Appendix D - Highways Impact Modelling Report

DATE:	05 October 2022	**CONFIDENTIALITY:**	Confidential
SUBJECT:	East Devon Local Plan Review Forecasting Technical Note		
PROJECT:	East Devon Local Plan Review	**AUTHOR:**	Henry Dixon
CHECKED:	Tom Holian	**APPROVED:**	Matthew Turner

INTRODUCTION

WSP have been commissioned to assist Devon County Council (DCC) alongside East Devon District Council (EDDC) in the process of refreshing the adopted Local Plan for EDDC through a 'Local Plan Review' with specific focus around Westpoint. The adopted Local Plan will extend the land use planning strategy in the area to 2030.

Demand for housing is predicted to continue increasing in the future. In order to model the impacts of increased housing and population on the local road network, a traffic model of the Greater Exeter (GE) area was developed by DCC (referred to as the "GE Model") using the SATURN strategic modelling software package. The GE Model area covers the Local Planning Authority (LPA) areas of Exeter, East Devon, Mid Devon, and Teignbridge, which has a combined population of approximately 475,000 people.

DCC commissioned a review of the GE Model to support the preparation of a transport evidence base, with a focus around the Westpoint area located to the east of Exeter. This work includes the review of base year and 2030 forecast models, reflecting the current and anticipated highway conditions, review and modification of a forecasting process, and the production of an updated end-of-Plan 2030 scenario.

This document outlines the forecasting process used to create a 2030 model, including the development around Westpoint.

MODEL OVERVIEW

The GE Model was developed in 2018 using the SATURN strategic traffic modelling software package. The model was developed using the latest version of SATURN at the time of development (11.4.07H, released August 2018).

The GE Model was initially developed based on the Bridge Road Model (BRM), another strategic model developed by DCC. The study area for the BRM was a smaller area focused on Bridge Road and therefore the model network was expanded to include the entirety of Exeter in addition to a large area east of Exeter.

This was then supplemented with more detailed geometries and saturation flows for key junctions from the East of Exeter (EoE) model, which had a specific focus on the M5 Exeter corridor and immediate surrounding area. The EoE model was developed by DCC in partnership with and approved by National Highways.

Modelled Time Periods

As per the GE Traffic Model Local Model Validation Report (LMVR)[1], the model represents a typical weekday in November 2017. In addition to this, there is a 2030 forecast model that includes Local Plan development and committed schemes.

[1] Version 006 October 2021

November was selected due to it being listed as a neutral month in the Department for Transport's (DfT's) Transport Appraisal Guidance (TAG) in addition to data availability and it being post completion of the Bridge Road widening scheme.

The GE Model includes the following three time periods:

- AM Peak: 08:00 – 09:00
- Inter-Peak: Average hour 10:00 – 16:00
- PM Peak: Average hour 16:00 – 18:00

Demand Segmentation

The GE Model comprises of three car User Classes (UCs), segmented by travel purpose, and two goods vehicle UCs as summarised below in Table 1.

Table 1 – GE Model Demand Segmentation

User class	Vehicle Type	Purpose
1	Car	Home Based Work (Commute)
2	Car	Employer's Business
3	Car	Other (Discretionary)
4	Light Goods Vehicle (LGV)	Employer's Business
5	Heavy Goods Vehicle (HGV)	Employer's Business

Generalised Cost Parameters

The Value of Time (VoT) values used in the GE Model were taken from the November 2018 release of the TAG Databook, the most recently available release at the time of the model development. The VoT values used are shown below in Table 2 in Pence Per Minute (PPM) alongside the operating cost values in Pence Per Kilometre (PPK).

Table 2 – Generalised Cost Parameters

UC	User Class	Value of Time (PPM)			Value of Time (PPK)		
		AM	IP	PM	AM	IP	PM
1	Car – Commute	12.3	12.5	12.34	9.84	9.69	9.79
2	Car – Employer's Business	21.82	22.36	22.14	13.74	13.33	13.61
3	Car – Other	8.48	9.04	8.89	9.84	9.69	9.79
4	LGV	15.2	15.2	15.2	14.69	14.7	14.68
5	HGV	15.66	15.66	15.66	33.19	32.02	32.81

DEVELOPMENT SCENARIOS

In order to assess the potential impact of the additional traffic generated by the Local Plan and Westpoint development, three development scenarios have been assessed. Each development scenario represents a different proposed site location, all containing 2,500 dwellings.

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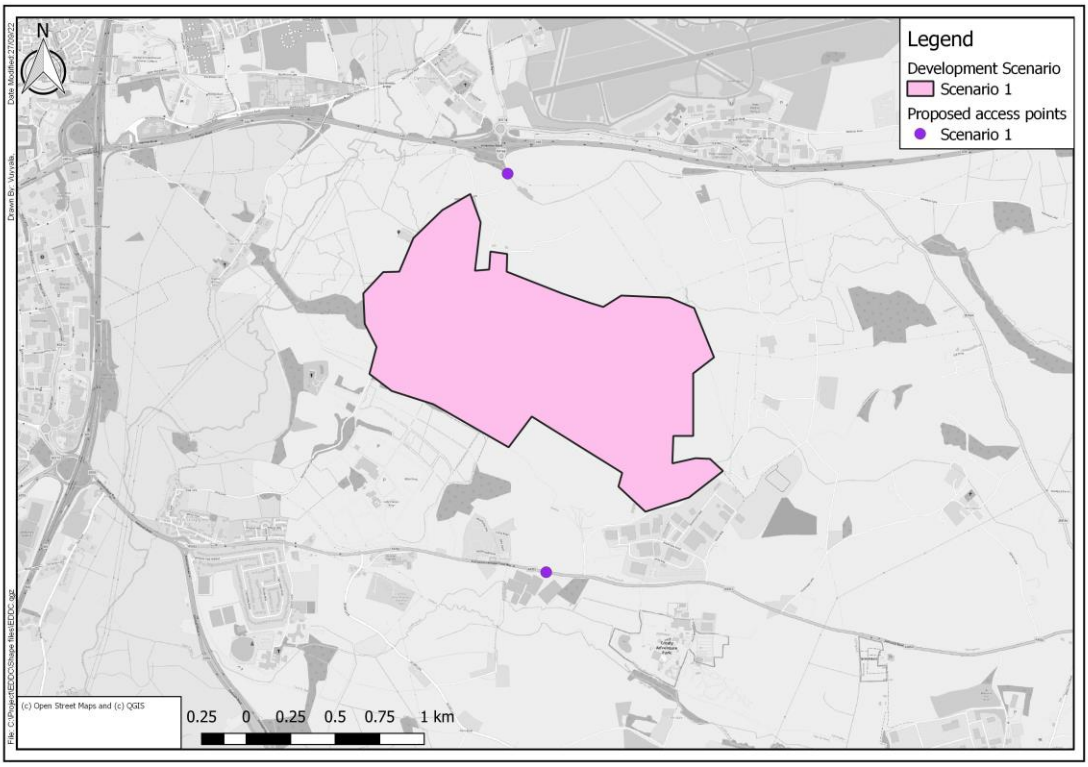
Scenario 1

Development scenario 1 includes a 521.0 ha site located between A30 Honiton Road in the north and A3052 East Devon Heritage Coast Way in the south. The location of the proposed development site is shown below in Figure 1.

Figure 1 – Scenario 1 Development Area



Two access points to the development site are planned as part of this scenario; one in the north providing access to the A30, and one in the south providing access to the A3052. A 2-lane, 20mph through-road connecting the northern and southern access points has been assumed to limit the amount of through routing. The access junctions connecting the through-road to the existing road network are coded as roundabouts with 2-lane approaches on each arm (one lane flaring to two), other than where pre-existing roads have different actual conditions. These approaches have been coded with modified stacking capacities and speed flow curves to imitate a 1-lane with flare approach on each arm.

The SATURN network around the proposed development site in this scenario is shown below in Figure 2, with development access roads highlighted in red.

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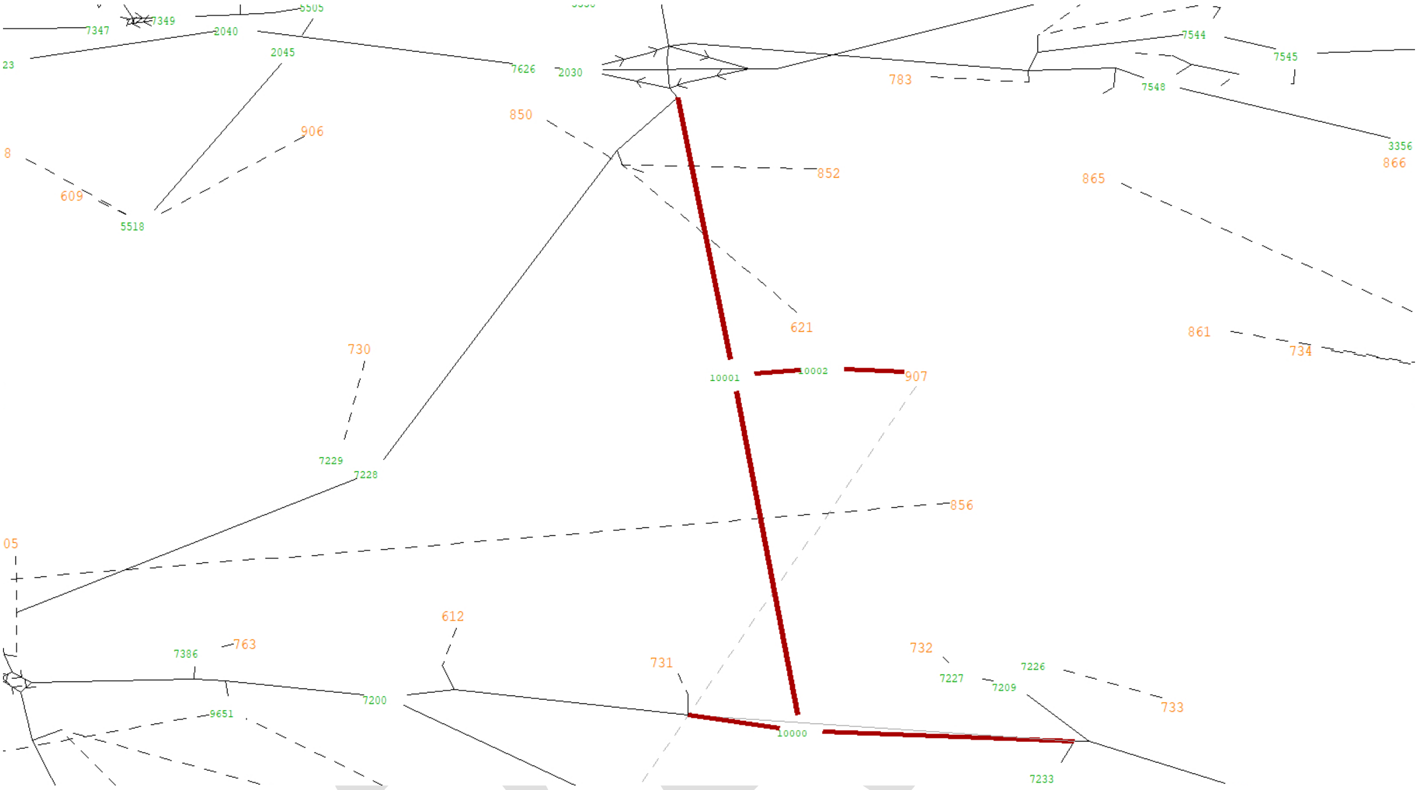
Figure 2 - Scenario 1 Development Site SATURN Network



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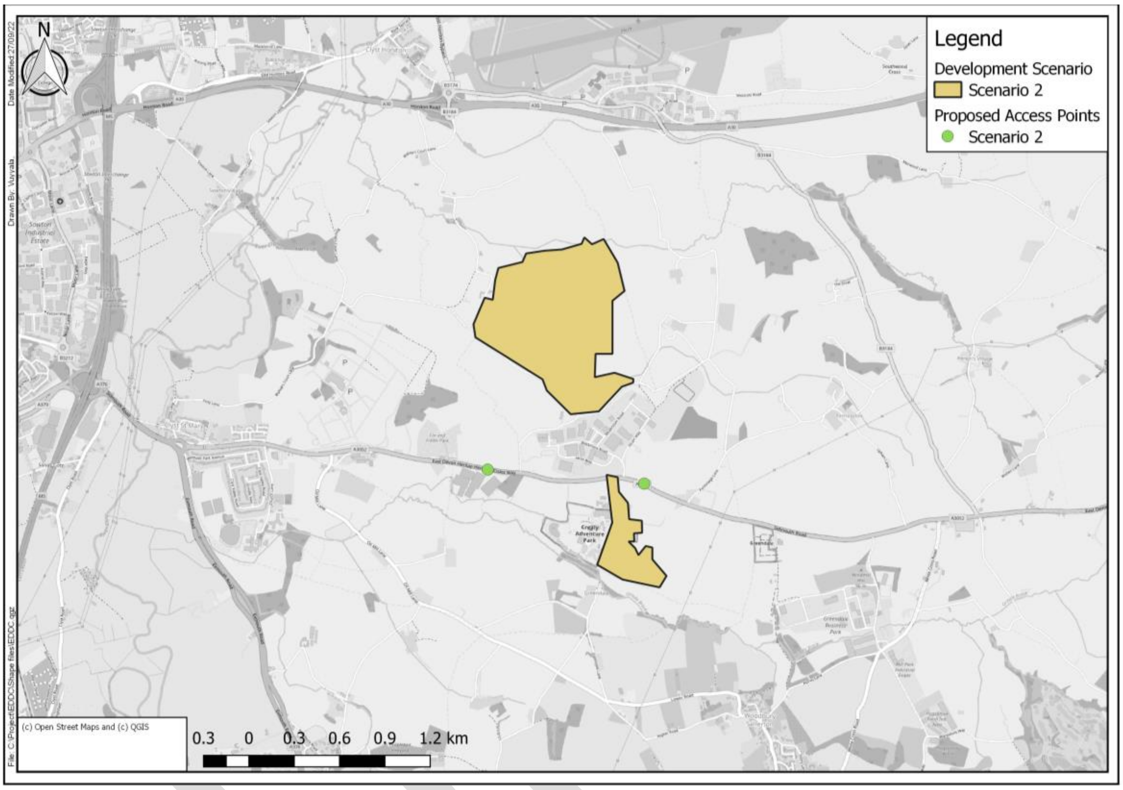
Scenario 2

Development scenario 2 includes a 521.5 ha site located across the A3052. The location of the proposed development site is shown below in Figure 3.

Figure 3 - Scenario 2 Development Area



Two access points to the development site have been considered as part of this development scenario, both providing access to the A3052. The access junctions connecting the development site zone to the wider road network are coded as roundabouts with 2-lanes (one lane plus flared approach). These approaches have been coded with modified stacking capacities and speed flow curves to imitate a 1-lane with flare approach on each arm.

The SATURN network around the proposed development site in this scenario is shown below in Figure 4, with development site access roads highlighted in red.

