Plymouth and South West Devon Joint Local Plan – 2034 Forecast SATURN model results summary – February 2017

Executive Summary

A traffic modelling exercise has been undertaken by WSP | Parsons Brinckerhoff on behalf of Plymouth City Council and the Transport Strategy Working Group (TSWG) to assess the future performance of the Plymouth highway network. The work was undertaken in support of the Plymouth and South West Devon Joint Local Plan (JLP) which will see additional homes built and jobs created.

An existing strategic model of the Plymouth road network has been used to assess the impact of traffic growth across the city for the year 2034 (the end year of the JLP). An extra 14,000 vehicle trips are forecast to be made per peak traffic period by this year and the model has been used to inform an assessment of the network's ability to accommodate the extra demand.

Three versions of the 2034 traffic model were created to test the impact of an increased number of vehicle journeys, as shown in Table i below; these were:

Table i - 2034 traffic model versions

Model Version	Description
1	2034 traffic growth with committed physical transport interventions only;
2	2034 traffic growth with committed physical transport interventions **plus** sustainable transport measures;
3	2034 traffic growth with committed physical transport interventions **plus** sustainable transport measures **plus** non-committed 'pipeline' transport interventions.

Junction capacity results were output from each of the models for analysis with the number of congested junctions in each used as the means to assess the operation of the network. Model version 1 displayed the highest number of congested junctions with the number reducing once sustainable interventions and additional transport schemes were added in versions 2 and 3.

The three versions of the model were compared against a 'core' scenario in which no JLP growth was applied. The aim of the exercise was to return the performance of the highway network to, or as close as possible to, the 'core' scenario and to verify that the 'direction of travel', in policy and infrastructure intervention terms, was indeed heading in the right direction (see Table ii below):

Table ii - Number of congested junctions by time period

	Number of congested junctions			
Period	**Core**	**1**	**2**	**3**
AM (08:00- 09:00)	184	222	206	205
PM (17:00- 18:00)	195	242	227	221

As can be seen the number of congested junctions reduces as interventions are applied; however more investigation is necessary to explore the transport strategy to further reduce the number of congested junctions. This will be achieved through analysis of model outputs and a professional review of sites requiring additional interventions / measures.

Introduction

Background

WSP | Parsons Brinckerhoff (WSP | PB) has been working on behalf of Plymouth City Council (PCC) and the Transport Strategy Working Group (TSWG) to produce future year traffic forecast modelling in support of the Plymouth and South West Devon Joint Local Plan (JLP).

The JLP is a blueprint for growth across Plymouth and the surrounding towns and villages with the plan being jointly developed by PCC, South Hams District Council and West Devon Borough Council (SHWDC). The plan outlines future housing and employment developments, with an objectively assessed need (OAN) of 30,300 dwellings identified within the Housing Market Area covering Plymouth and SHWDC[1].

An additional 14,000 vehicle trips, resulting from the forecast increased number of dwellings and employment opportunities within the Plymouth area over the plan period, were tested using an existing SATURN Highways Assignment Model (HAM). The existing Plymouth HAM 2 based on 2009 highway operation but updated to include housing and employment growth realised from 2009 – April 2016, was used to represent the likely operation of the highways network in 2034, producing future year modelled networks for assessment.[2]

AM and PM peak period models were produced representing the busiest times in terms of traffic volumes for a typical weekday. The AM peak covers the hour between 08:00 – 09:00 with the PM peak covering the hour between 17:00 – 18:00.

Objective

The purpose of the modelling exercise was to identify junctions on the network which are forecast to see an increase in congestion as a result of 2034 traffic growth. In highlighting junctions which are forecast to exceed their capacity in future then proportionate and appropriate measures can be identified with the aim of minimising the overall impact on the Plymouth highway network.

Modelling Methodology

An origin / destination matrix was produced for each development scenario to calculate 2034 traffic volumes. These were then assigned through the future year Plymouth HAM. The results from each scenario were analysed to assess the implications of traffic growth and the road network's ability to accommodate the predicted number of vehicle trips, in comparison with a 'core' scenario representing the 2034 Plymouth road network with committed developments only and committed physical transport interventions;

Three rounds of modelling using the Plymouth HAM have taken place. The model iterations are summarised in Table 1.

[1] It is noted that the OAN housing figure has recently been revised to 27,300 dwellings, however for the purposes of the report the earlier figure is assumed as this was the best information available at the time that the future year traffic forecast modelling was undertaken.
[2] A description of the model and the updates is described in the Plymouth and South West Devon Joint Local Plan Strategic Modelling Methodology Note (February 2017).

