

# Technical Note

Project:	WERTM SGC Update		
Subject:	Network Updates		
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Date:	01/11/2023	Project No.:	5219624
Distribution:	Representing:		

## Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	Issued for Client	AB/PJ	PV	DD	MH	30/05/2023
2.0	Additional network updates at centroid connectors and M4J19 added in 1.2.4 and 1.2.5	AB	PV		MH	01/11/2023

## Client signoff

Client	South Gloucestershire
Project	WERTM SGC Update
Project No.	5219624
Client signature / date	

# 1. Introduction

Atkins was commissioned to undertake a partial update to the West of England Regional Transport Model (WERTM) to improve its accuracy in key areas significant to the South Gloucestershire Council (SGC) Local area, including the A38, A4174, North Fringe and A432.

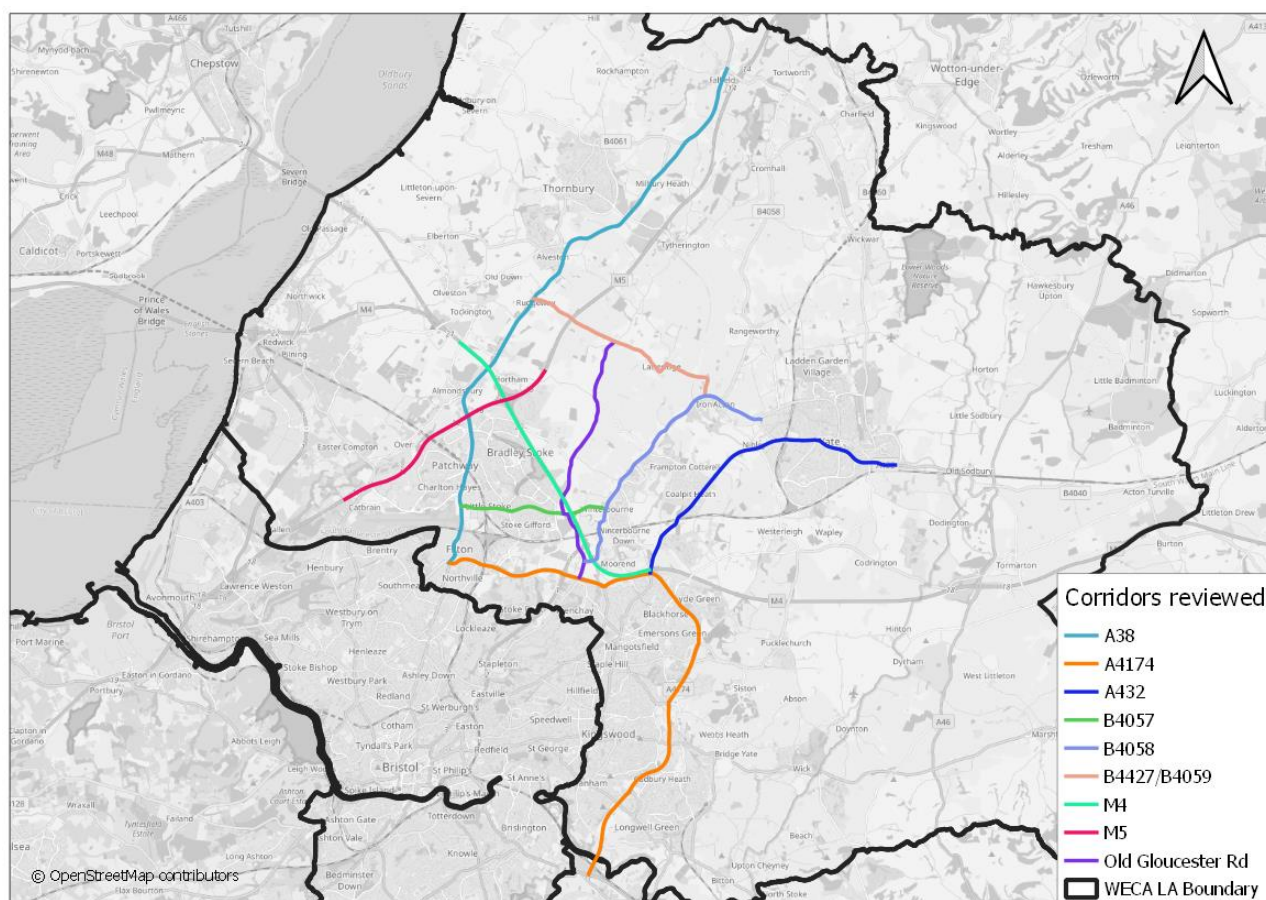
This technical note presents the network updates or improvements carried out to the WERTM highway assignment model.