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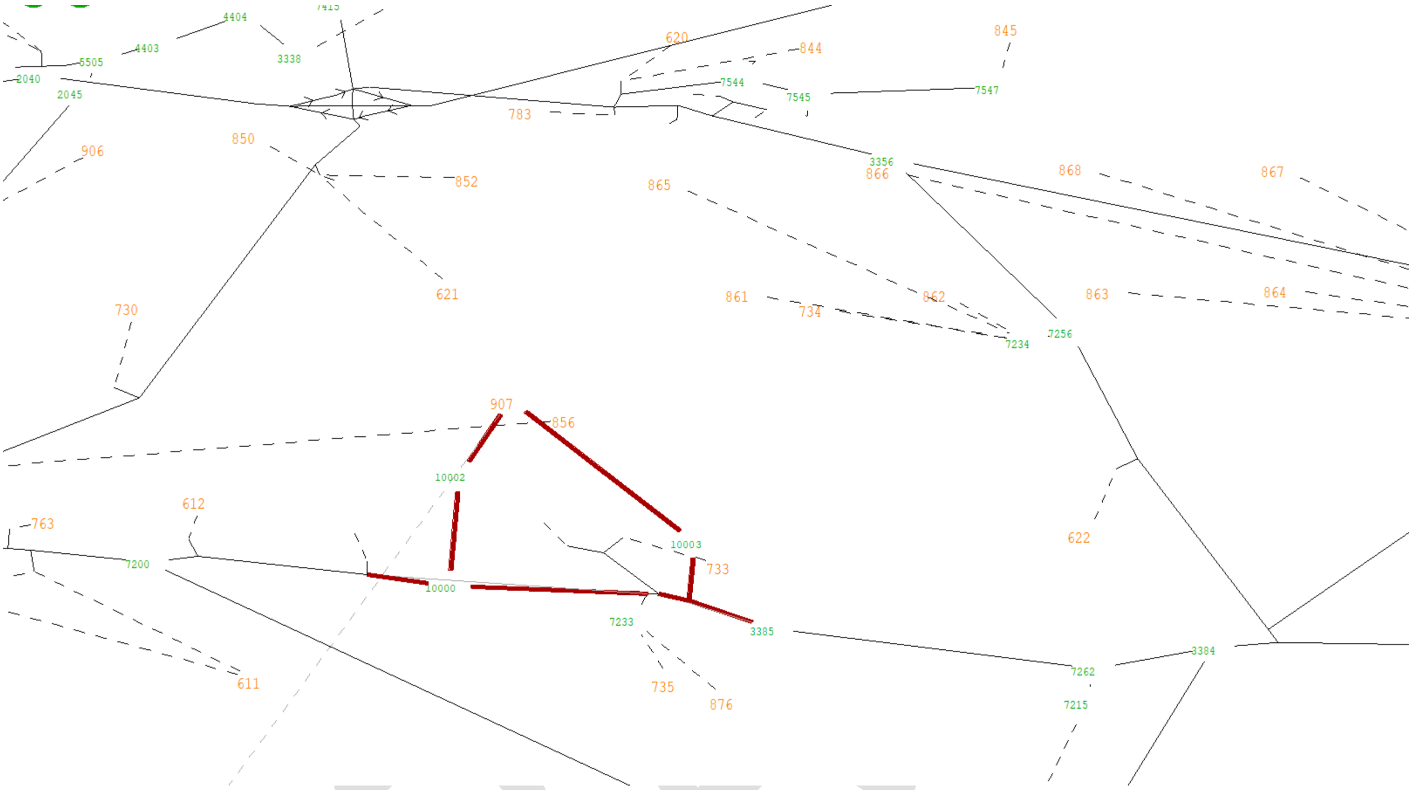
Figure 4 - Scenario 2 Development Site SATURN Network



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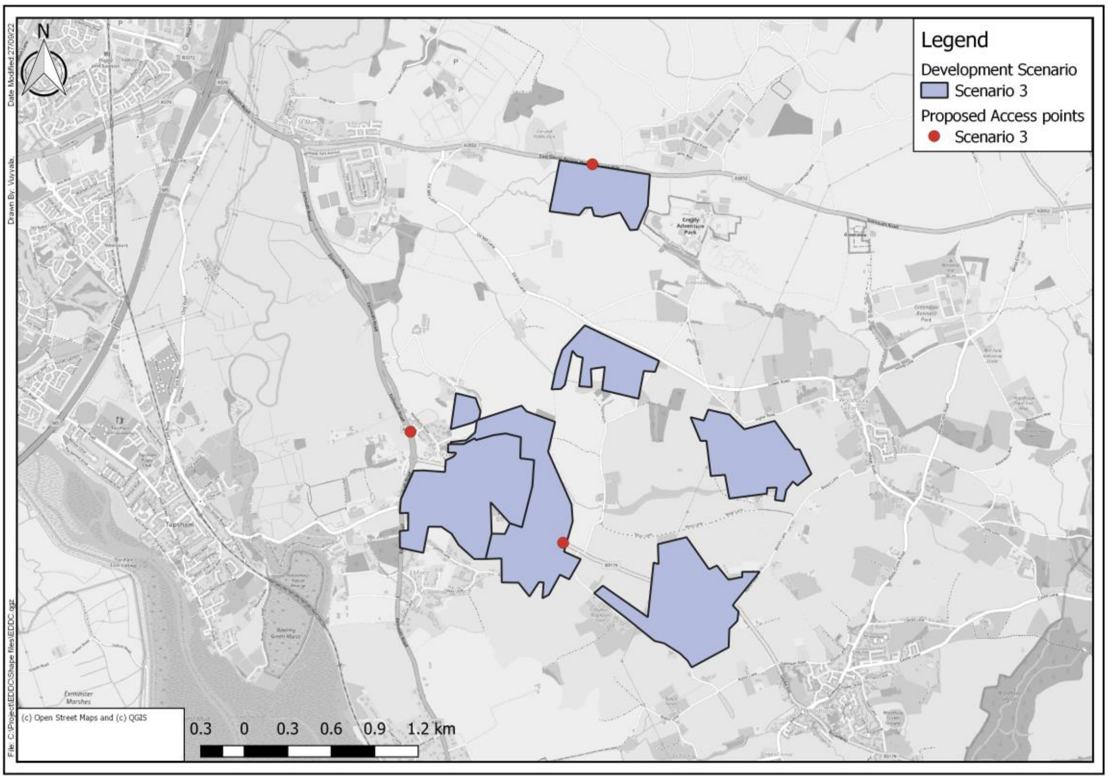
Scenario 3

Development scenario 3 includes a 523.2 ha site located in the vicinity of Woodbury Salterton between A3052 East Devon Heritage Coast Way, B3180, B3179, and A376 Exmouth Road. The location of the proposed development site is shown below in Figure 5.

Figure 5 - Scenario 3 Development Area



Three access points to the development site have been considered as part of this development scenario: one connecting to the A3052, one connecting to the B3179, and one connecting to the A376. The access junctions connecting the development site to the wider road network are coded as roundabouts with 2-lane (One lane plus flared approach), 20mph approaches on each new arm. These approaches have been coded with modified stacking capacities and speed flow curves to imitate a 1-lane with flare approach on each arm.

The SATURN network around the proposed development site in this scenario is shown below in Figure 6, with development site access roads highlighted in red.

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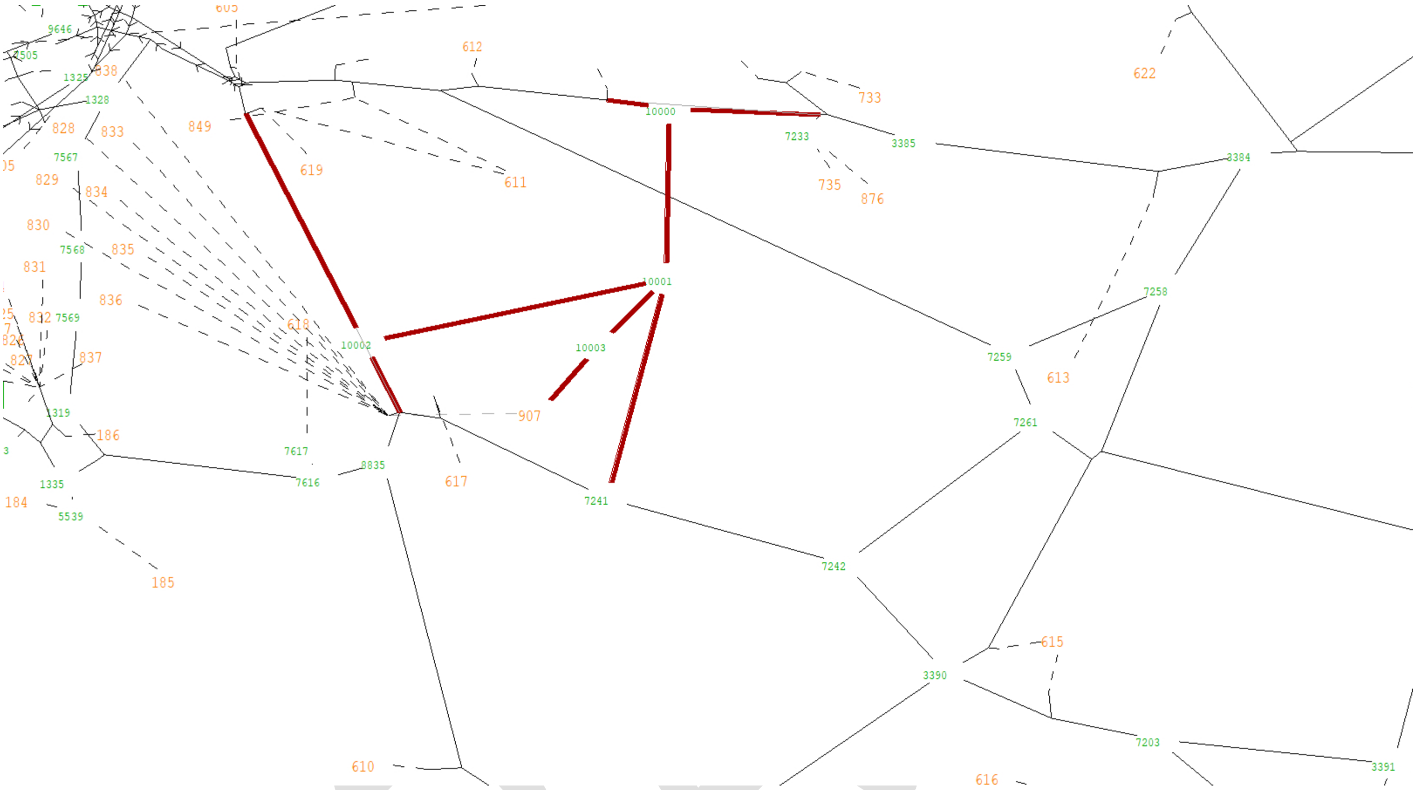
Figure 6 - Scenario 3 Development Site SATURN Network



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FORECASTING PROCESS

Trip Generation Methodology

DCC undertook an exercise to create a set of bespoke car trip rates for new communities within the Greater Exeter area[2]. Using an average of five urban survey sites from Greater Exeter Spatial Plan settlements, AM peak vehicle trip rates were calculated with consideration applied to the site location and internalisation by purpose. These are shown in Table 3 below.

Table 3 – AM Trip Rates for New Communities (Per dwelling)

Type	Inbound	Outbound	2-Way
Internal	0.02	0.10	0.12
External	0.07	0.27	0.34
Total	0.09	0.37	0.46

Both internal and external trip rates were provided, but only the external trip rates have been used as the proposed development sites are singular zones for this assessment. No internal trips have been assumed in this modelling. To obtain PM car trip rates, the AM car trip rates identified above have been compared to the AM values in Trip Rate Information Computer System (TRICS) to gain a relative difference. The same relative difference has then been inversed and applied to the PM with trip rates for all other modes coming from TRICS. Trips rates provided in TRICS are detailed below in Table 4. All trip rates for the IP have come directly from TRICS.

Table 4 – TRICS Trip Rates per Dwelling

Vehicle	Peak	Arrival	Departure
Car	AM	0.138	0.409
	IP	0.131	0.129
	PM	0.383	0.164
LGV	AM	0.013	0.018
	IP	0.017	0.018
	PM	0.022	0.014
HGV	AM	0.000	0.000

[2] TR2 – Trip Rates for New Communities

Vehicle	Peak	Arrival	Departure
	IP	0.001	0.001
	PM	0.000	0.000
Total	AM	0.151	0.427
	IP	0.149	0.147
	PM	0.405	0.178

The final development site trip rates once the relative differences have been applied are detailed below, in Table 5.

Table 5 – Final Development Site Trip Rates per Dwelling

Vehicle	Peak	Arrival	Departure
Cars	AM	0.070	0.270
	IP	0.131	0.129
	PM	0.244	0.096
LGV	AM	0.013	0.018
	IP	0.017	0.018
	PM	0.022	0.014
HGV	AM	0.000	0.000
	IP	0.001	0.001
	PM	0.000	0.000
Total	AM	0.083	0.288
	IP	0.149	0.147
	PM	0.266	0.110

Forecasting Process Methodology

The GE Model has a bespoke forecasting process developed by DCC, which has been inherited for this development assessment. High level processes are detailed below, but further information can be found in the Greater Exeter Traffic Model Forecasting Report[3].

[3] Greater Exeter Traffic Model Forecasting Report, October 2021 (GE-FR-06)

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The forecasting process starts by factoring the base year matrices to account for local background growth and windfall development up to the year 2030. The matrices generated by this step are referred to as the Local Background Growth 2017 to 2030 (LBG1730) matrices.

The GE Model has a forecast year of 2030, whereas the 2,500 dwellings located at the proposed development sites are due to be completed by 2040. As part of the GE Model forecasting process, major roads in Exeter do not experience any growth in trips during the modelled peak hour(s) due to already being at capacity. Therefore, the calculations for the forecast year of 2030 are deemed to be a suitable proxy for the forecast year of 2040, for the purposes of preliminary testing and comparison of the impacts of the proposed development sites.

The forecasting process then uses the LBG1730 matrices and Local Plan development up to the year 2030 to create targets for a furnessing process. This is the stage at which the Local Plan Review development trips are inserted into the forecasting process to produce the Do-Something (DS) matrices, or not inserted to produce the Do-Minimum (DM) matrices. The matrices generated by this step are referred to as the Local Plan 2017 to 2030 Pre Park & Change (LP1730_Pre_PC) matrices.

The LP1730_Pre_PC matrices are then assigned to the development scenario networks, and select links are taken from the networks at identified future Park & Change sites. These select link matrices are factored and recombined with the LP1730_Pre_PC matrices to produce the Local Plan 2017 to 2030 (LP1730) matrices.

The next stage of the forecasting process generates and furnesses matrices based on the Road Traffic Forecast (RTF) scenarios, which combines the resulting matrix with the LP1730 matrices to adjust traffic flows on the Strategic Road Network (SRN).

Finally, a series of select links along the M5 are undertaken on the adjusted LP1730. These select links are subsequently factored and combined into the adjusted LP1730 matrices, the final forecast matrices.