Table 1 - Future model iterations

Model iteration	Description
1	JLP growth with committed physical transport interventions
2	JLP growth with committed physical transport interventions **plus** sustainable measures
3	JLP growth with committed physical transport interventions, sustainable measures **plus** non-committed 'pipeline' transport interventions

Specifically this report will focus upon the results from the following modelled scenarios:

- **A1** – 'Core' scenario, representing the 2034 Plymouth road network with committed developments only and committed physical transport interventions;

- **B1** – JLP scenario, representing the 2034 Plymouth road network with committed & JLP developments and committed physical transport interventions;
- **B2** – As B1 plus sustainable transport measures;
- **B3** – As B2 plus non-committed 'pipeline' interventions.[3]

Physical transport interventions and sustainable transport measures were tested in the model with the objective of returning the network performance of the Scenario B highway network to that, or as close as possible to that, seen in the 'core' A1 scenario.

The B1 scenario displays the highest number of congested junctions across the network with this figure reduced in the B2 and B3 scenarios once sustainable transport measures and additional physical transport interventions were applied to the network respectively.

This report provides a summary of results for each time period with numbers of congested junctions in each modelled scenario providing an indication of overall network performance.

Results

Upon completion of the modelling, results were extracted from each scenario to assess their individual operation. Primarily, junction capacity results were analysed with the number of junctions considered congested used to assess the overall operation of the network, i.e. the fewer congested junctions the better the network is deemed to operate.

Congested junctions were defined as locations on the network displaying a Ratio of Flow to Capacity (RFC) of 75% or above. RFC is a measure of junction saturation and indicates how much traffic is passing through the junction in relation to its overall capacity. Should the volume of traffic approach the available throughput then a junction will become congested and delay will begin to occur.

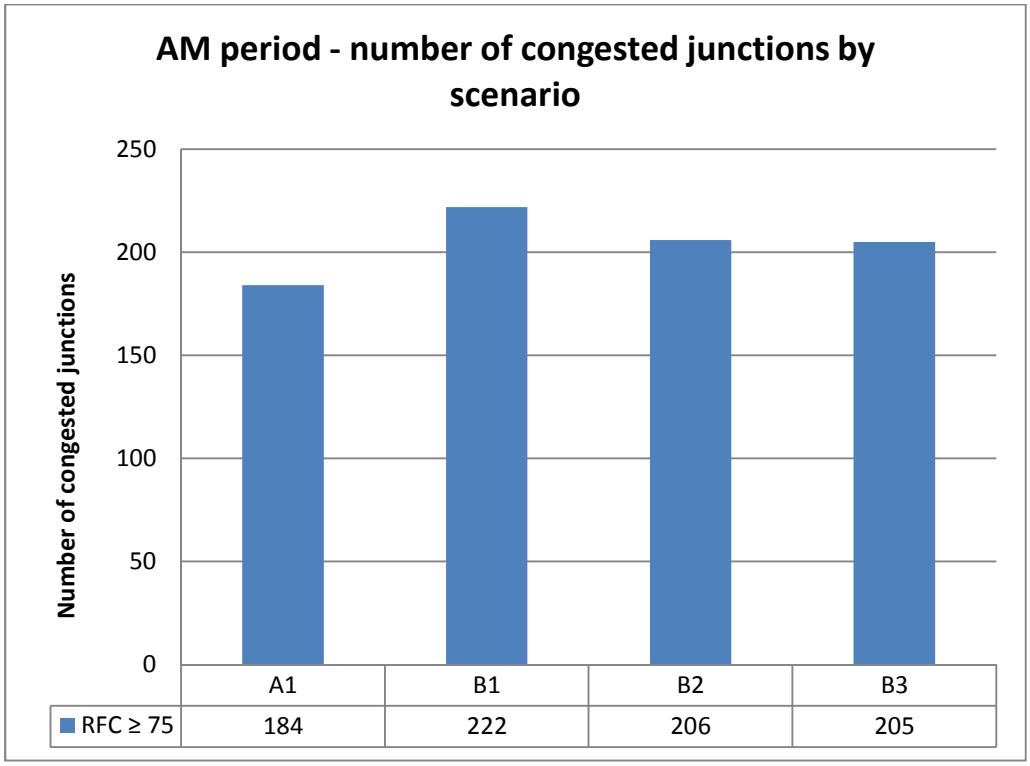
AM

Figures 1 and 2 display the junction RFC results output from the AM modelled scenarios. The results are used to analyse the overall network operation and to assess the effectiveness of proposed interventions in reducing the overall number of junctions which appear as congested in the model.

Figure 1 displays the number of junctions which are deemed as congested per scenario:

[3] 'Pipeline' schemes are targeted infrastructure interventions likely to come forward during the life of the JLP

Figure 1 - Number of congested junctions per scenario (AM)



As can be seen in the above graph the number of congested junctions increases between the 'core' scenario (A1) and the JLP development scenario (B1). This is the result of an increase in traffic flow once the JLP development allocations are factored into the 2034 traffic forecast.

