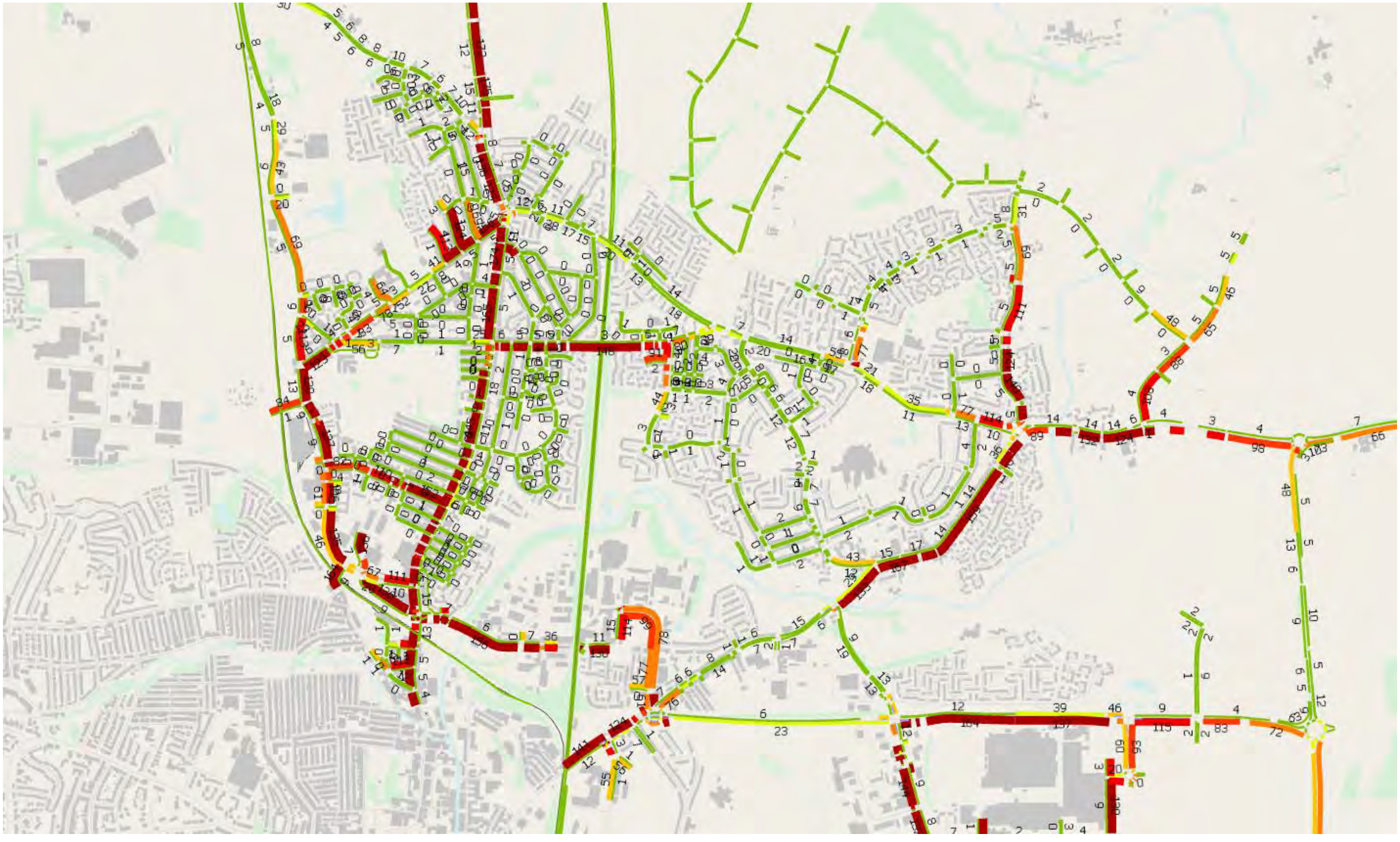
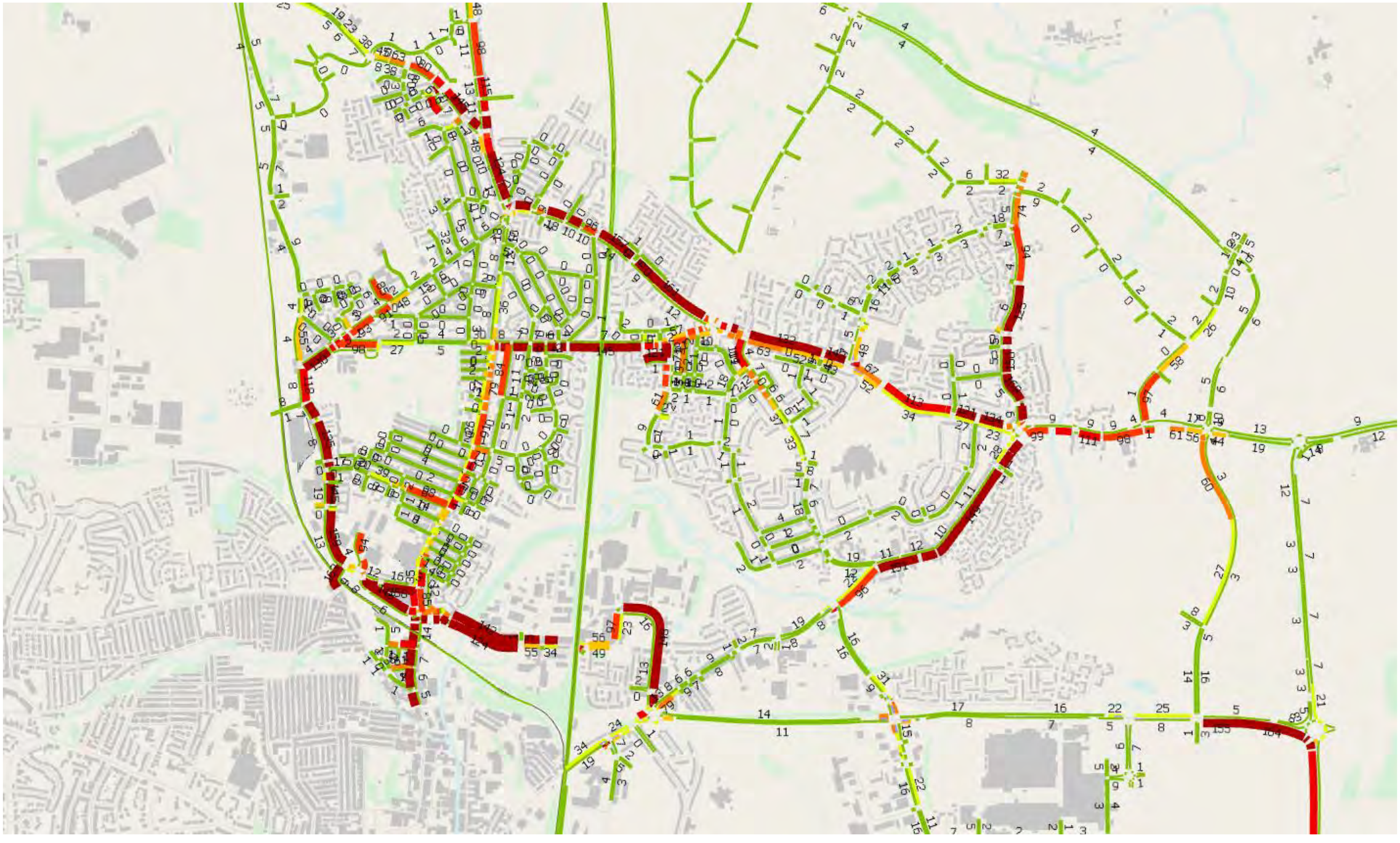