The GE Model forecasting process produces two sets of forecast matrices based on different RTF scenarios. For the purposes of this assessment, only the set of matrices based on RTF scenario 1 have been analysed, and a comparison of total matrix trips between the different development scenarios are presented below in Table 6**.**

Table 6 - Matrix Totals Comparison

Scenario	AM	AM Diff. vs Base	IP	IP Diff. vs Base	PM	PM Diff. vs Base
Base	45,697	0.00%	32,612	0.00%	42,041	0.00%
DM	53,289	16.61%	38,195	17.12%	48,480	15.32%
DS Scenario 1	53,710	17.53%	38,545	18.21%	48,909	16.34%
DS Scenario 2	53,792	17.71%	38,567	18.26%	48,834	16.16%

Scenario	AM	AM Diff. vs Base	IP	IP Diff. vs Base	PM	PM Diff. vs Base
DS Scenario 3	53,778	17.68%	38,567	18.26%	48,840	16.17%

This comparison shows that the number of trips added to the network by the development changes between scenarios, despite being based on the same trip rates and number of dwellings. This is due to the stage at which the development trips are inserted into the forecasting process, as noted in the forecasting methodology. Select links are taken from the model, factored, and recombined after the development trips are added, thereby affecting the final matrix totals.

RESULTS

Bespoke models have been created for each development scenario and compared against the DM models produced by the same forecasting process, with a particular focus on effects on and around the M5 from J29 to J31.

To aid this comparison, a set of diagrams showing traffic flows on the M5 from J29 to J31 and parts of the A30, A38, and A380 to the east and west of Exeter have been produced. These diagrams were initially produced by DCC as part of the GE Model development process and have been modified and updated with model data for the DM and three DS development scenarios. However, these diagrams do not include details of the junctions themselves at M5 J29 and J30, or details of Clyst St. Mary Roundabout and the road network immediately to the east of Exeter.

Therefore, for each development scenario, a summary of information included in the diagrams and an investigation of the models at M5 J29 and J30, Clyst St. Mary Roundabout, and areas to the east of Exeter have been provided. Images of the AM and PM models have also been provided for each model investigation, showing demand flow, actual flow, delay, and volume over capacity (V/C) at M5 J29 and J30. In each model image, the demand and actual flows and delay times have been truncated to show only changes of greater than 25 PCUs per hour and five seconds respectively. Anything less than five seconds could be a consequence of model noise rather than actual results.

The full set of diagrams are available in Appendix A. To aid these diagrams, SATURN difference plots are available in Appendix B for each scenario with an additional set of model screenshots of the M5 J29 and J30, A30, A3052, and Clyst St. Mary Roundabout in Appendix C.

Scenario 1

In the AM for Scenario 1, the model shows a slight increase in traffic flows travelling southbound on the M5, westbound on the A30 west of Exeter, and southwest bound on the A38 and A380. However, the model also shows a slight decrease in traffic travelling in the opposite direction. The IP and PM models show similar slight changes in traffic flow. All models show a slight increase in traffic travelling in all directions on the A30 east of Exeter. This has not had a material impact on delay along the M5, with the largest increase being less than a second.

The SATURN models show an increase in traffic flow but minimal overall changes to delay along the M5 and the surrounding road network to the east of Exeter. Increases in delays at Junction 29 can be seen in the AM and PM models, predominantly on the eastern side of the M5. Clyst St. Mary Roundabout shows an increase in delay, with an additional 33 seconds on the westbound approach in the AM model and 35 seconds on the eastbound approach in the PM model. Subsequently, additional turning delay can be seen on the roundabout itself.

Images of the demand flow, actual flow, delay and volume over capacity in the AM and PM models are shown below, in Figure 7 through to Figure 14.