## 1.1. Network Review

A detailed network coding review was undertaken on the key corridors of the model presented in Figure 1-1. During this process, the network coding for the junctions and the links was reviewed against the on-ground conditions using Google Maps and Street View for the model year 2019 in conjunction with the WERTM network coding manual (a network coding manual developed to ensure consistency in approach and coding of the highway assignment model component in WERTM) for the following attributes:

- Junction type and configuration;
- Number of lanes per arm and turn allocation;
- Turn saturation flows;
- Link lengths;
- Speed;
- Distance;
- Speed Flow Curve (SFC);
- Zone centroid connectors; and
- Banned turns.

**Figure 1-1 - Corridors Reviewed in WERTM**



In addition to these corridors, the network was also reviewed in the areas/roads passing through Bradley Stoke, Kingswood, Alveston, Thornbury, Tytherington and local roads connecting Old Gloucester Road to the A38.

Network consistency checks were undertaken throughout the process to make sure the updates were carried out in all peak models.

## 1.2. Network Updates

Based on the findings from the network review, updates/improvements were carried out to the model network which mainly consist of:

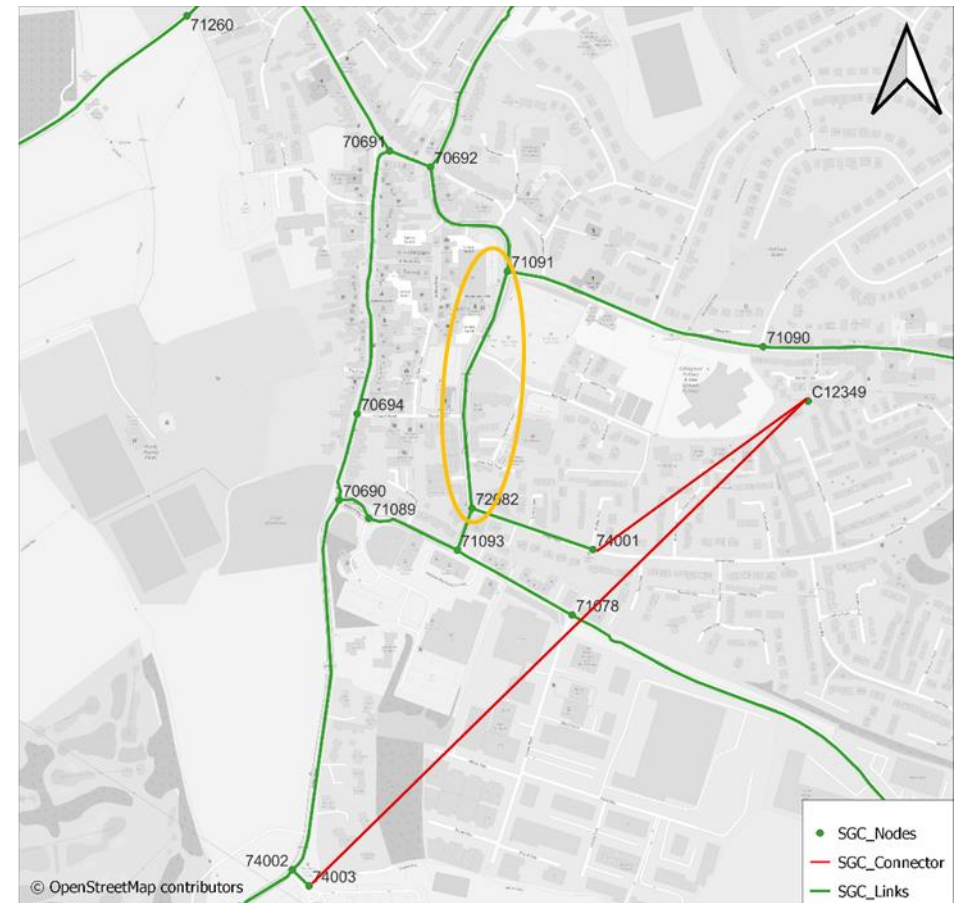
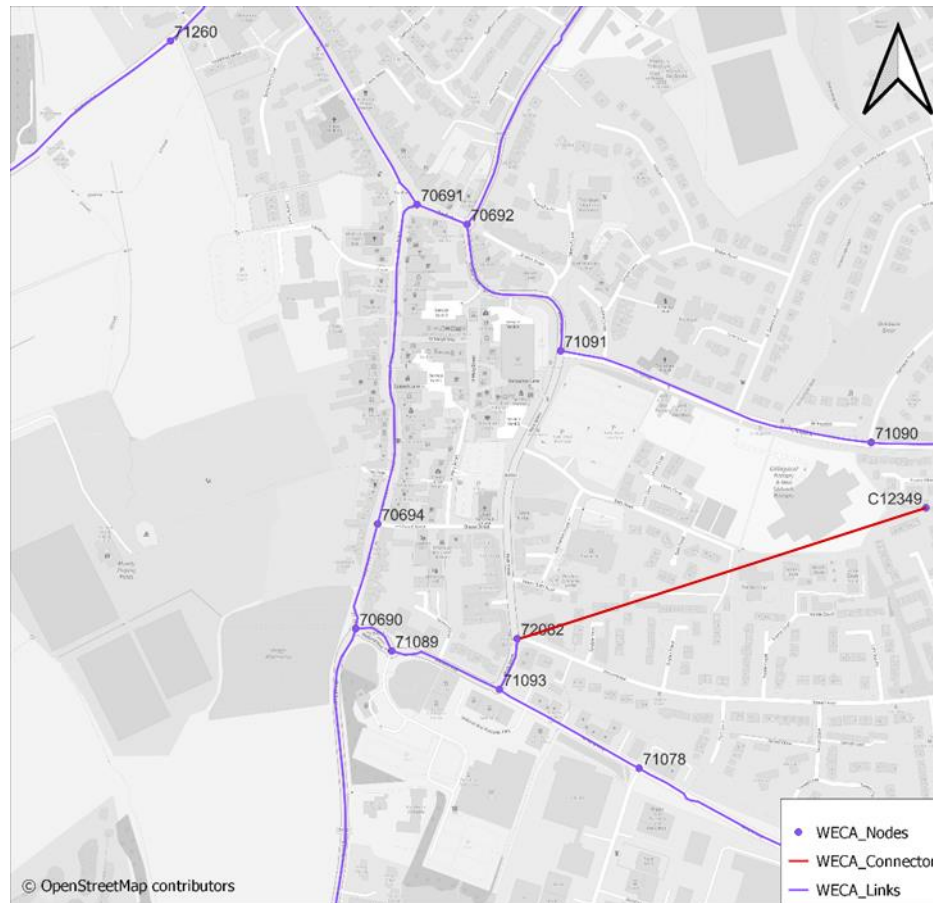
- Structural changes – includes addition of new nodes and links:
  - A4174 stretch of the JT route has new nodes inserted on the entry arms at roundabouts to cater for the reduced speeds at the junction; and
  - New nodes are also inserted to allow for HOV lane segregation – no other structural changes are made to represent HOV lane, capacity of the links were reduced by 30% where HOV lane is available.
- Link properties – includes changes to speeds and capacities;
- Node properties – change in node type; and
- Turn properties – includes update of lane allocations, saturation flows.