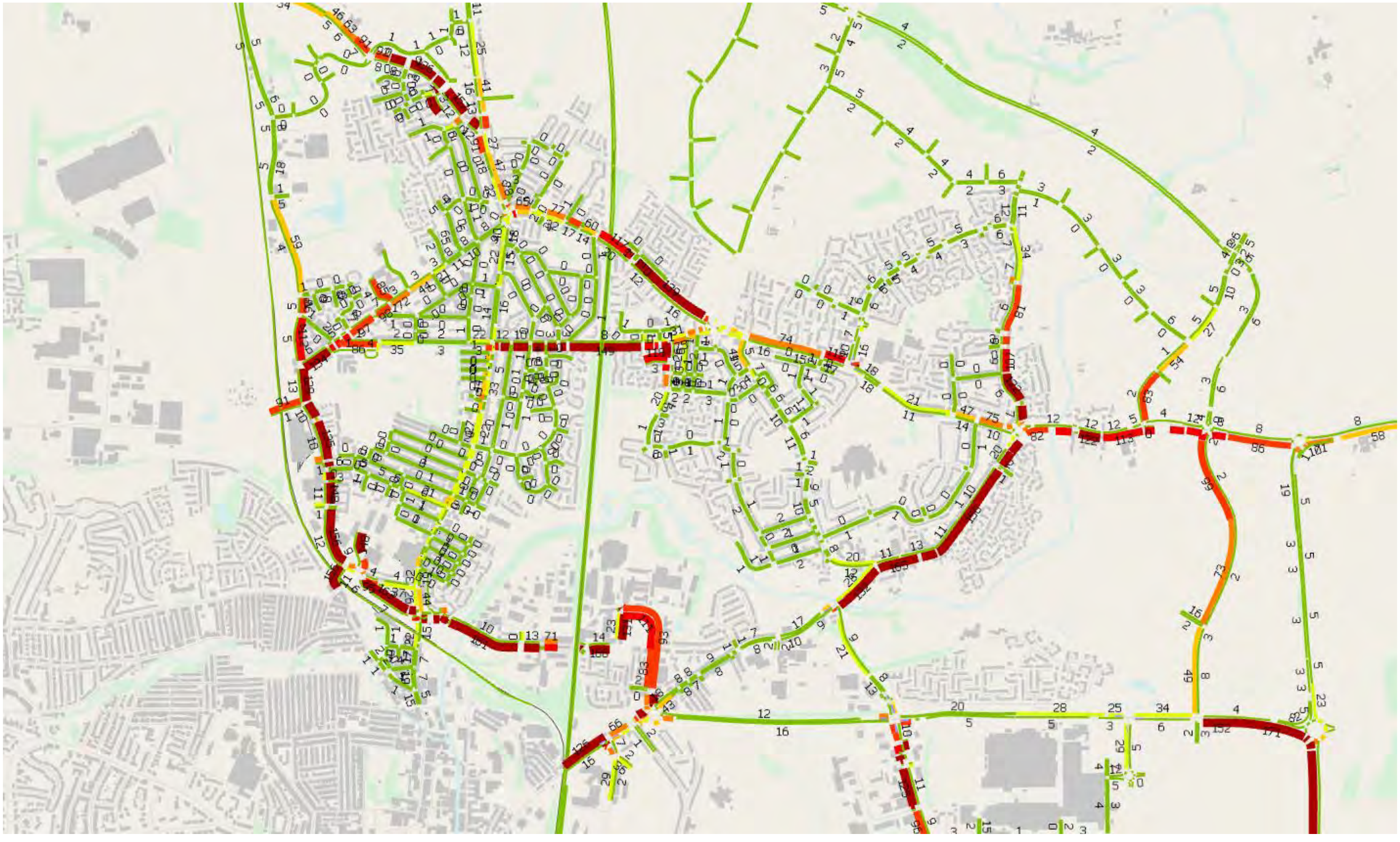
2035 Development Only PM



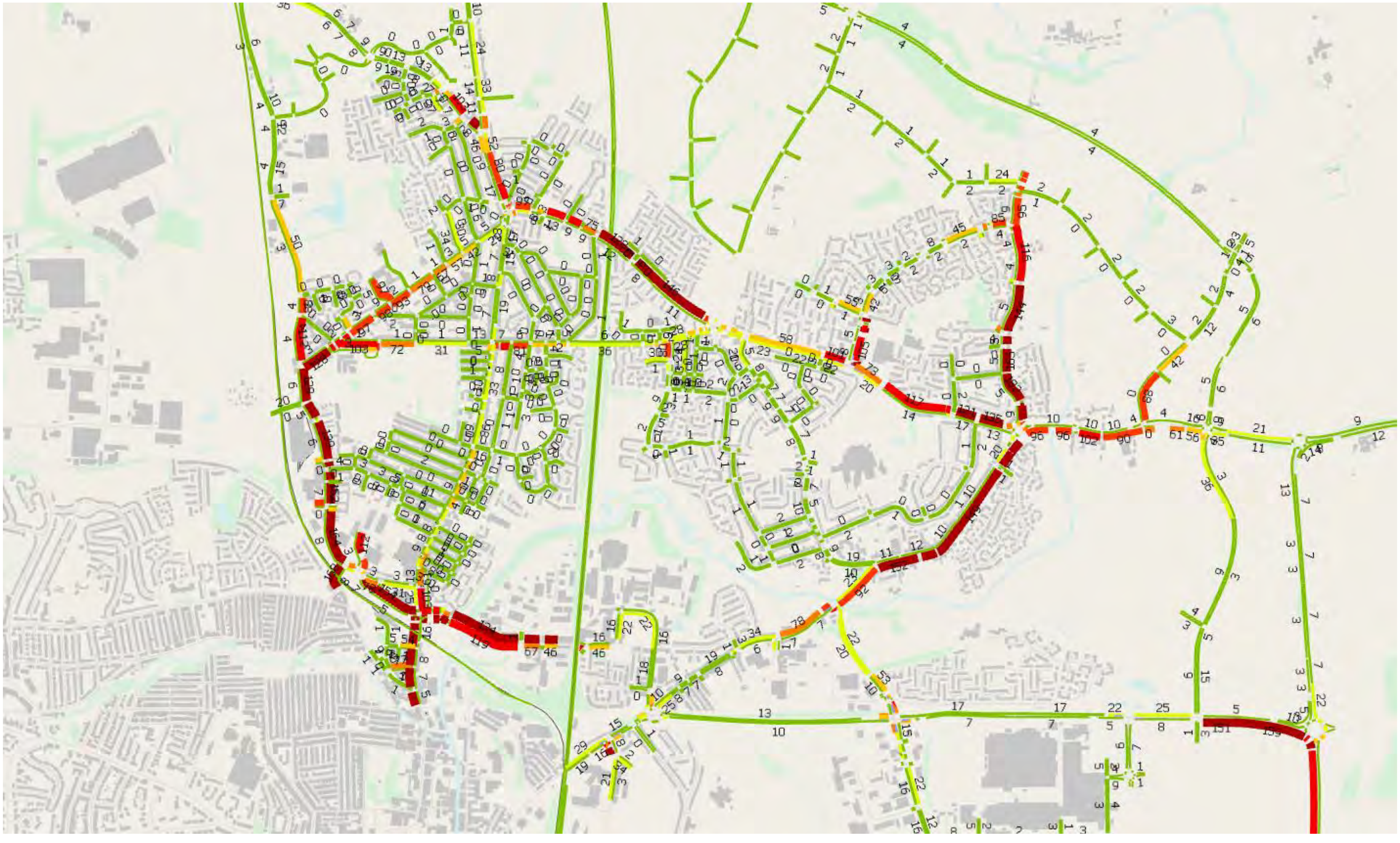