Figure 7 – DM vs DS Scenario 1, AM, Demand Flow

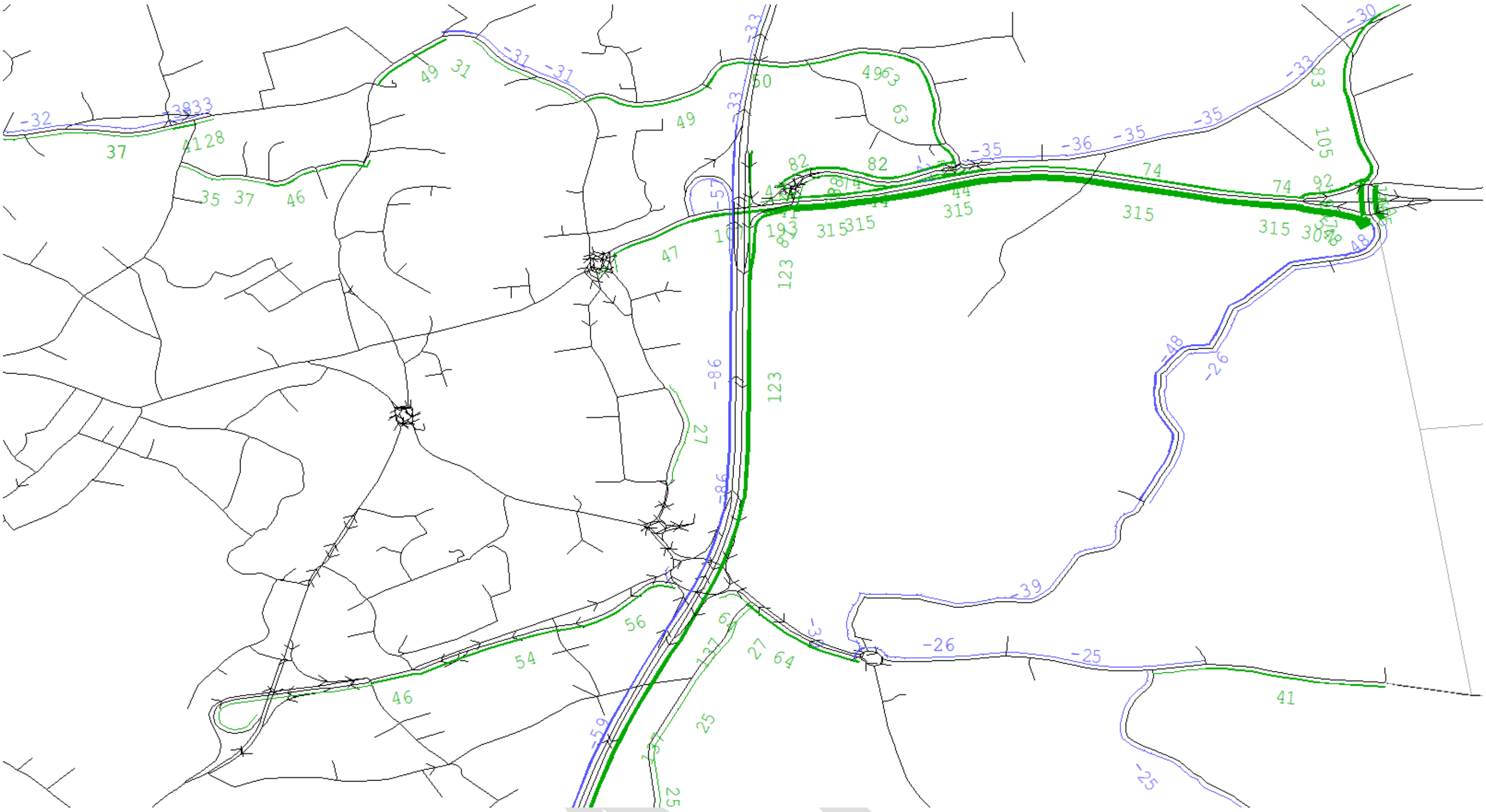


Figure 8 – DM vs DS Scenario 1, AM, Actual Flow

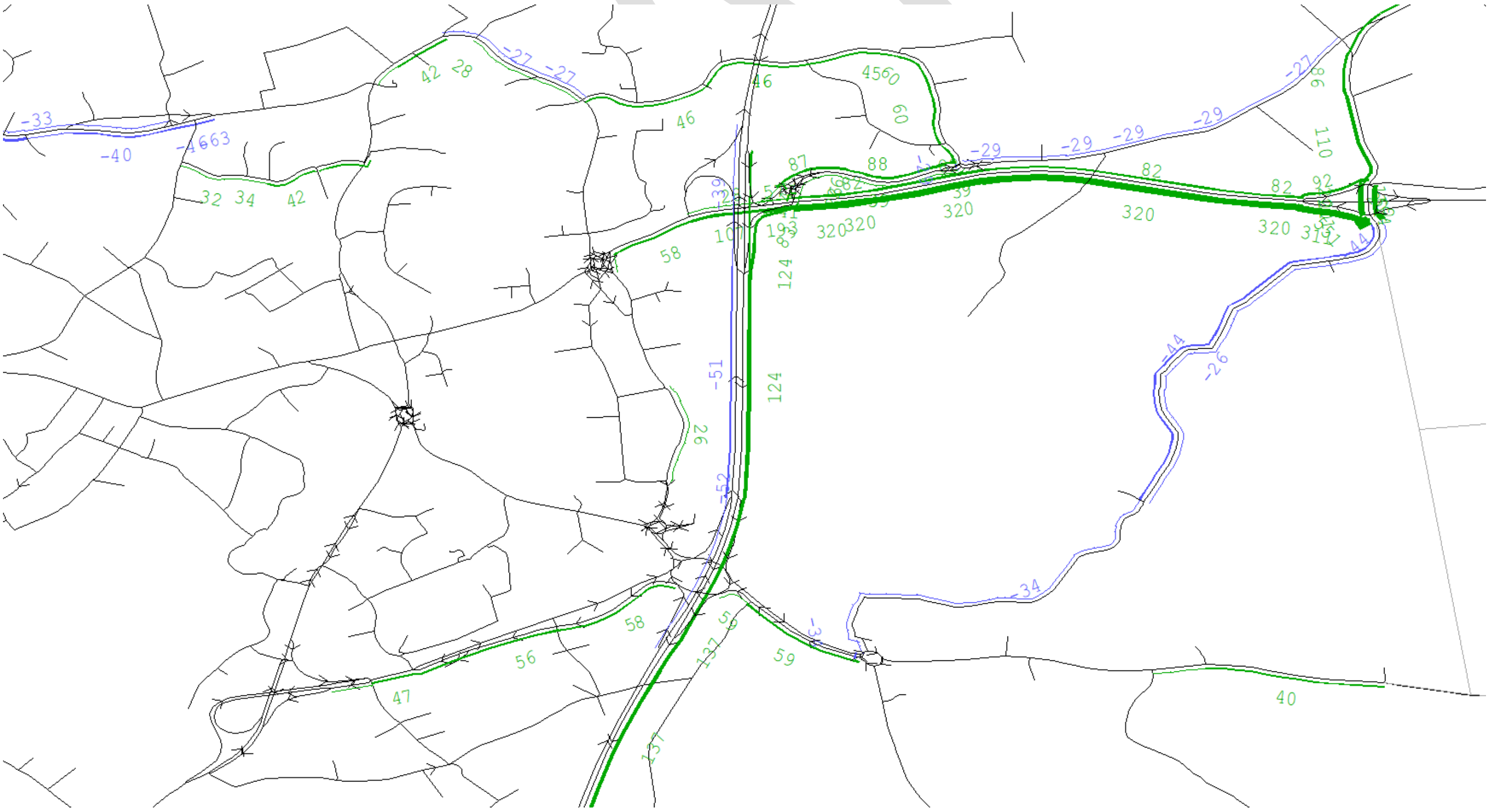


Figure 9 – DM vs DS Scenario 1, AM, Delay

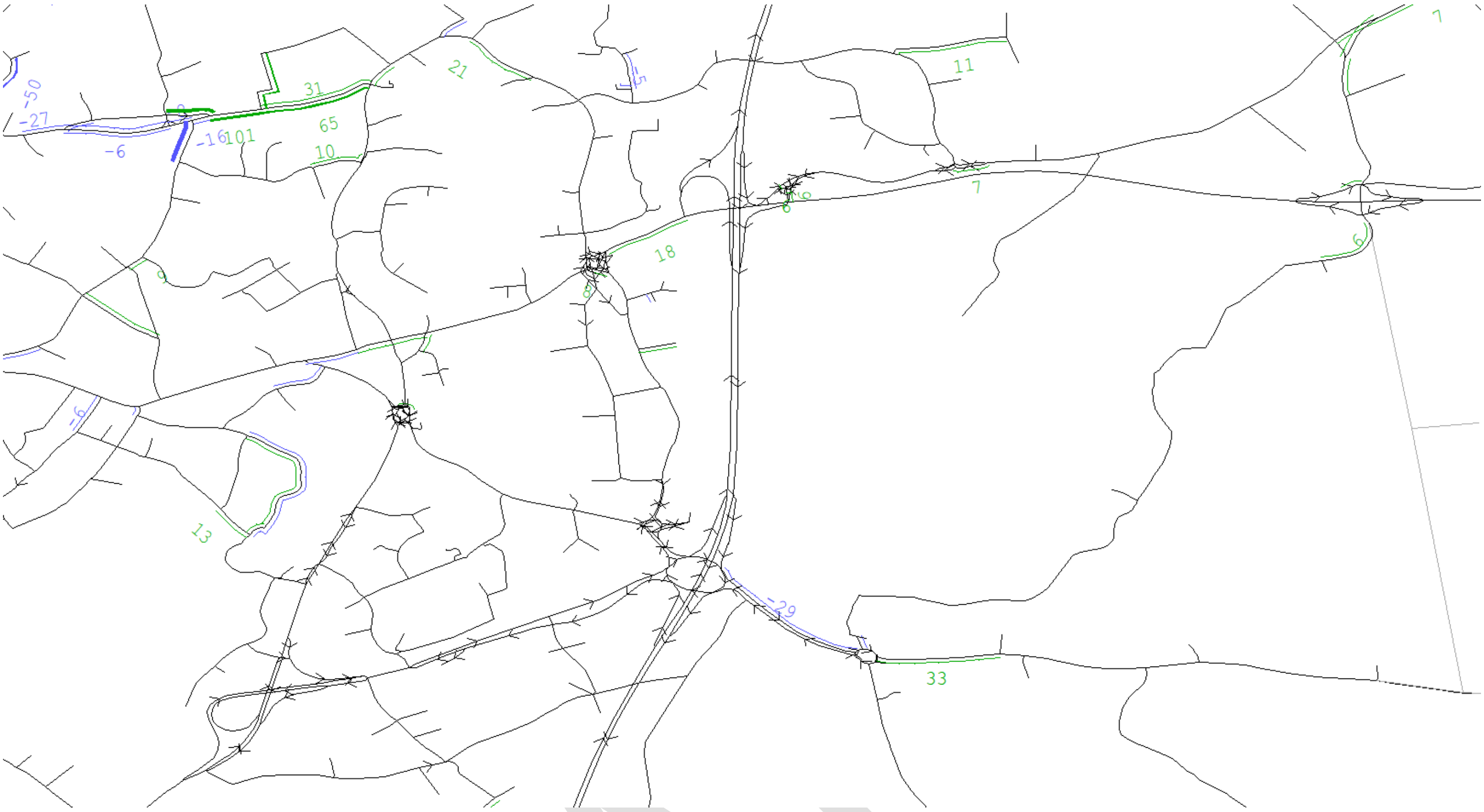


Figure 10 – DM vs DS Scenario 1, AM, V/C

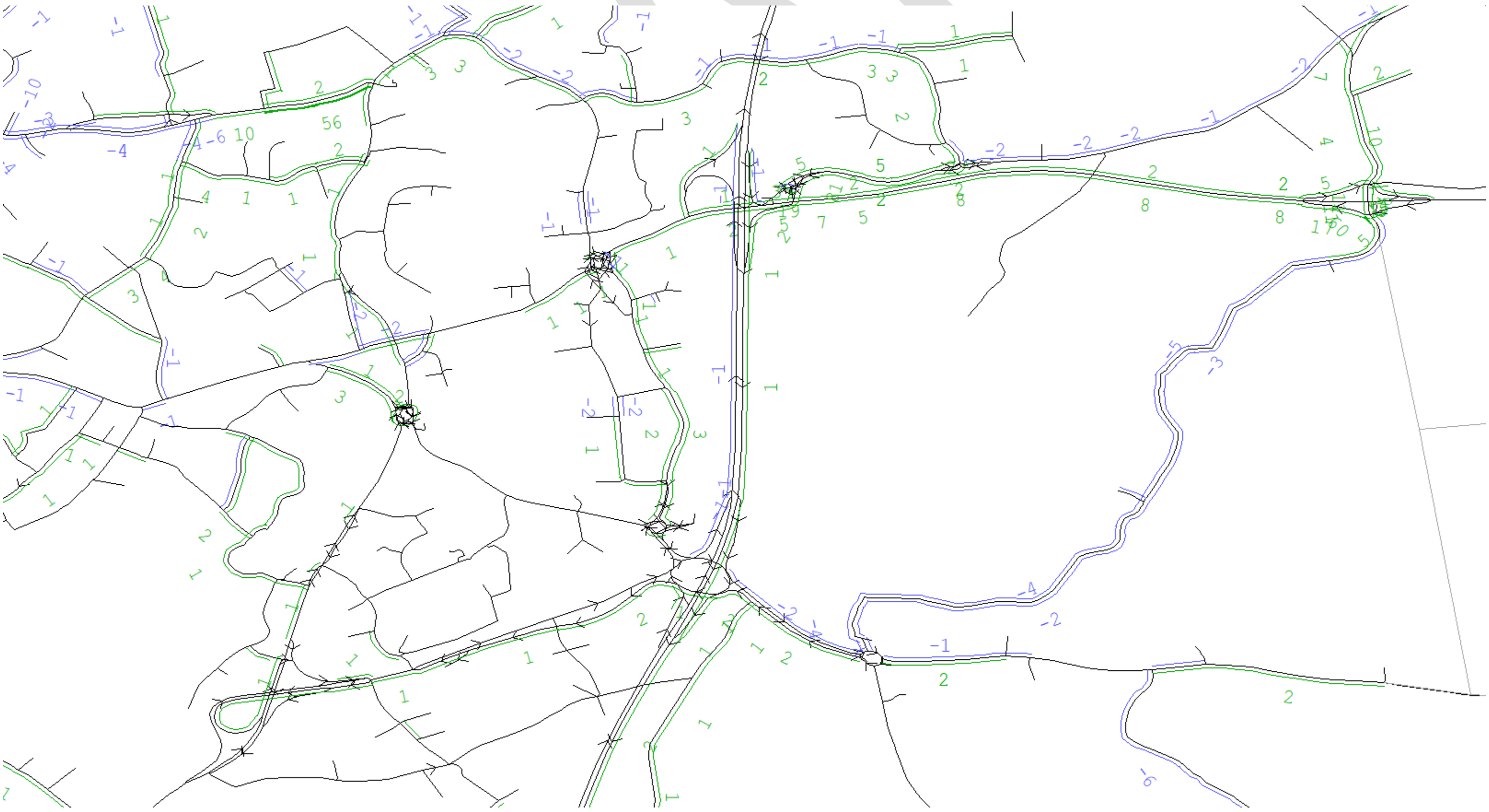


Figure 11 – DM vs DS Scenario 1, PM, Demand Flow

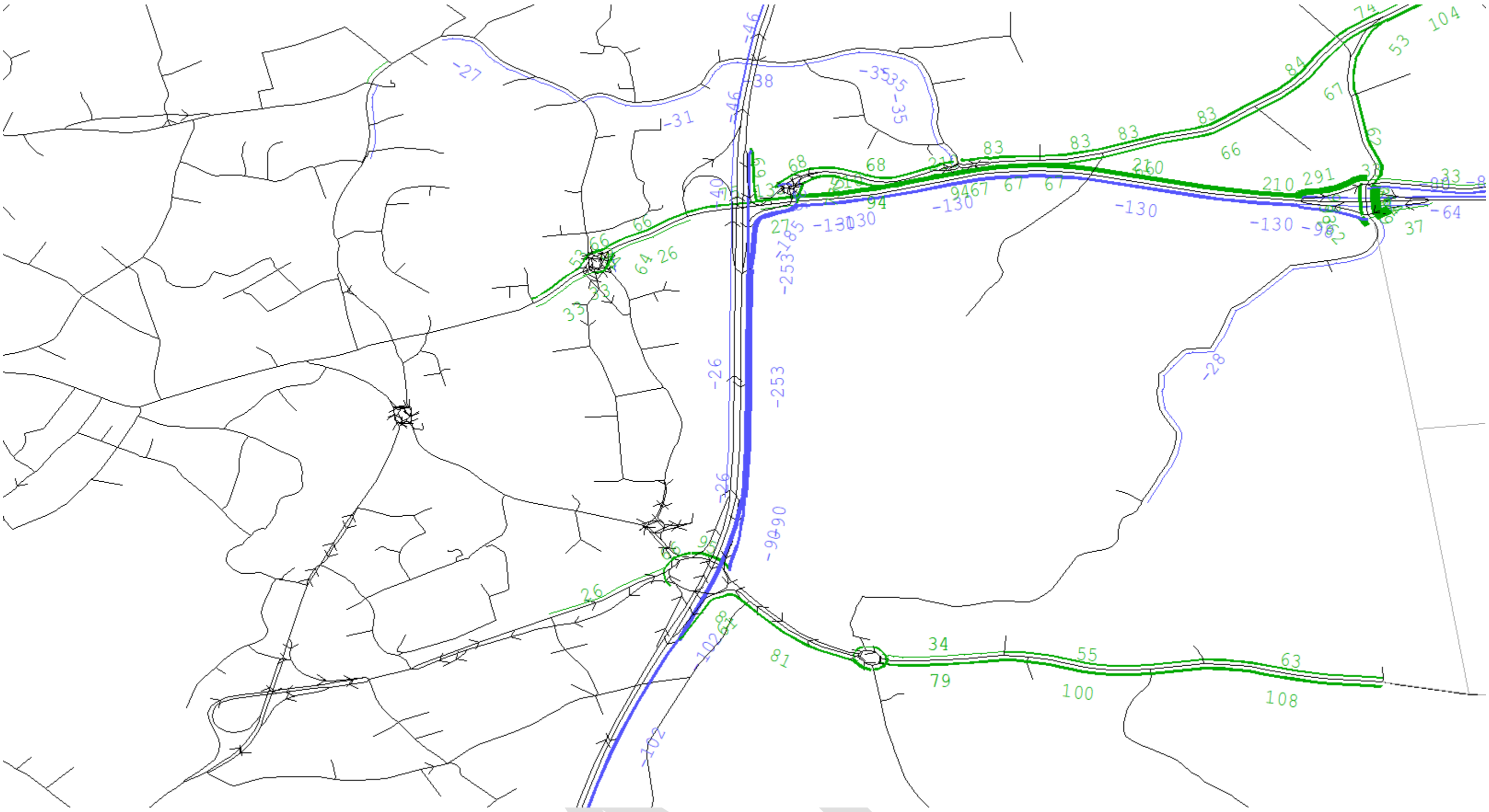


Figure 12 – DM vs DS Scenario 1, PM, Actual Flow

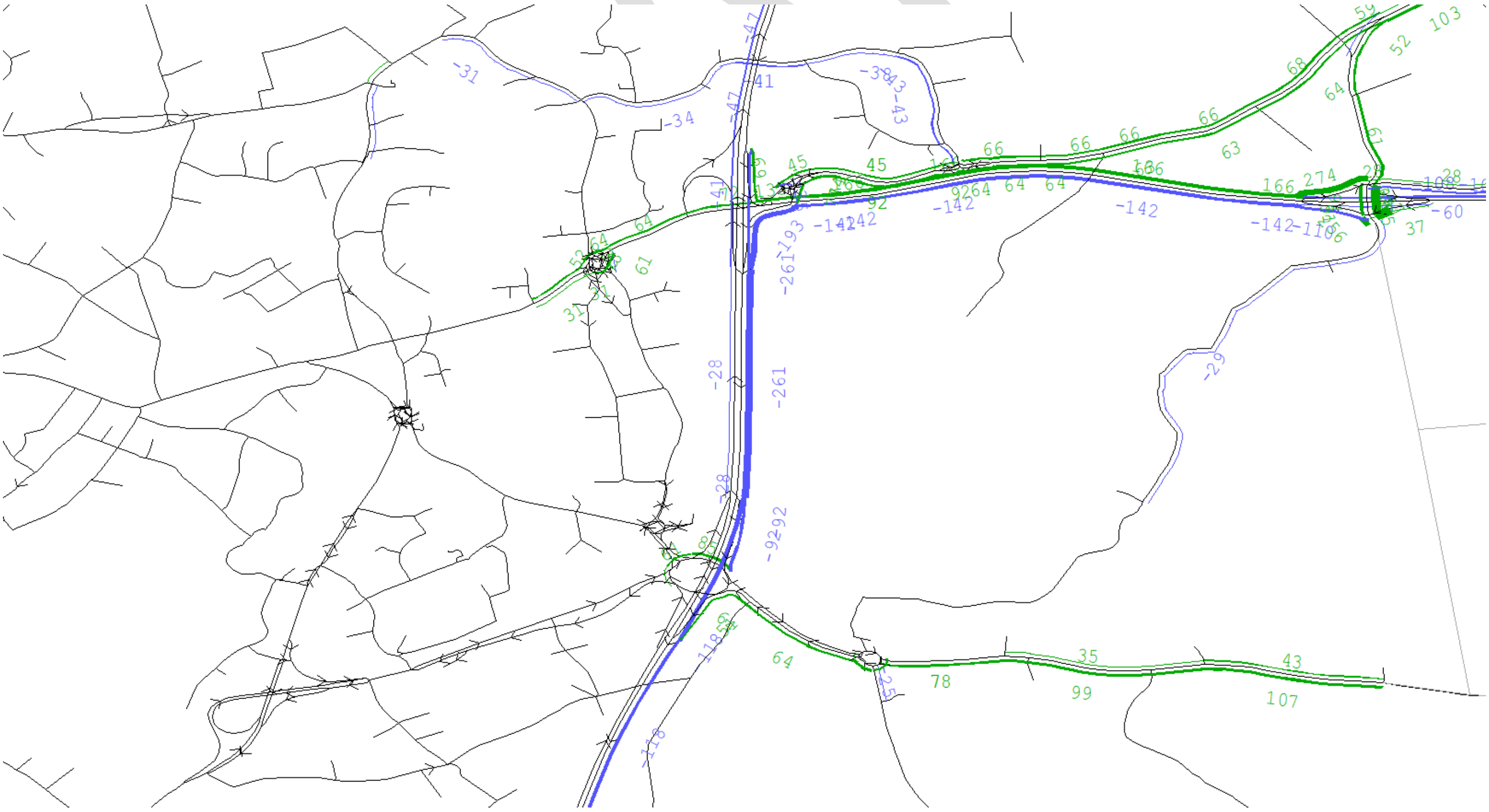


Figure 13 – DM vs DS Scenario 1, PM, Delay

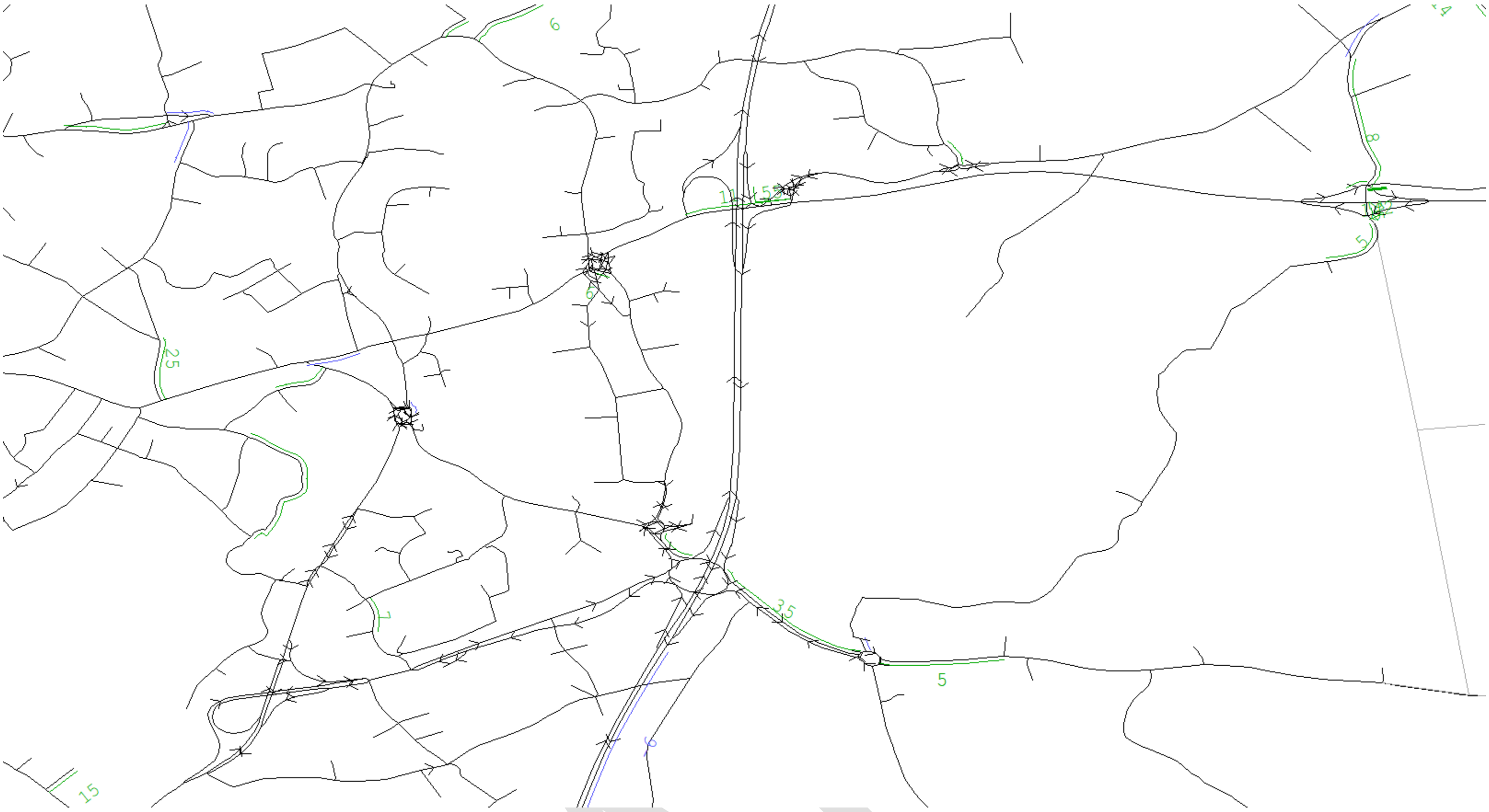
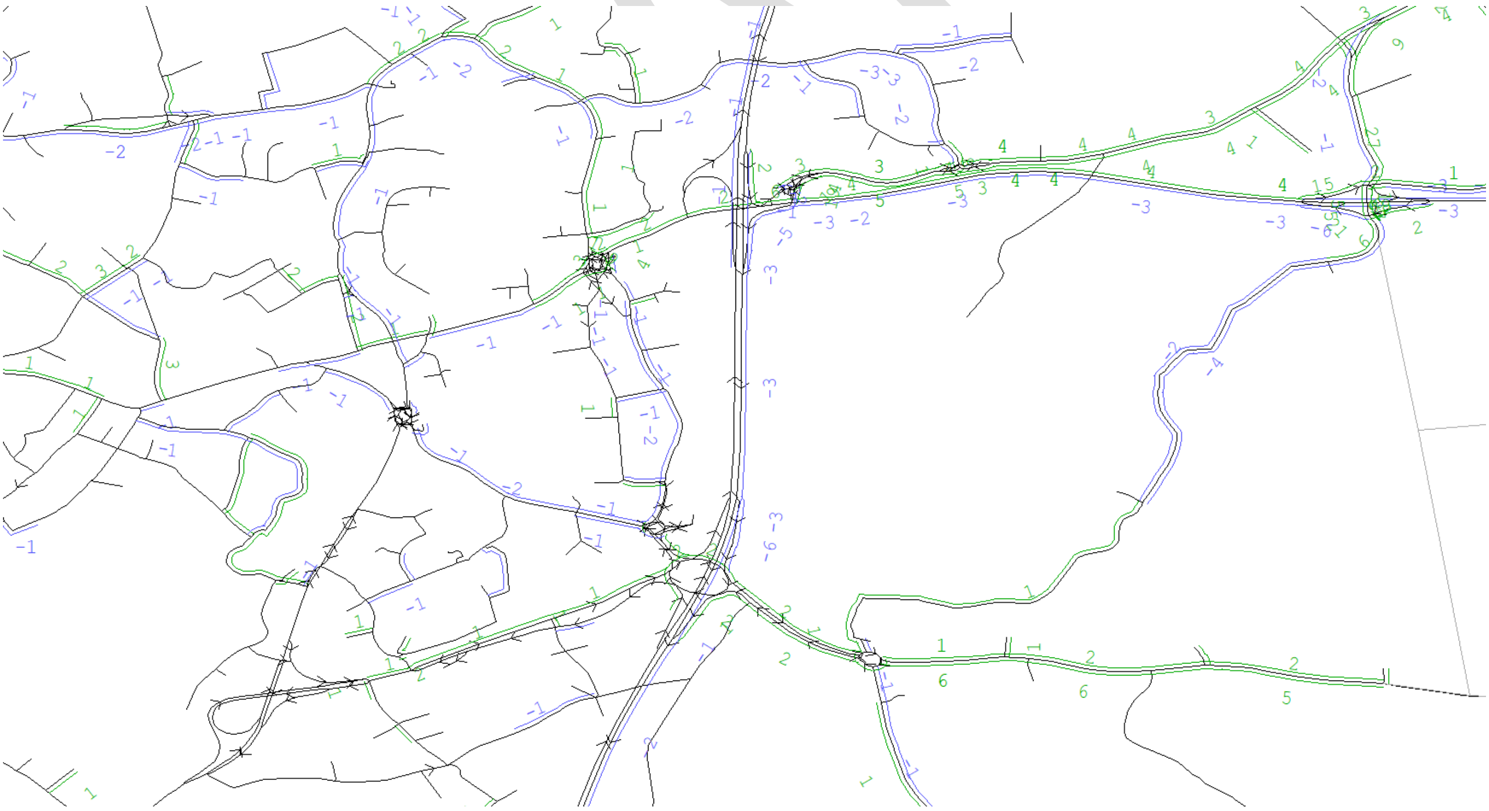


Figure 14 – DM vs DS Scenario 1, PM, V/C



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Scenario 2

In the AM and IP models for Scenario 2, there are slight traffic flow changes along the M5, A30, A38, and A380. The PM model similarly shows slight traffic flow changes, however there are some larger differences in flow of up to 130 Passenger Car Units (PCUs). Minimal changes in delay can be seen on the M5 itself, increasing by less than four seconds in any model.

Increased traffic flows can be seen alongside minimal changes in delay along the mainline at M5 Junction 29 and Junction 30 in addition to the road network to the east of Exeter. Junction 29 and 30 along the M5 see some increases in delay in the AM and PM models, focused on the east side of the M5 at Junction 29 and the north side of the junction at Junction 30.

The models show that Clyst St. Mary Roundabout sees a significant increases in delay in Scenario 2, with an increase of 277 seconds of delay on the westbound approach in the AM and 160 seconds additional delay on the eastbound approach in the PM. In addition to this, there is an overall increase in the turning delay on the roundabout itself. Some parts of the road network to the east of Exeter also see large increases in delay. The AM model shows an increase of 227 seconds southbound on Bond’s Lane and 90 seconds northbound on Woodbury Road around the combining junction. An increase of 76 seconds can also be seen northbound on the A376 at the junction with Topsham Road.

Images of the demand flow, actual flow, delay and volume over capacity in the AM and PM models are shown below, in Figure 15 through to Figure 22.