Snapshots of the network before and after the update are presented in the subsequent sections. GIS plots are provided where possible to present the structural changes and SATURN P1X plots are provided for other changes.

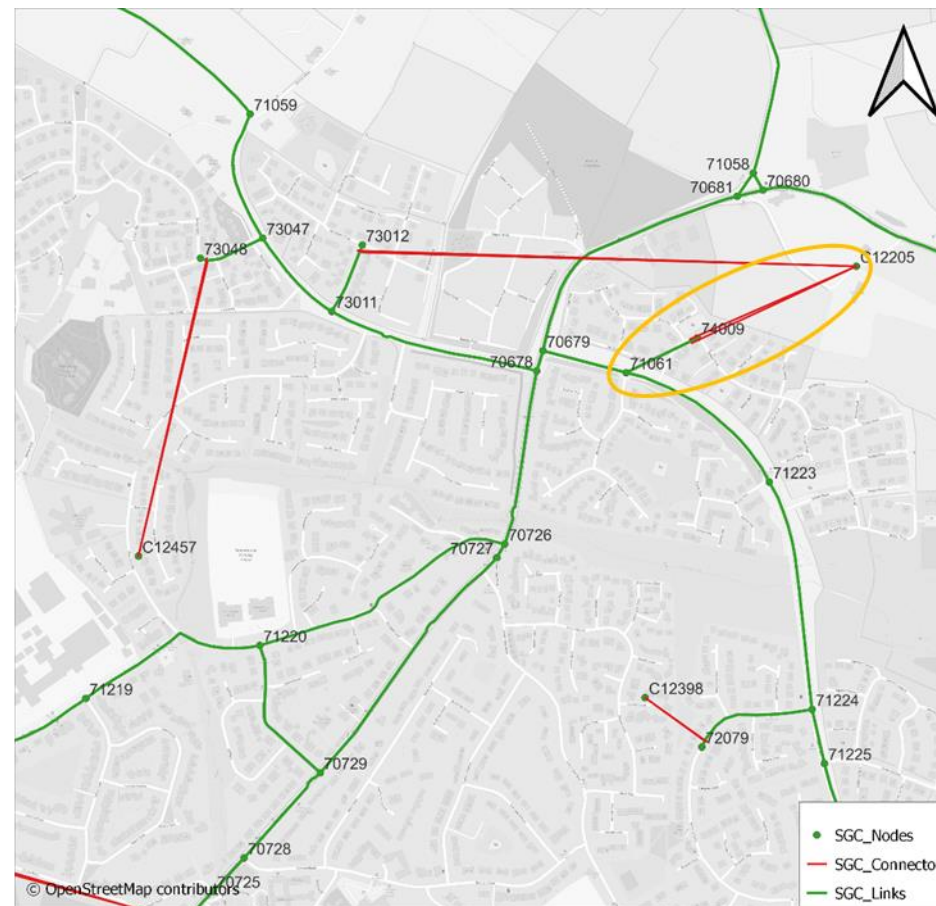
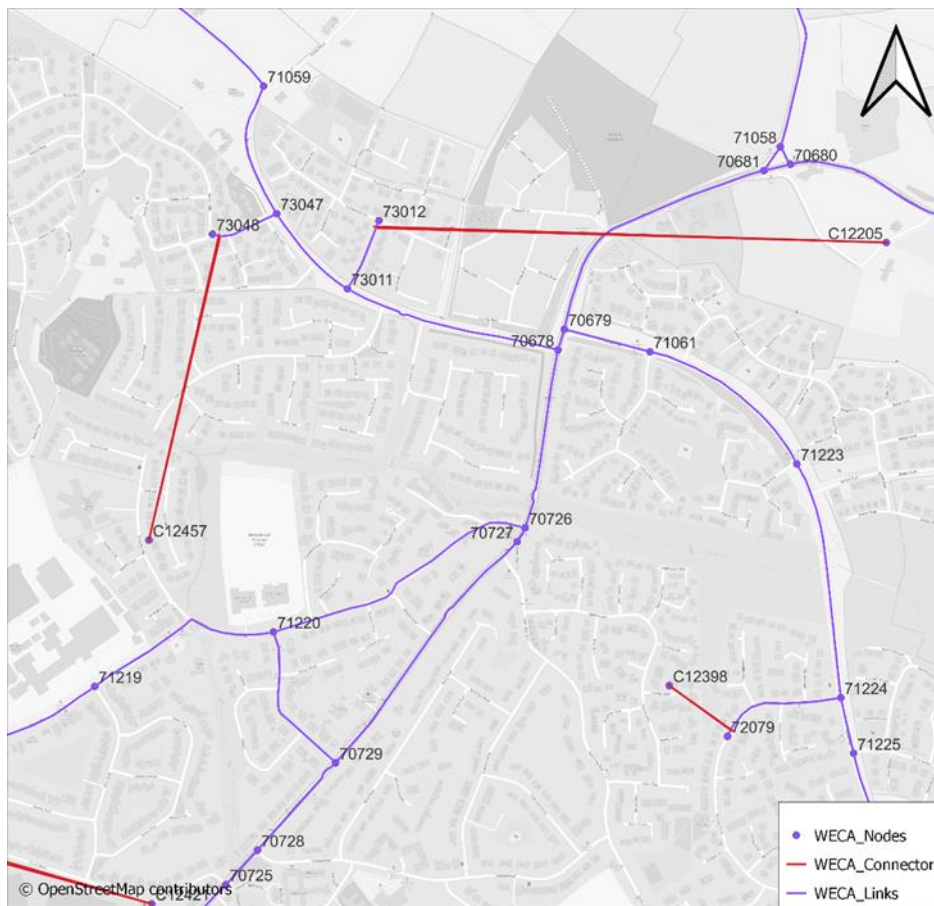
### 1.2.1. Network Updates carried out in the model