2035 Local Plan AM



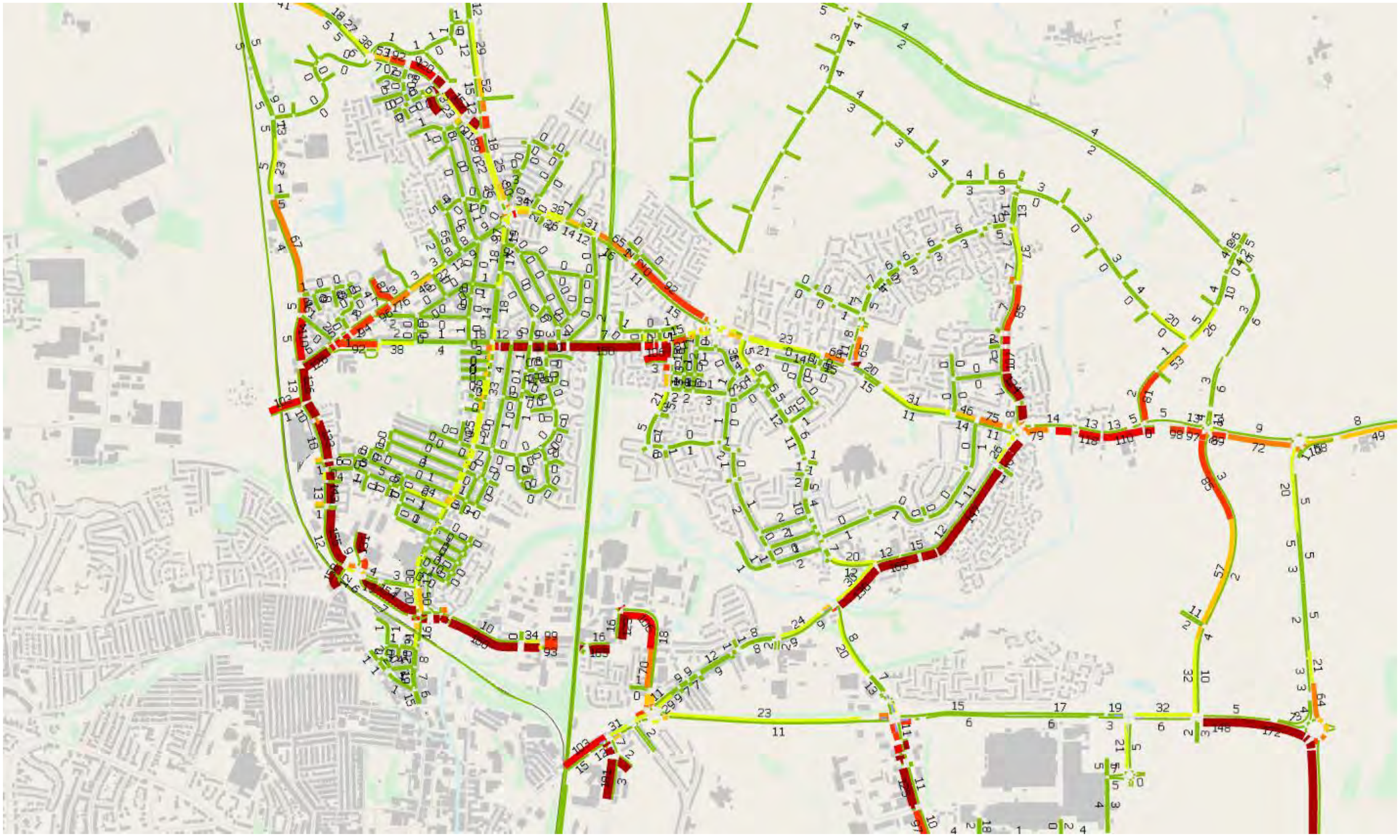
2035 Local Plan PM



2035 Optimised Local Plan AM



2035



Optimised Local Plan PM

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

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