The number of congested junctions decreases by 16 following the application of sustainable transport measures in the B2 model (B2-B1). An assumption of a 5-10% reduction in vehicle demand has been applied to the B2 scenario to reflect likely modal shift resulting from sustainable transport measures and policies outlined in the JLP.

The decrease in the number of congested junctions between the B1 and B2 modelled scenarios indicates that proposed sustainable measures will have a positive impact on the operation of the future Plymouth road network. An additional junction is removed from the overall number of congested junctions once physical 'pipeline' transport interventions are applied to the network in the B3 scenario.

Figure 2 - AM congested junctions once 'core' scenario congested junctions are removed

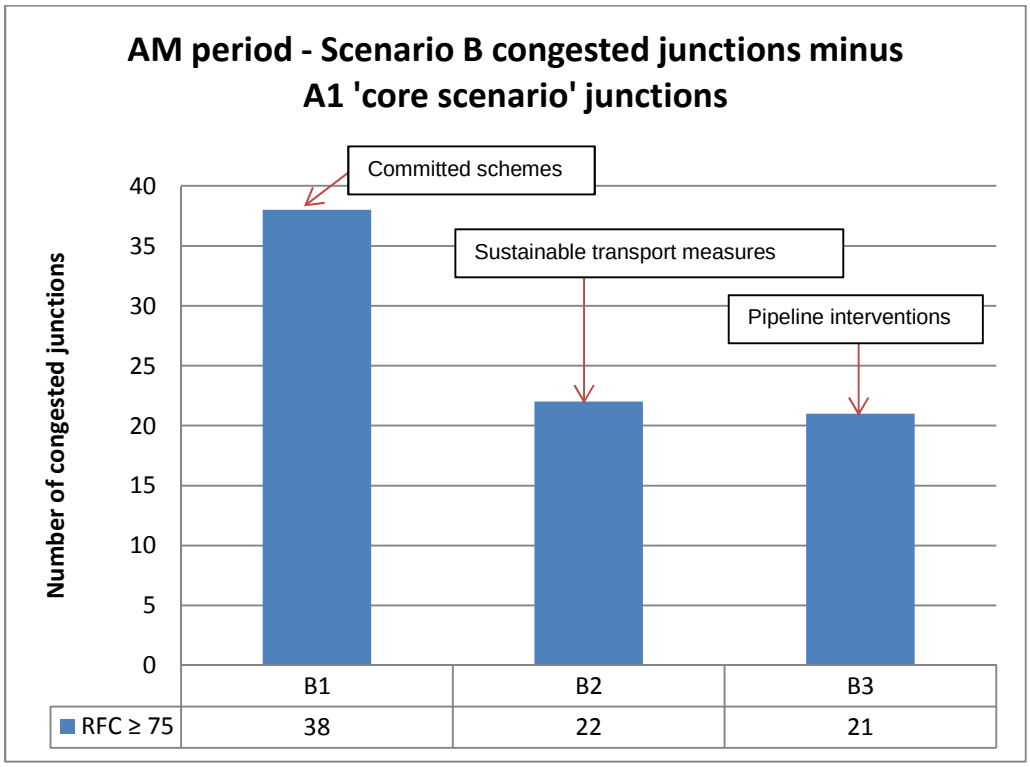


Figure 2 represents the number of junctions which are deemed as overcapacity as a result of the JLP growth, i.e. junctions which are not congested in the 'core' scenario but become so once JLP traffic flows are assigned to the network. Removing those junctions which are congested in the 'core' scenario allows us to pinpoint those areas in the network which become congested as a direct result of JLP development allocations.