Figure 15 – DM vs DS Scenario 2, AM, Demand Flow

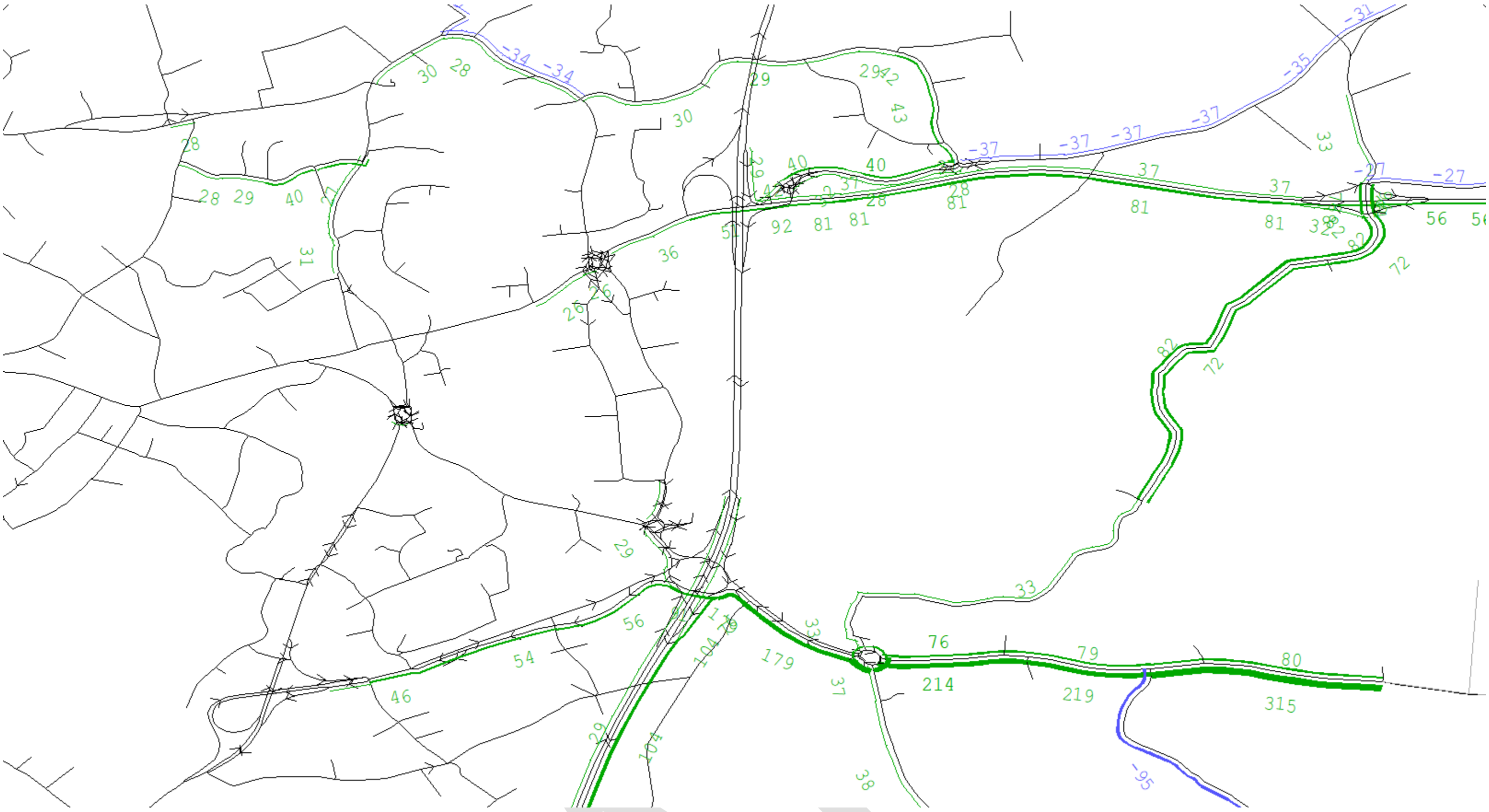


Figure 16 – DM vs DS Scenario 2, AM, Actual Flow

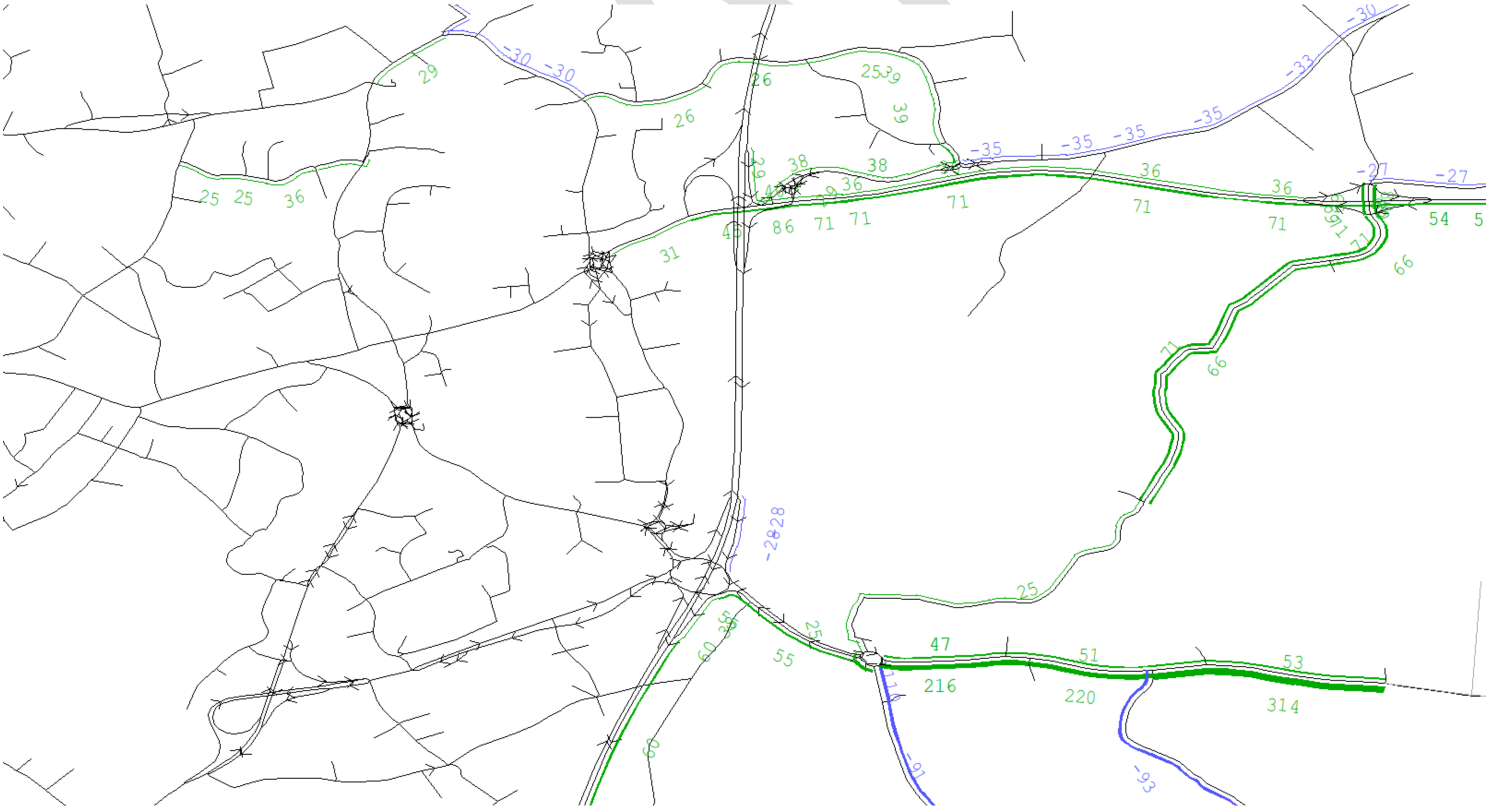


Figure 17 – DM vs DS Scenario 2, AM, Delay

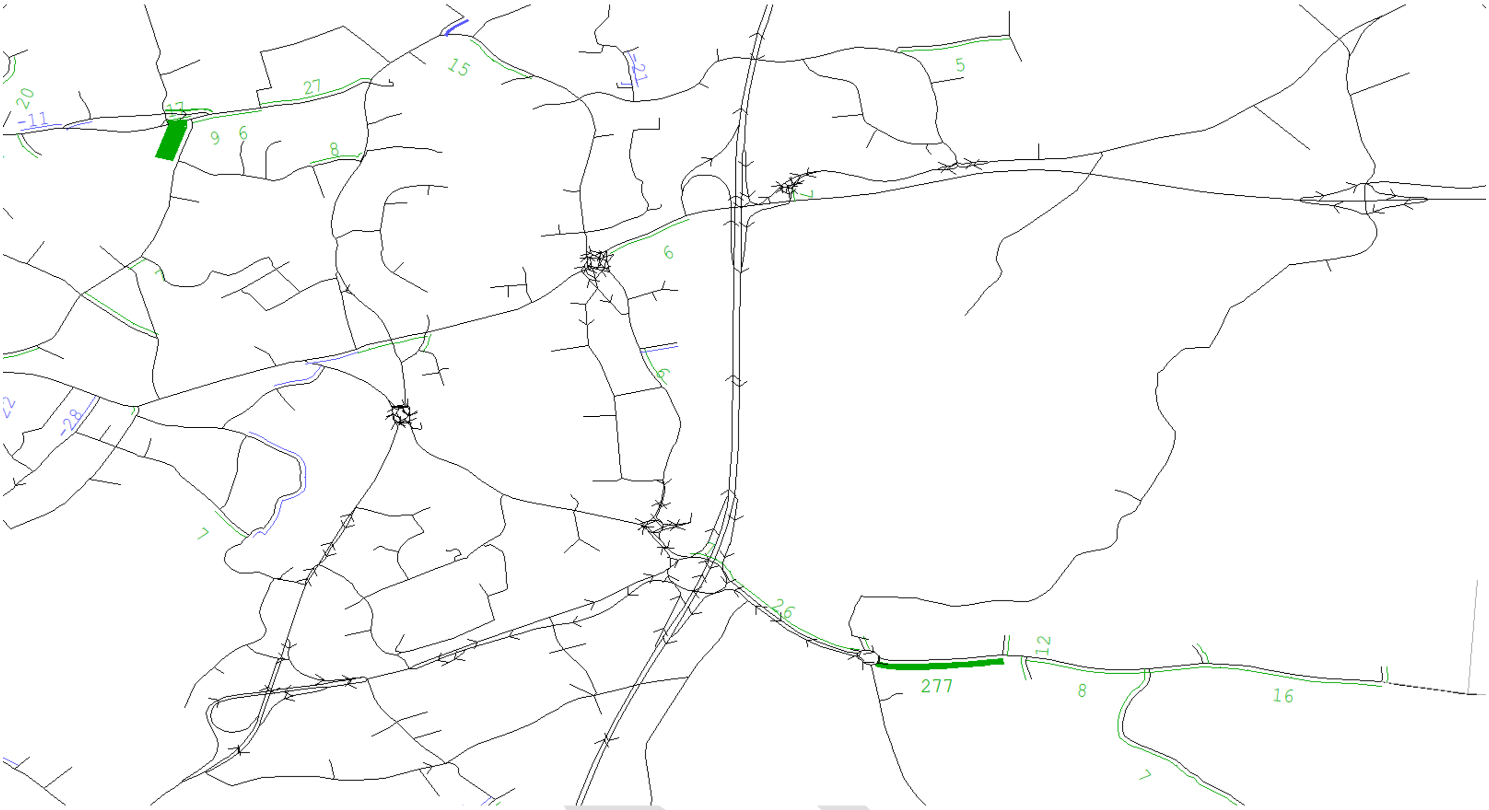


Figure 18 – DM vs DS Scenario 2, AM, V/C

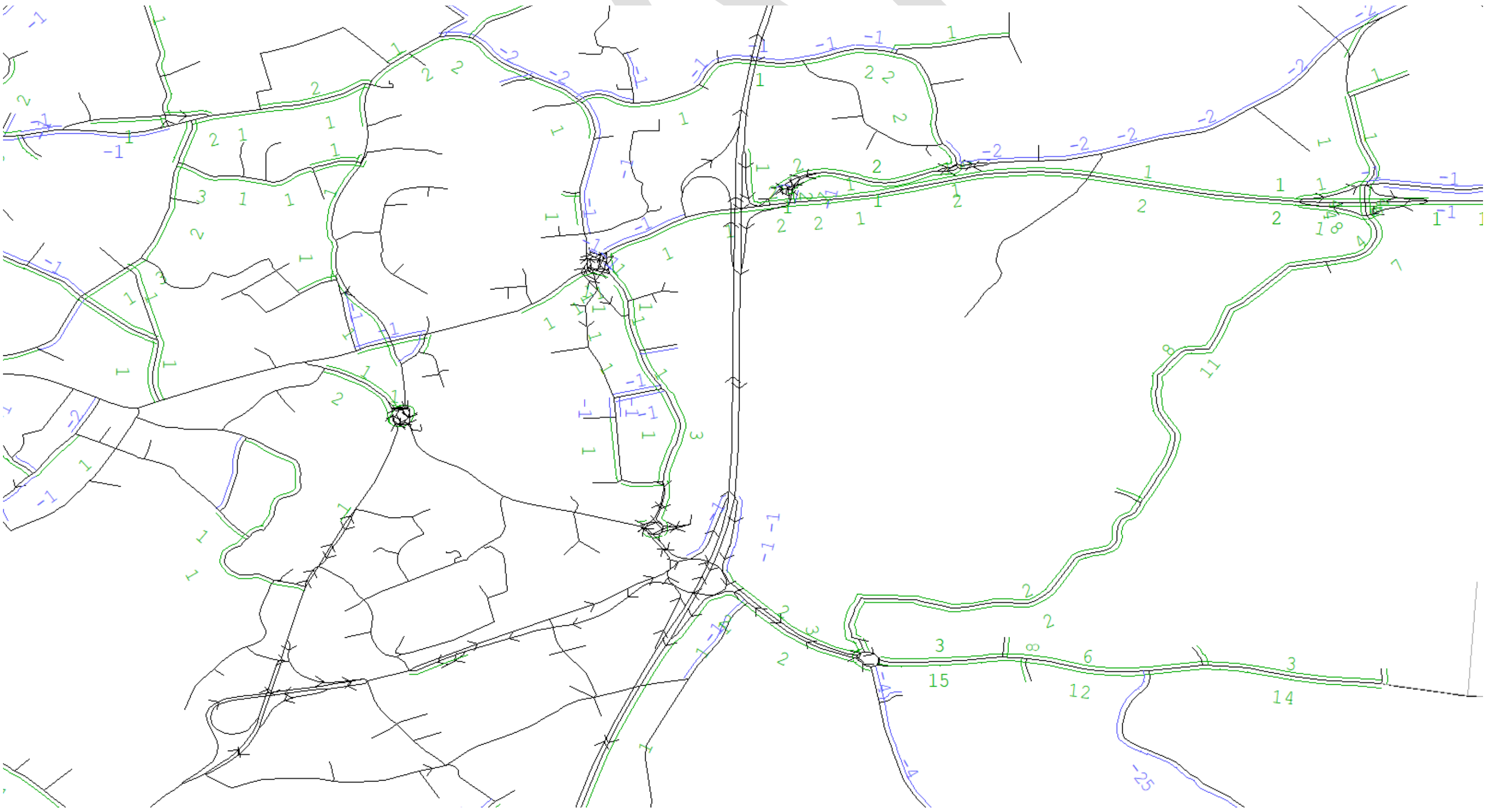


Figure 19 – DM vs DS Scenario 2, PM, Demand Flow

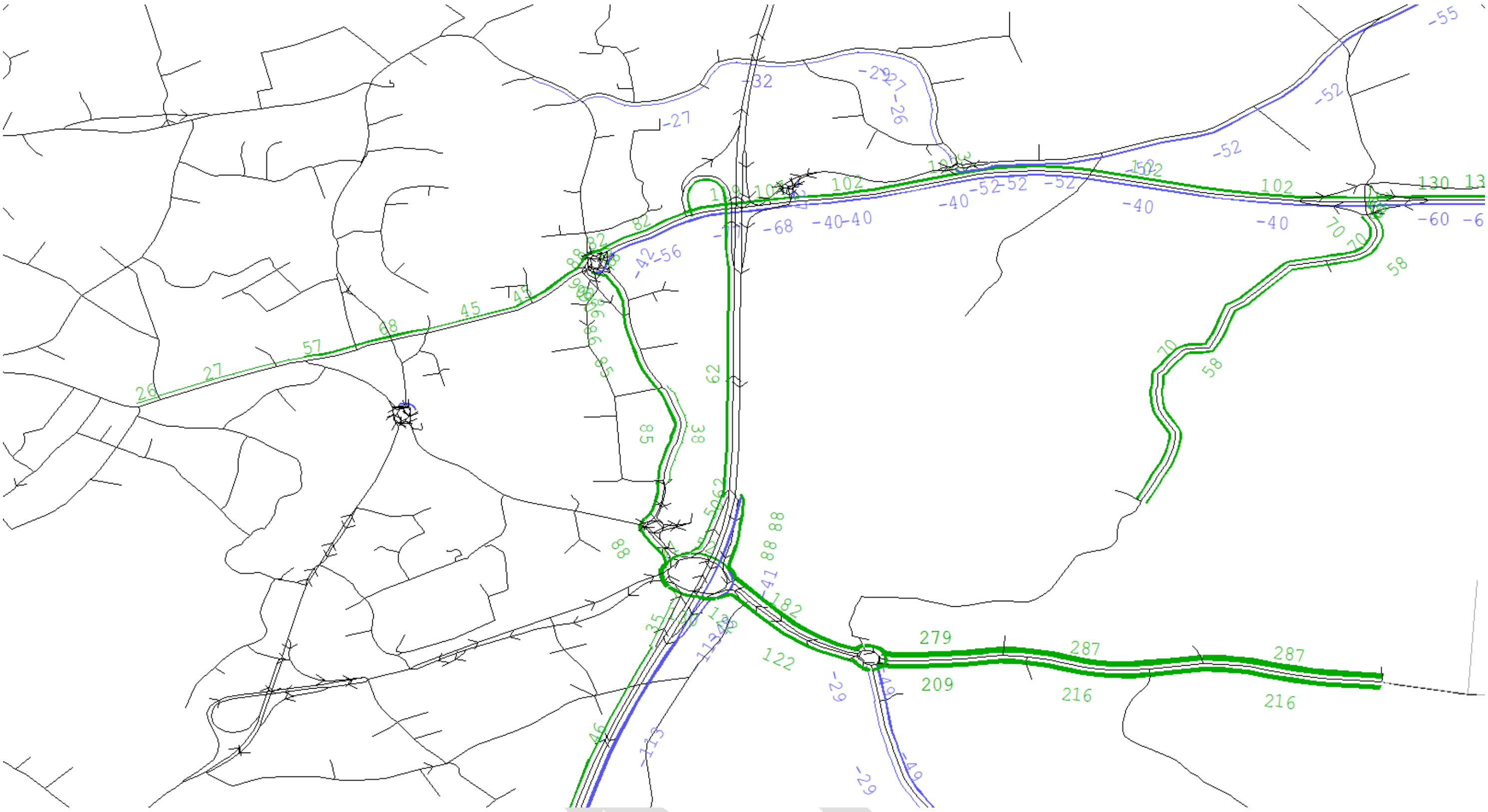


Figure 20 – DM vs DS Scenario 2, PM, Actual Flow

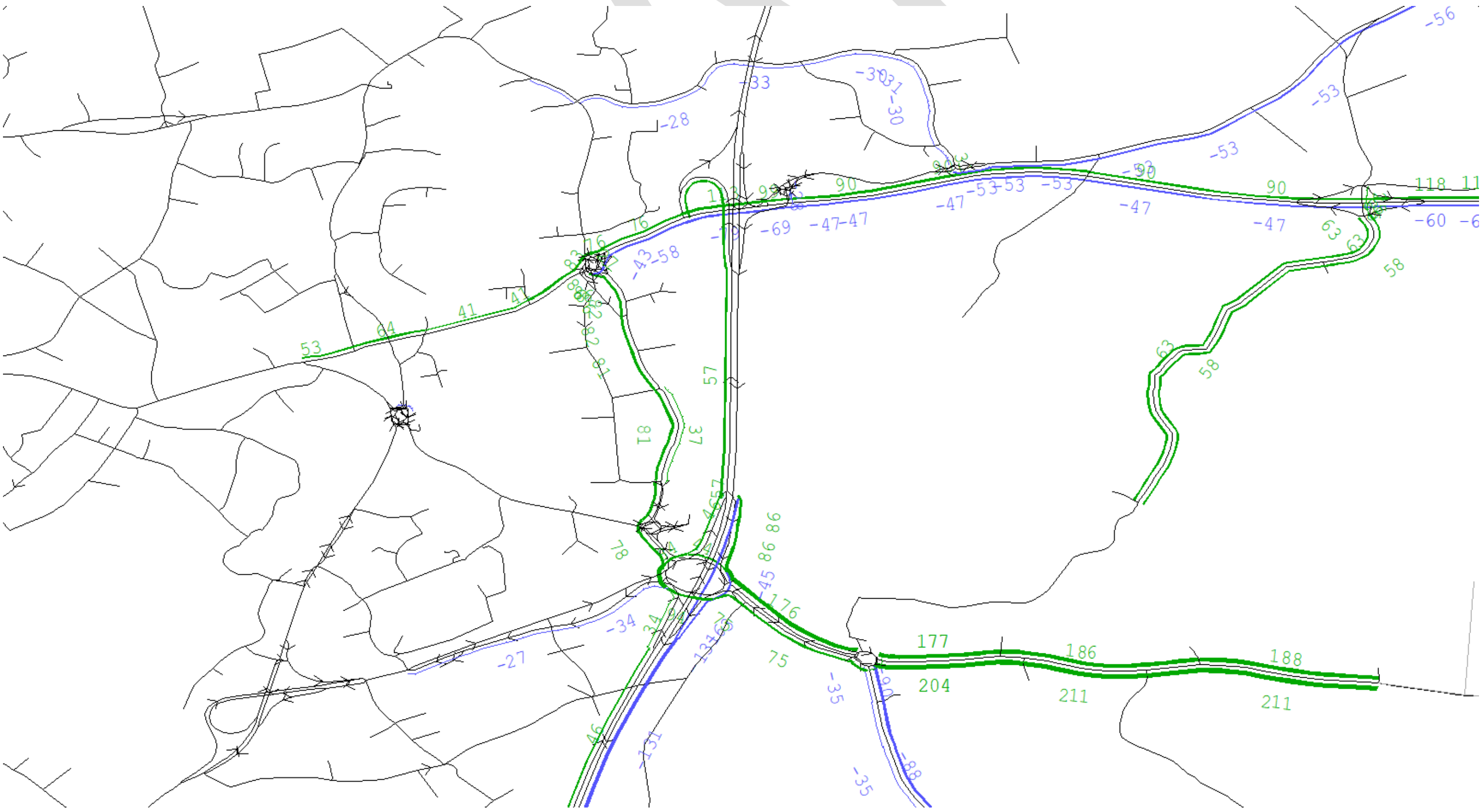


Figure 21 – DM vs DS Scenario 2, PM, Delay

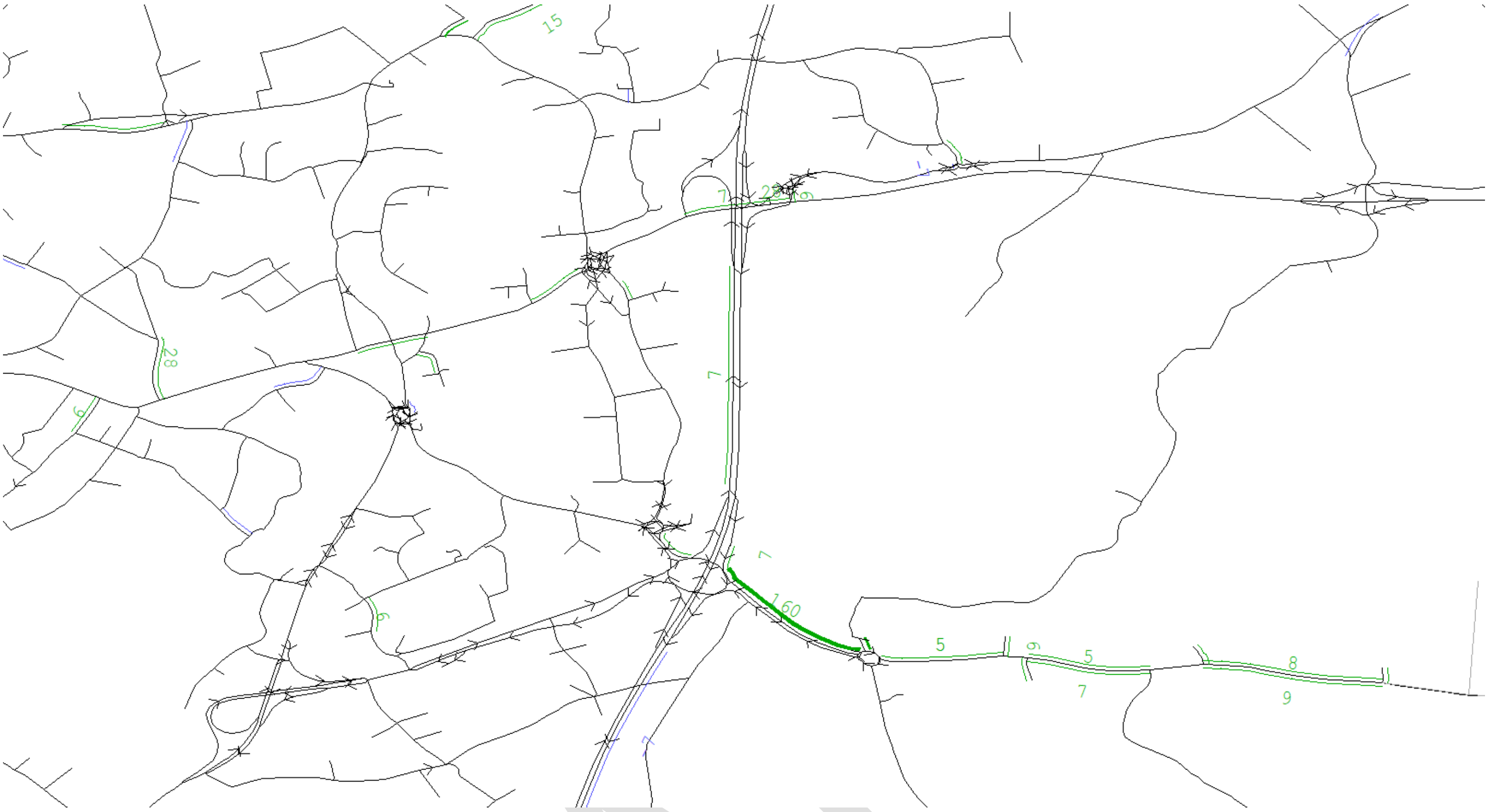


Figure 22 – DM vs DS Scenario 2, PM, V/C

Scenario 3

The AM and IP models for Scenario 3 show slight traffic flow changes along the M5, A30, A38, and A380. However, the PM models show greater traffic differences in comparison to the DM of up to 130 PCUs. Delay is not materially affected by this, with the model showing increases of less than two seconds.

The models show that at M5 Junction 29 and 30 there are increases in delay in the AM and PM, focused on the east side of the M5 at Junction 29 and the north side of the junction at Junction 30. Clyst St. Mary Roundabout shows some significant changes in delay, with an increase of approximately 50 seconds of delay on both the eastbound and westbound approaches in the AM model and 136 seconds of delay on the eastbound approach in the PM model.

Images of the demand flow, actual flow, delay and volume over capacity in the AM and PM models are shown below, in Figure 23 through to Figure 30.