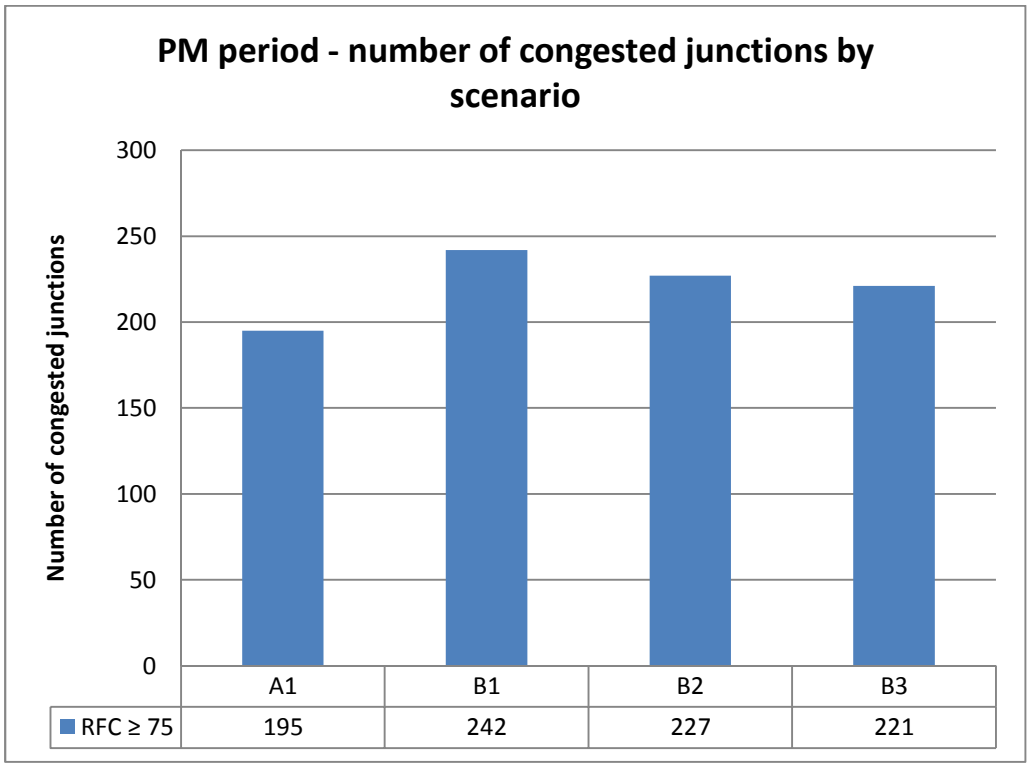
The graph in Figure 2 above shows that there are 38 additional congested junctions in the B1 scenario over and above the 184 which appear as congested in the 'core' scenario. 22 additional junctions are congested in the B2 scenario (compared with A1) and 21 in the B3 scenario (compared with A1). By investigating those junctions which appear congested due to vehicle trips generated by JLP growth it is possible to target specific areas for improvement.

The list of junctions in the B3 model scenario which are ≥ 75% RFC, or more than as reported in scenario A1 if the junction was already greater than 75% in A1 can be found in Appendix A.

PM

As with the AM period, junction capacity results were extracted from the model for analysis and comparison. The number of junctions which appear with an RFC of 75% or above, and are therefore considered as congested, can be seen on Figure 3 below:

Figure 3 - Number of congested junctions per scenario (PM)



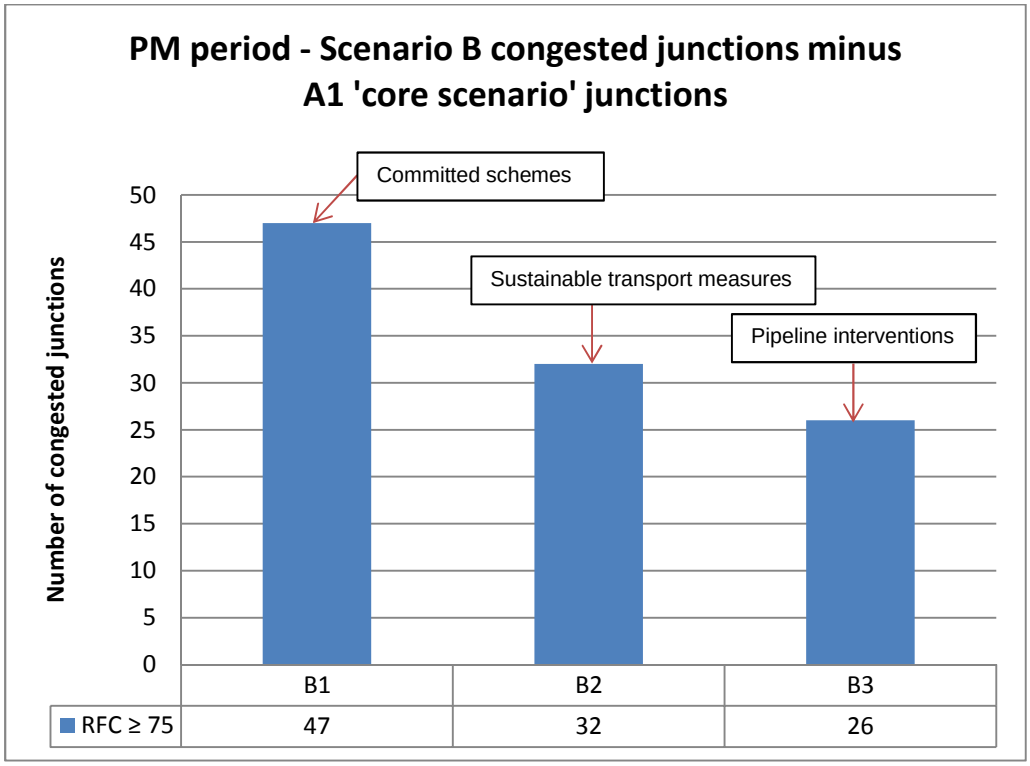
The graph in Figure 3 shows that in the PM peak there are 47 additional junctions that are congested in the B1 network as a result of increased traffic flow generated by the JLP development allocations.

Between the B1 and B2 scenarios the number of congested junctions reduces by 15 signifying that decreased traffic volumes resulting from sustainable transport measures has a positive impact on the road network.

A further 6 junctions are removed from the overall number of congested junctions in the PM B3 scenario once physical 'pipeline' transport interventions are also introduced to the highway network. This indicates that the pipeline physical transport interventions are easing the level of congestion experienced across Plymouth.

Figure 4 illustrates the number of congested junctions in each development scenario once those junctions which are congested in the 'core' scenario are removed:

Figure 4 - PM congested junctions once 'core' scenario congested junctions are removed



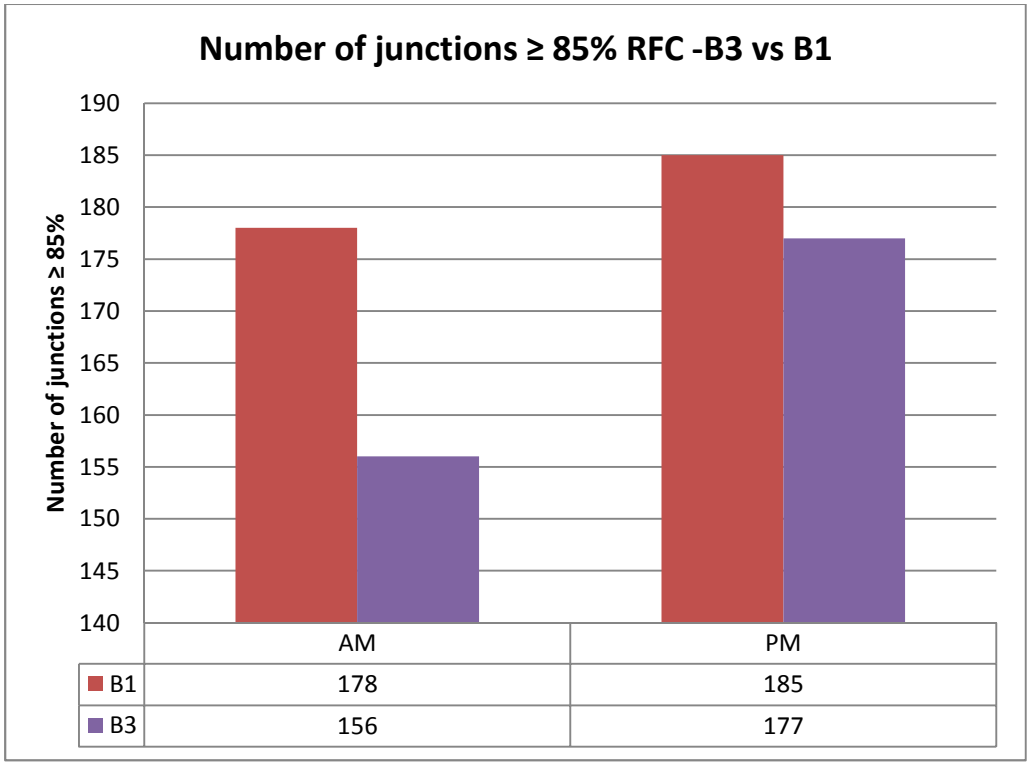
The graph highlights an encouraging downward trend in the number of congested junctions seen within each scenario once sustainable transport measures and 'pipeline' interventions are applied. 26 additional junctions remain congested as a result of the JLP sites following that mitigation.

The list of junctions in the PM, in the B3 model scenario, which are ≥ 75% RFC, or more than as reported in scenario A1 if the junction was already greater than 75% in A1 can be found in Appendix A.

Assessing the benefits derived from the pipeline transport interventions

To further analyse the benefits of the 'pipeline' interventions the number of junctions which are operating at or above 85% RFC for the AM and PM peak periods has also been reviewed. The results are shown in Figure 5.

Figure 5 - Number of junctions ≥ 85% RFC



As can be seen in peak periods once the 'pipeline' interventions are implemented in the B3 scenario the overall number of junctions operating above 85% reduces. 22 fewer junctions are operating at or above 85% in the AM B3 scenario with 8 less in the B3 PM scenario in comparison to B1. This shows that the 'pipeline' interventions have a positive impact on the network.