Figure 23 – DM vs DS Scenario 3, AM, Demand Flow

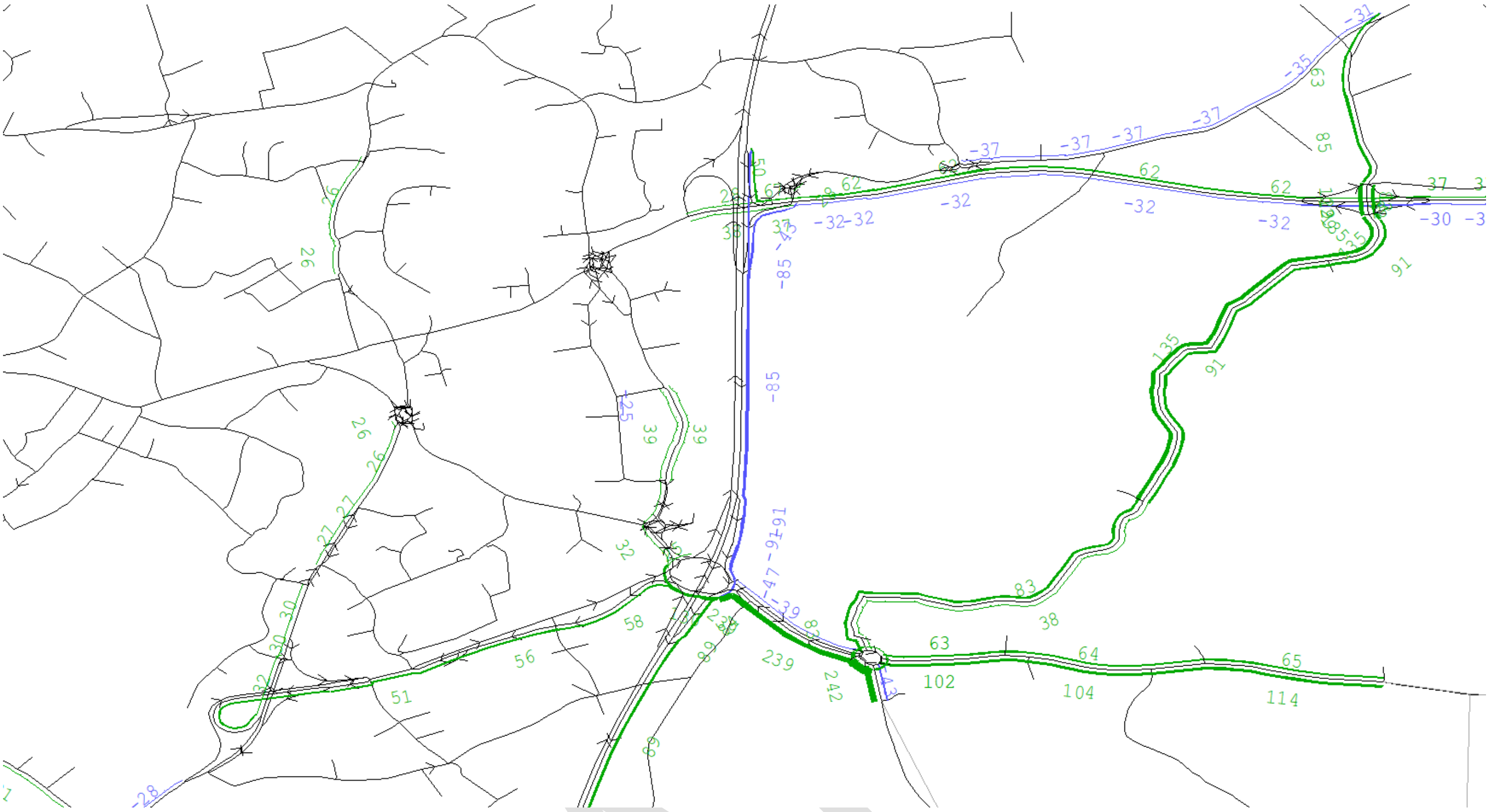


Figure 24 – DM vs DS Scenario 3, AM, Actual Flow

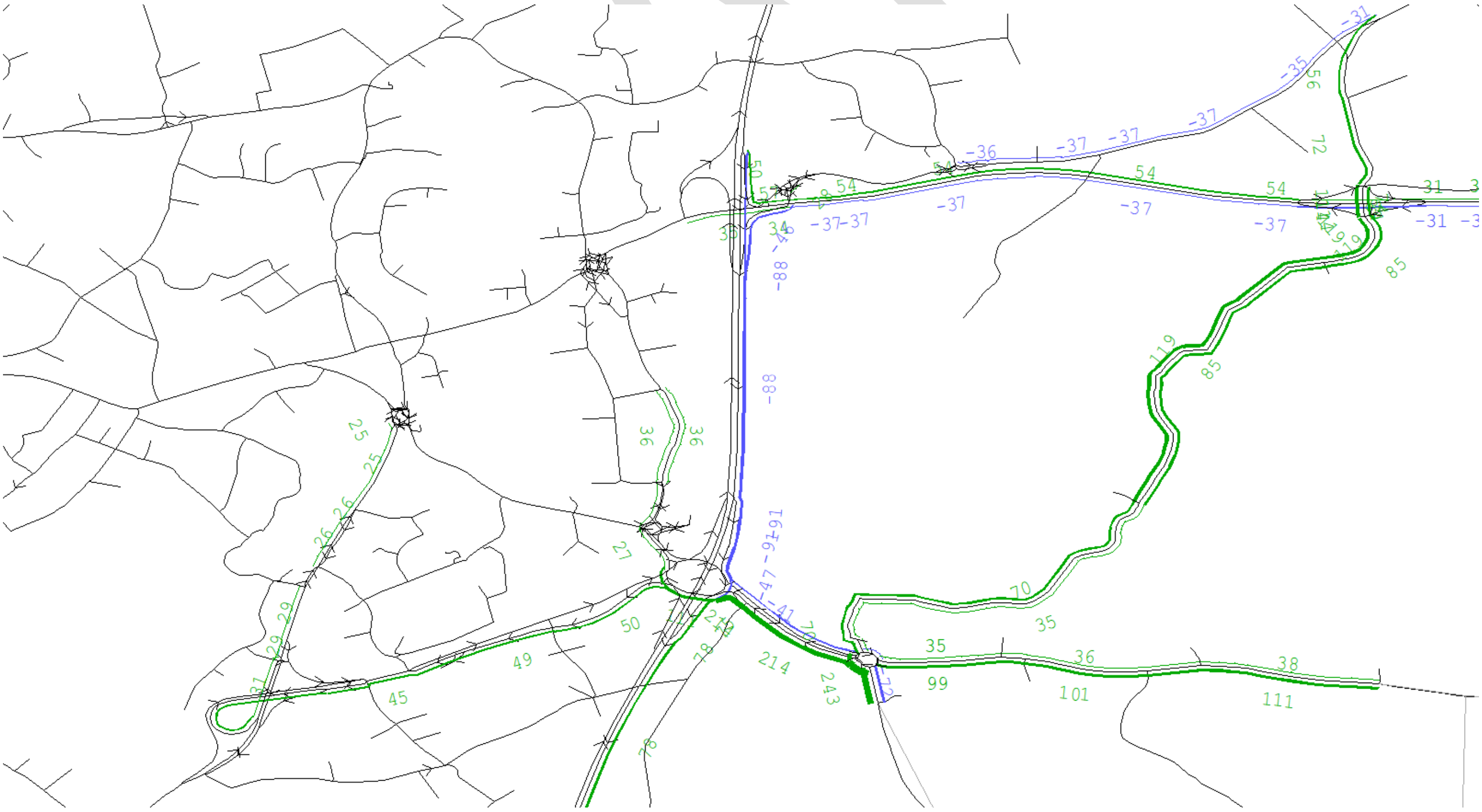


Figure 25 – DM vs DS Scenario 3, AM, Delay

Figure 26 – DM vs DS Scenario 3, AM, V/C

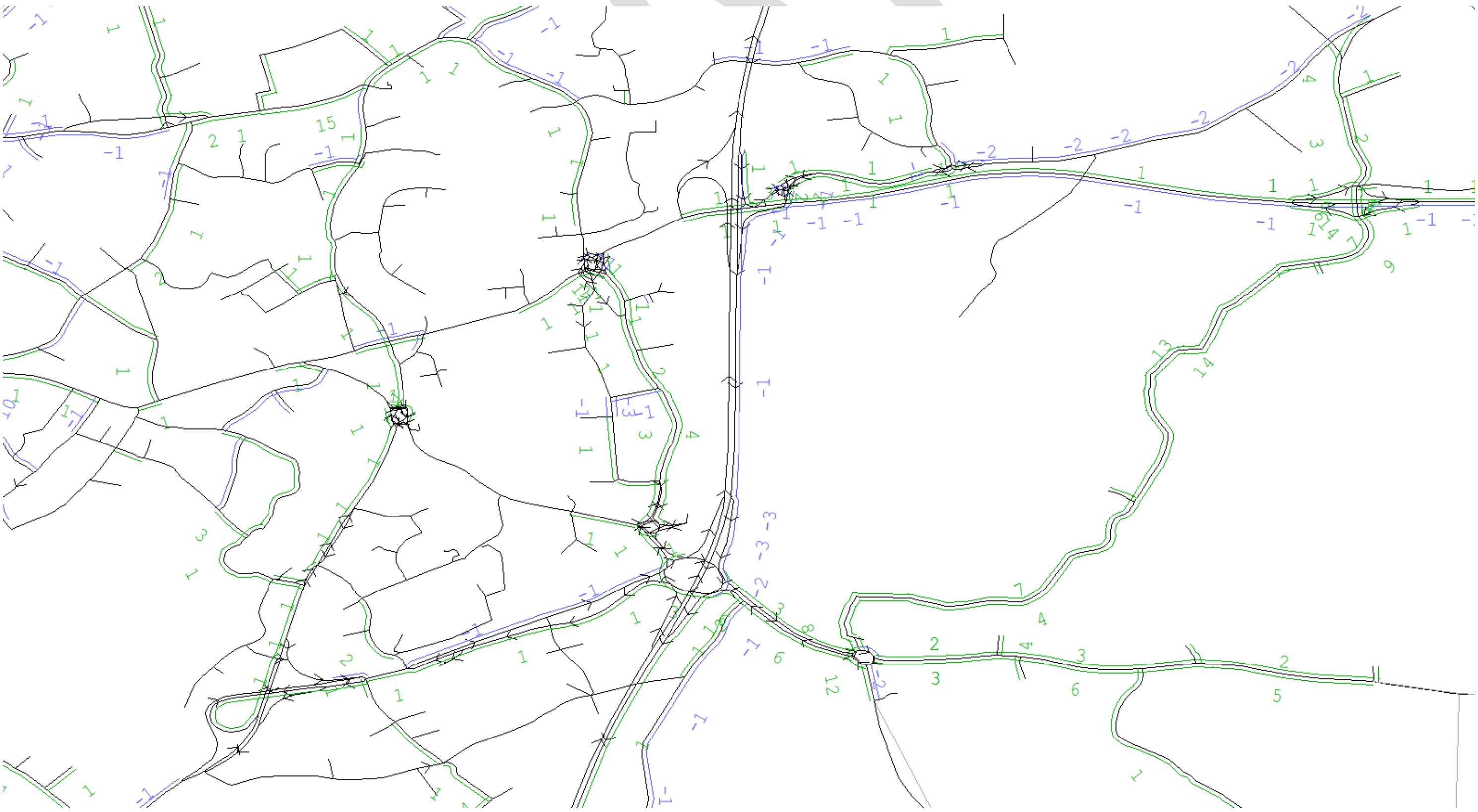


Figure 27 – DM vs DS Scenario 3, PM, Demand Flow

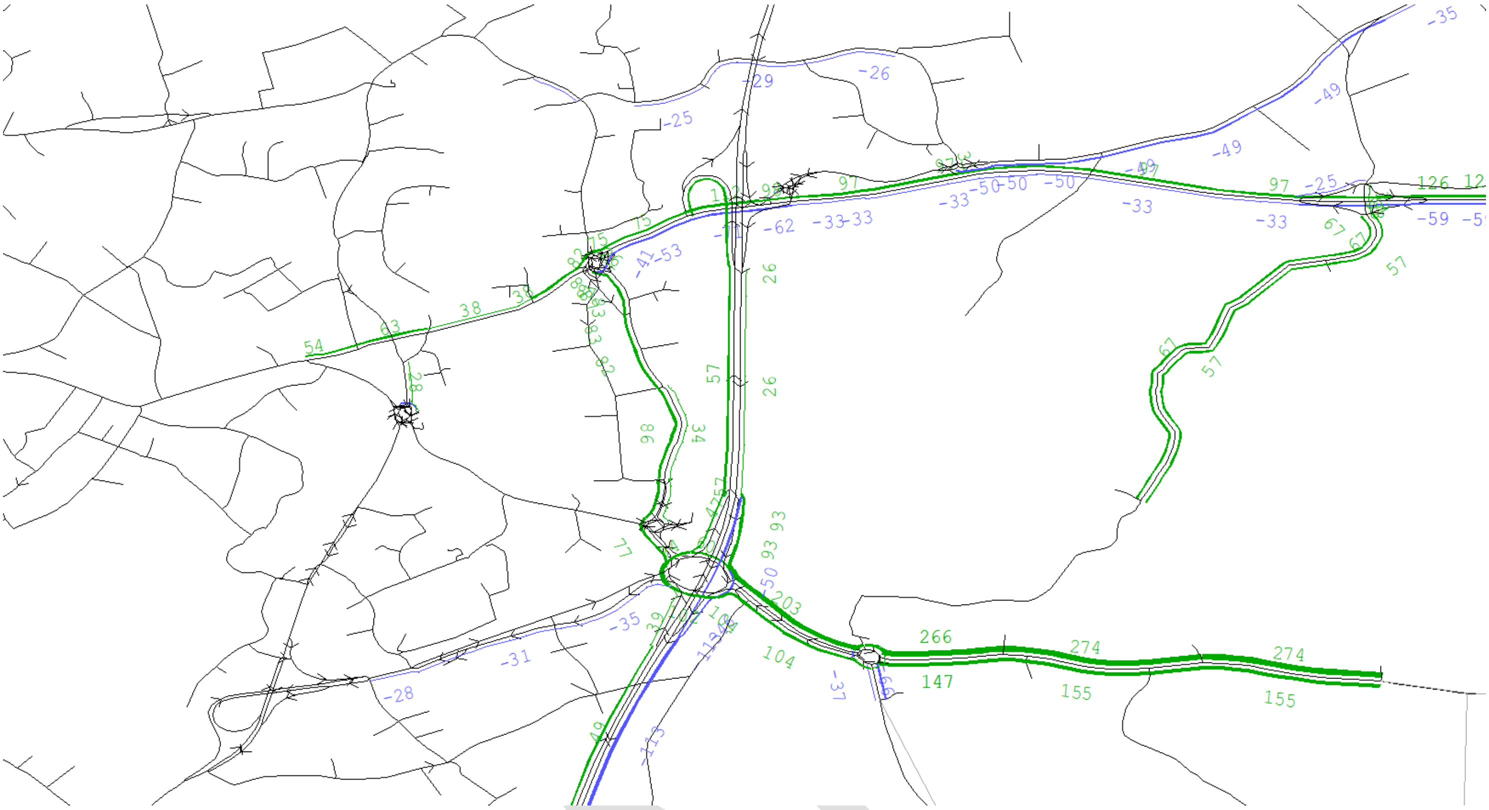


Figure 28 – DM vs DS Scenario 3, PM, Actual Flow

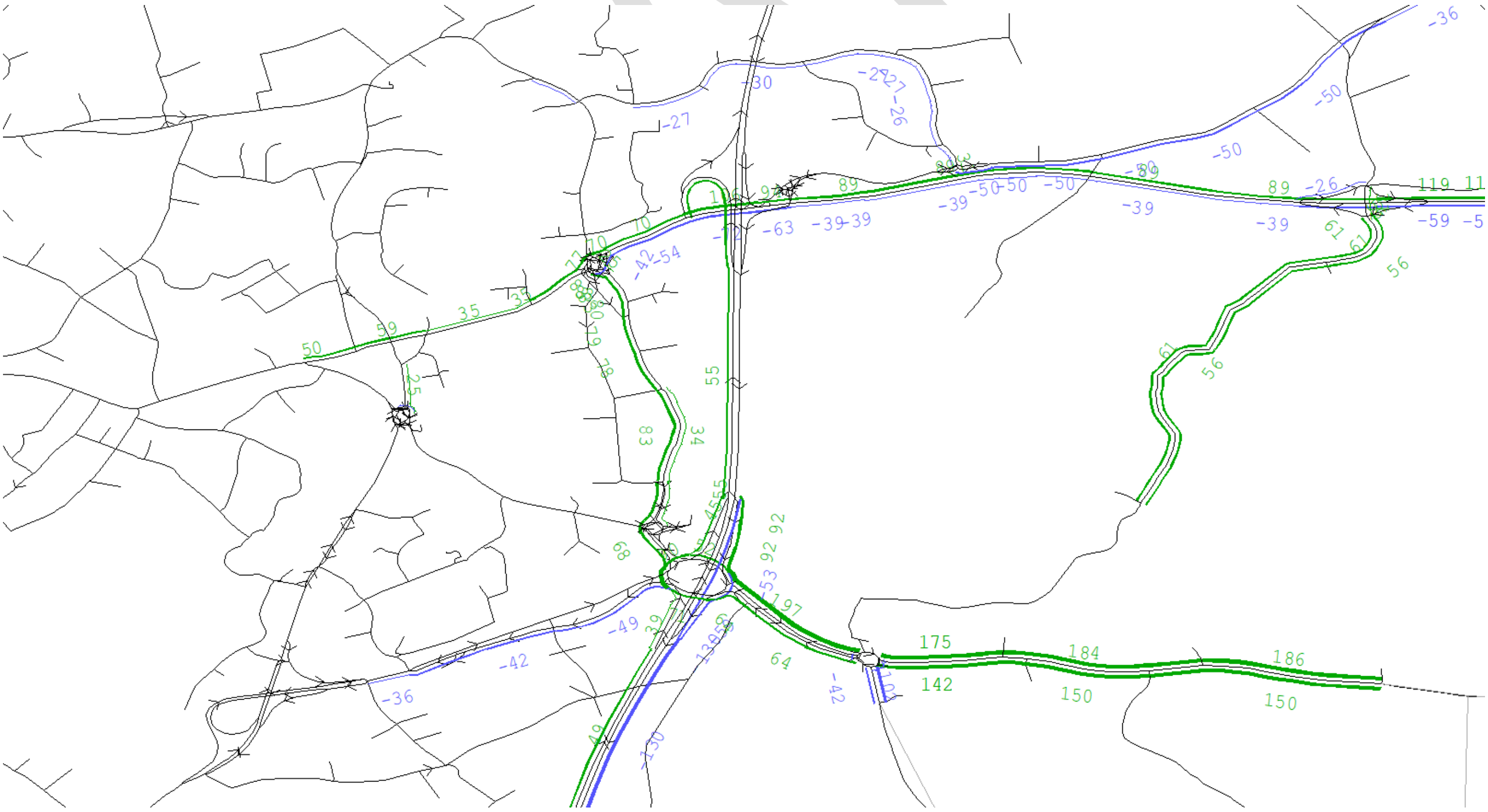
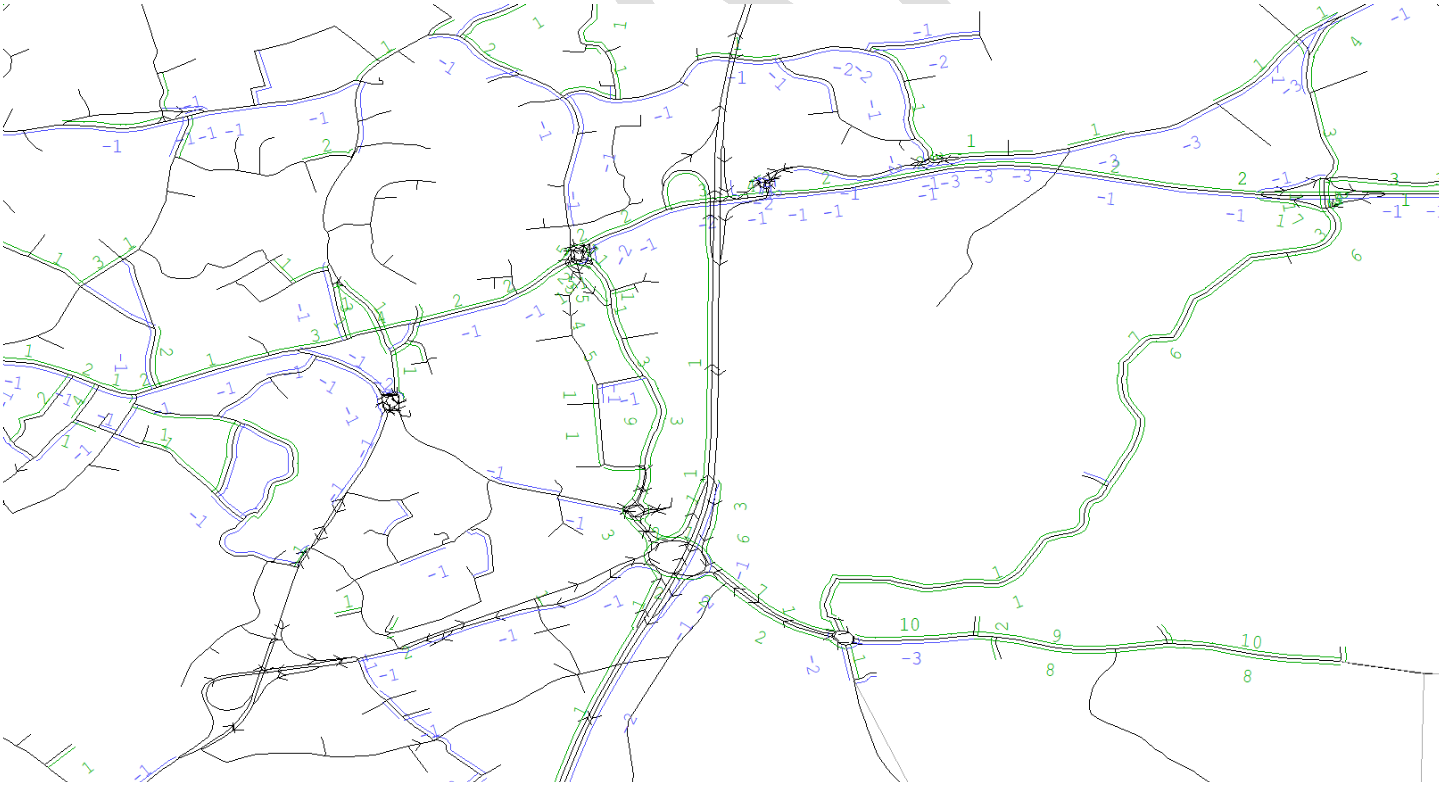


Figure 29 – DM vs DS Scenario 3, PM, Delay

Figure 30 – DM vs DS Scenario 3, PM, V/C



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PROJECT:	East Devon Local Plan Review	**AUTHOR:**	Henry Dixon
CHECKED:	Tom Holian	**APPROVED:**	Matthew Turner

CONCLUSION

This technical note has detailed the background of the Local Plan Review commissioned by DCC alongside EDDC, looking at the proposed development scenarios, trip generation, forecasting process methodology, and a comparison of the resultant traffic models.

The model comparisons highlight that the additional traffic generated by the development has minimal effects on traffic flows and delays on the M5, A30, A3052, A38, and A380 around Exeter. However, Clyst St. Mary Roundabout is negatively affected in all three development scenarios and the road network to the east of Exeter is negatively affected in two out of three scenarios (Scenarios two and three).

The impacts of the three development scenarios on various key parts of the road network around Exeter have been compared to the DM models and summarised below in Table 7.

Table 7 - Development Scenario Impacts Summary

Area	Scenario 1	Scenario 2	Scenario 3
M5 J29 to J31 Mainline	Some increase in overall traffic flows, but minimal change in delay.	Minimal increases in overall traffic flows and delay.	Some increase in overall traffic flows, but minimal change in delay.
M5 J29	Increases in overall traffic flows across all peaks. Minimal delay increases in IP models, but small, tidal delay increases in AM and PM models.	Increases in overall traffic flows across all peaks. Minimal delay increases in IP models, but small, tidal increases in AM and PM models.	Increases in overall traffic flows across all peaks. Minimal delay increases in IP models, but small, tidal increases in AM and PM models.
M5 J30	Increases in overall traffic flows across all peaks, but minimal increases in delay.	Increases in overall traffic flows across all peaks. Minimal delay increases in IP models, but some delay increases in AM and PM models. Largely being affected by the tidal flow of traffic with larger increases westbound in the AM and eastbound in the PM.	Increases in overall traffic flows across all peaks. Minimal delay increases in IP models, but some delay increases in AM and PM models. Largely being affected by the tidal flow of traffic with larger increases westbound in the AM and eastbound in the PM.
M5 J31	Some increase in overall traffic flows, but minimal change in delay.	Some increase in overall traffic flows, but minimal change in delay.	Some increase in overall traffic flows, but minimal change in delay.

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Area	Scenario 1	Scenario 2	Scenario 3
A30	Large increases in traffic to the east of Exeter but minimal increases in delay on the mainline. Minimal changes to the west of Exeter	Some increases in traffic to the east of Exeter but minimal increases in delay on the mainline. Minimal changes to the west of Exeter	Minimal changes in traffic flows and delay both to the east and west of Exeter.
A3052	Small increases in traffic flows in both directions of travel. Minimal changes in delay on the mainline, but minor levels of additional delay at junctions.	Large increases in traffic flows in both directions of travel. Minimal changes in delay on the mainline, but minor levels of additional delay at junctions.	Some increase in traffic flows in both directions of travel. Minimal changes in delay on the mainline, but minor levels of additional delay at junctions.
A38 & A380	Minimal changes in traffic flows and delay.	Minimal changes in traffic flows and delay.	Minimal changes in traffic flows and delay.
Clyst St. Mary Roundabout	Least impact of the scenarios. Minimal increases in traffic flows and delay westbound in the AM model and eastbound in the PM model. Slight additional turning delay at the roundabout itself in all models.	Second highest impact of the scenarios. Significant increases in delay westbound in the AM model and eastbound in the PM model. Moderately high levels of additional turning delay at the roundabout itself in all models.	Highest impact of the scenarios. Large increases in delay eastbound and westbound in the AM model and eastbound in the PM model. High levels of additional turning delay at the roundabout itself in all models.
East of Exeter	Minimal changes in traffic flows and delay.	Large increases in delay on the road network near Woodbury Salterton and at the A376 junction with Topsham Road.	Some increase in overall traffic flows, but minimal change in delay.