Conclusion

The modelling exercise undertaken in support of the JLP has achieved the objective of identifying those locations on the network which are forecast to become congested in 2034, as a result of traffic growth associated with JLP development. The results show that, when JLP growth is applied, there is an increase during both peaks in the number of junctions which operate with an RFC of 75% or above and so are considered congested.

It is apparent that as a result of the scale of growth, which adds circa 14,000 additional vehicle trips per peak period, the Plymouth road network will experience additional congestion. The number of congested junctions can be reduced through the application of sustainable transport measures, with additional physical transport interventions (the 'pipeline' schemes) further improving network performance.

The PM peak period, which sees more congested junctions than the AM peak, benefits particularly from the pipeline transport interventions with the number of congested junctions across the network decreasing from 242 junctions to 221 once both sustainable transport measures and physical transport interventions are applied.

The application of further focused analysis and targeted interventions, including sustainable transport measures, will seek to deliver additional network performance improvements.

APPENDIX A – Location of congested junctions (Scenario B3)

Appendix A - Location of congested junctions (Scenario B3)

Address	Node	Junctions in the B3 model scenario which are ≥ 75% RFC, or more than as reported in scenario A1 if the junction was already greater than 75% in A1[4]	
		AM Peak	PM Peak
William Prance Road / Forder Valley Link Road	33		✓
William Prance Road (East)	38		✓
William Prance Road (South)	46	✓	✓
Union Street / The Crescent	160	✓	✓
Union Street / Martin Street	161	✓	✓
Cumberland Road / George Street	165	✓	✓
Park Avenue / Fore Street	166		✓
Park Avenue / Ferry Road	168	✓	
Ferry Road / Pottery Road	171	✓	
Mill Bridge / Wilton Street	183	✓	
Fore Street / Kings Road	186	✓	
Molesworth Road / Milehouse Road	194	✓	
Albert Road / Park Road	197		✓
Keyham Road / St Levan Road	199		✓
Ford Hill / St Levan Road	203		✓
Wolseley Road / Royal Navy Avenue	207	✓	
Saltash Road / Wolseley Road	213	✓	✓
Weston Mill Drive / Ferndale Road	214	✓	✓
Saltash Road / North Road West	239		✓

[4] Note that by this definition, if a node is above 75% in both scenarios but the RFC decreases from Core to B3, it is not included in this table.

Alma Road / Outland Road	245	✓	
Outland Road / Milehouse Road	248		✓
Outland Road / Seagrave Road	252		✓
Outland Road / Peverell Park Road	253	✓	
Seagrave Road / North Prospect Road	258	✓	✓
Beacon Park Road / North Prospect Road	263	✓	✓
Western Approach / Mayflower Street	275		✓
Ford Park Road / College View	284	✓	✓
Hyde Park Road / Gifford Terrace Road	285	✓	
Hyde Park Road / Weston Park Road	286	✓	
Weston Park Road / Burleigh Park Road	287		✓
Ham Drive / Pennycross Park Road	293	✓	✓
Crownhill Road / Budshead Road	314		✓
Crownhill Road / St Peters Road	318	✓	✓
Crownhill Road / Meavy Way	320	✓	✓
Budshead Way / Budshead Road	321	✓	✓
Budshead Road / Tamerton Foilot Road	322	✓	✓
Budshead Road / Milford Lane	325	✓	✓
Milford Lane / Fore Street	326	✓	
Tamerton Foliot Road / Southway Drive	337	✓	
North Hill / Clifton Place	349	✓	
Mannamead Road / Western College Road	360	✓	✓
Mannamead Road / Seymour Road	362	✓	✓

Mannamead Road / Eggbuckland Road	363	✓	✓
Mannamead Road / Thornhill Road	366	✓	✓
Mannamead Road / Torr Lane	367	✓	✓
A386 Tavistock Rd north of Manadon Roundabout	372	✓	✓
Tavistock Road / Meavy Way	373	✓	✓
Tavistock Road / Plumer Road	376	✓	✓
Tavistock Road / Charlton Road (S/B)	377	✓	✓
Tavistock Road / Sendall's Way	378	✓	✓
Derriford Roundabout / Tavistock Road (North)	379	✓	
Tavistock Road / Powisland Drive	380	✓	✓
Mannamead Road / Compton Park Road	382	✓	✓
Tavistock Road / Morgan Road	385	✓	✓
Mannamead Road / Hartley Road	388	✓	
Tavistock Road / Derriford Road	389	✓	
Derriford Roundabout / Brest Road	390	✓	✓
Derriford Roundabout / Tavistock Road (South)	391	✓	✓
Derriford Roundabout / Looseleigh Lane	392	✓	✓
Lipson Road / Mount Gould Road	408		✓
Alexandra Road / Southern Terrace	412		✓
Alexandra Road / Ashford Hill	413		✓
Lipson Road / Mostyn Road	414		✓
Old Laira Road / Efford Lane	417	✓	
Eggbuckland Road / Efford Road	423		✓

Eggbuckland Road / Shallowford Road	426	✓	✓
Fort Austin Road / Widey Lane	430	✓	✓
Fort Austin Road / Church Hill	431	✓	✓
Barnstaple Close / Longbridge Road	437	✓	✓
Forder Valley Road / Novorossiysk Road	439	✓	✓
Novorossiysk Road / Miller Way	440		✓
Novorossiysk Road / Sheepstor Road	441	✓	
Glenn Road / Hillcrest Drive	460	✓	
Deep Lane E/B off-slip / Deep Lane	462	✓	✓
A38 / Deep Lane E/B off-slip	463	✓	
A38 / Deep Lane W/B off-slip	464	✓	
Deep Lane / A38 W/B off-slip	466		✓
Deep Lane / W/B on-slip	467	✓	✓
Sherford Road / Stamps Hill	469		✓
Notte Street / Princess Street Ope	484		✓
Exeter Street / Bretonside	489	✓	✓
A38 E/B off-slip / Marsh Mills Roundabout	504	✓	
Ridgeway / Moorland Road	515	✓	
Merafield Road / Ridge Road	528	✓	✓
Stamps Hill / Deep Lane	533	✓	
Springfield Road / Reservoir Road	551		✓
Laira Bridge Road / Hele's Terrace	552		✓
Laira Bridge Road / Finnigan Road	553		✓

Billacombe Road / Pomphlett Road	554	✓	✓
Colesdown Hill / Billacombe Road	555	✓	
Stanborough Road / Haye Road	559	✓	
Dean Cross Road / Radford Park Road	569		✓
Plymstock Road / Randwick Park Road	570	✓	
Pomphlett Road / Pomphlett Roundabout (south)	574	✓	
Outland Road / St Erth Road	581	✓	✓
Gdynia Way / Barbican Approach (W/B)	589		✓
Western Approach / King Street	591	✓	
Novorossiysk Road / Dover Road	611		✓
Deep Lane / Ridgeway	614		✓
Gdynia Way / Cattewater Road	618	✓	
Embankment Road / Embankment Lane	621	✓	✓
Gdynia Way / Laira Bridge Road	622	✓	✓
A38 E/B off-slip / Crownhill Road	625	✓	
Victoria Way / Roman Road (Crownhill Roundabout South)	628		✓
Ernsettle Lane / Crownhill Road	632	✓	✓
Crownhill Roundabout (North) / Crownhill Road	633		✓
A38 W/B off-slip / Roman Way	634	✓	✓
A38 E/B off-slip / Weston Mill	637	✓	
A38 W/B off-slip / Weston Mill	639	✓	✓
The Parkway / Weston Mill Drive (South)	640	✓	

Tavistock Road (S/B) / Manadon Roundabout	642	✓	✓
A38 E/B on-slip / A3 E/B	643		✓
Manadon Roundabout / Mannamead Road	645		✓
Manadon Roundabout / A38 E/B off-slip	647	✓	
Manadon Roundabout / A38 E/B on-slip	648	✓	✓
A38 E/B off-slip / Marsh Mills Roundabout (north)	650	✓	✓
Marsh Mills Roundabout / A38 E/B on-slip	651	✓	
A38 W/B on-slip / Marsh Mills Roundabout	653	✓	
Manadon Roundabout / Outland Road (S/B)	654		✓
A38 W/B off-slip / Manadon Roundabout	655	✓	
Forder Valley Interchange (north) / Forder Valley Road	657	✓	✓
A38 W/B off-slip / Forder Valley Interchange	659	✓	✓
Forder Valley interchange A38 W/B on-slip / A38 W/B	700		✓
A38 / A38 W/B off-slip toward Forder Valley interchange	701	✓	
A38 / A38 W/B off-slip toward Manadon Roundabout	702	✓	✓
Manadon Roundabout / Outland Road (N/B)	703	✓	✓
Manadon Roundabout / Manadon Hill (N/B)	705	✓	✓
Manadon Hill / Great Berry Road	712	✓	✓
Tothill Road / Desborough Road	750	✓	
Union Street / Derry's Cross	770	✓	

Royal Parade / Derry's Cross	772	✓	✓
St Andrews Cross / Royal Parade E/B	780		✓
St Andrews Cross / Exeter Street	782		✓
Charles Cross Roundabout / Charles Street (N/B)	790		✓
Charles Cross Roundabout / Charles Street (S/B)	791	✓	
Charles Cross Roundabout / Exeter Street (W/B)	793	✓	✓
Charles Cross Roundabout / Exeter Street (SW/B)	794	✓	✓
A386 Tavistock Road (north of Roborough)	817	✓	✓
Tavistock Road / William Prance Road	821	✓	✓
Tavistock Road / McDonalds Entrance	823	✓	
Crownhill Road / Transit Way	831	✓	
Wolseley Road (S/B) / Wolseley Roundabout	860	✓	✓
Seagrave Road / Wolseley Roundabout	861		✓
Wolseley Road (N/B) / Wolseley Roundabout	862		✓
Alma Road (N/B) / Outland Road	887	✓	
North Cross / Cobourg Street	900	✓	
North Cross / Western Approach	901		✓
North Cross / Saltash Road	902		✓
North Road East / North Cross Roundabout	903		✓
A38 W/B / A38 W/B off-slip toward Marsh Mills	950	✓	
Notte Street / Athenaeum Street	961	✓	✓

North Street / Princess Way	963		✓
Notte Street / Lockyer Street	964	✓	✓
Notte Street / Hoe Approach	965	✓	✓
Tamar Bridge / W/B exit	973	✓	
Tavistock Road / Woolwell Road	974	✓	✓
Tavistock Road (N/B) / Woolwell Road	975	✓	✓
A38 W/B on-slip / Smithaleigh	1004	✓	✓
A38 E/B off-slip / Lee Mill	1006	✓	✓
A38 W/B off-slip / Lee Mill	1007	✓	✓
Cobourg Street / North Hill (Drake Circus)	1096	✓	
A38 W/B off-slip / Forder Valley Interchange	1106	✓	✓
Plymouth Road E/B / Great Woodford Drive	1201	✓	
Plymouth Road / Cot Hill	1202	✓	✓
Plymouth Road W/B / Larkham Lane	1204		✓
Plymouth Road / Great Woodford Drive	1205	✓	✓
Plymouth Road / Ridgeway	1209	✓	
Plymouth Road / Ridgeway	1210		✓
Gdynia Way (N/B) / Barbican Approach (E/B)	1221		✓
Gdynia Way / Barbican Approach	1222	✓	✓
Finnigan Road / Faraday Road	1226		✓
Embankment Road / Langham Place	1227		✓
Tavistock Road / Bladder Lane	1235	✓	✓
Mannamead Road / Compton Avenue	1247	✓	

Pemros Road (N/B) / Tamar Bridge	1260		✓
A38 W/B / Tamar Bridge	1261		✓
Tamar Bridge E/B / Pemros Road Roundabout	1265	✓	
A38 W/B / Pemros Road Roundabout	1266		✓
Eggbuckland Road / Deer Park Road	1286		✓
Plymouth Road (E/B) Coypool Lane	1294	✓	✓
Plymouth Road (W/B) Coypool Lane	1295	✓	
A386 Tavistock Road / New Road	1299	✓	✓
Holland Road / Ledgate Lane	1304	✓	
A38 E/B on-slip / Ridgway	1307	✓	✓
A379 / Orchard Hill	1312	✓	
Lee Mill W/B on-slip / A38 W/B	1350		✓
Old Laira Road / Wycliffe Road	1360	✓	
Western Approach / Sainsbury's exit	1362		✓
Milehouse Park & Ride / Life Centre exit	1376		✓
Park Avenue / Granby Way	1395	✓	
Old Laira Road / Bramley Road	1627	✓	
Old Laira Road / Wycliffe Road	1628	✓	
Glen Road / Steer Park Road	1651	✓	
Glen Road / Eagle Road	1653	✓	✓
Embankment Lane / Laira Bridge Road	1668		✓
Forder Valley Road / Novorossiysk Road	1675	✓	✓
Forder Valley Road north of Forder Valley Interchange	1676	✓	✓

Derry's Cross / Royal Parade	1679	✓	✓
Royal Parade / Armada Way (Crossing)	1680	✓	✓
Royal Parade / St. Andrews Cross	1681	✓	✓
Union Street west of Derry's Cross	1682	✓	
Embankment Road / Embankment Lane	1695	✓	
A38 W/B toward Tamar Bridge	1700		✓
A38 E/B toward Weston Mill	1701	✓	
A38 W/B toward Weston Mill	1704		✓
A38 W/B toward Manadon Roundabout	1706	✓	✓
Derriford Roundabout / Tavistock Road	1732		✓
Outland Road / Park and Ride	3005		✓
Laira Bridge Road / Embankment Lane	3007	✓	✓
A38 W/B / Marsh Mills W/B on-slip	4001	✓	✓
Sherford High Street / Plympton Hill	4002	✓	✓
Haye Road / Sherford Main Street	4003	✓	✓
Chapel Street / Fore Street	4059	✓	
Devonport Hill / Cumberland Road	4061	✓	
Tavistock Road / Sendall's Way	4076		✓
Billacombe Road / Broxton Drive	4101		✓