This section presents the structural changes made to the network in terms of addition of new nodes, zone connectors and addition of new links etc.

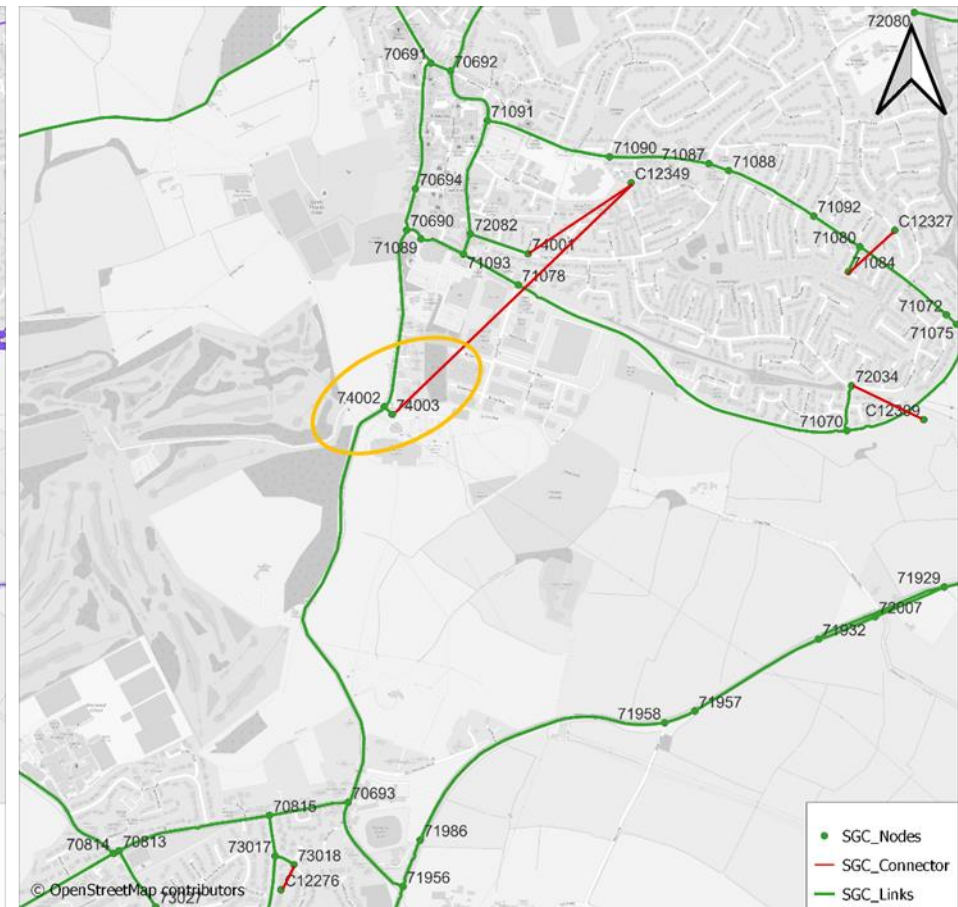
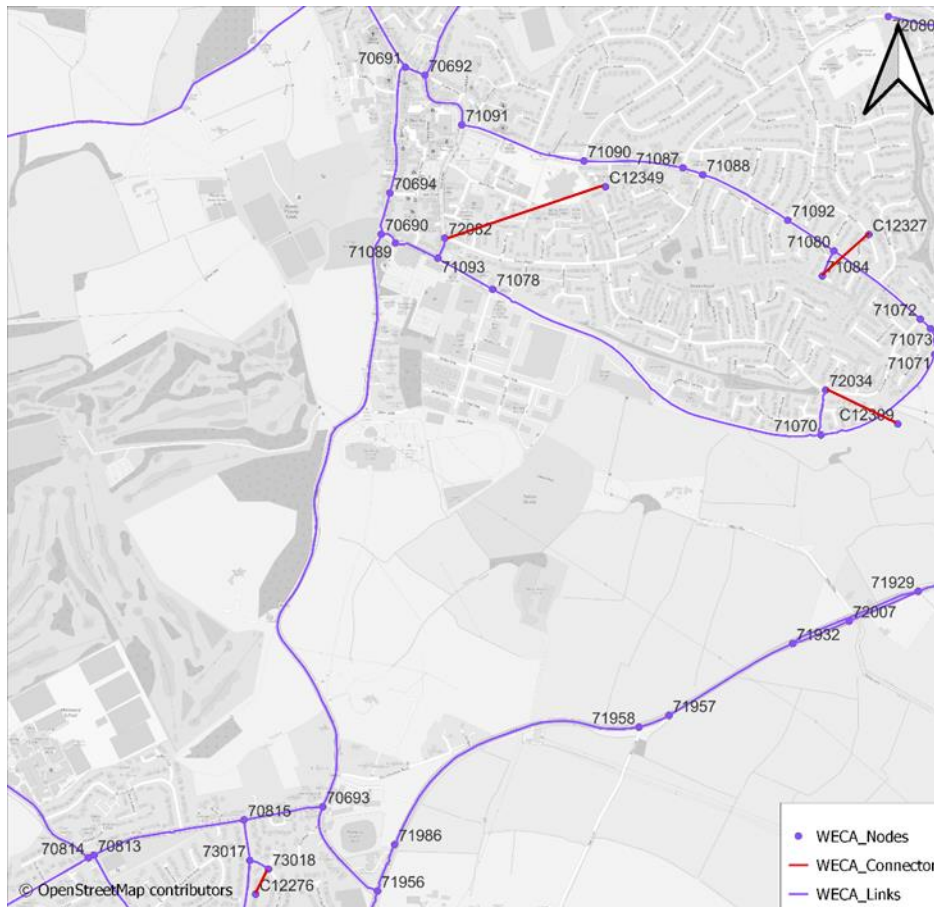
- **B4061 – Rock Street:** The missing major road Rock Street in the model is now included (connecting 71091 and 72082) and the zone connector for zone 12349 has been modified to load onto Rock Street via link 74001-72082 on Streamleaze lane.
- **High Street:** Added capacity index for 70691-70694 for both directions. SFC with mid link capacity of 896 added to restrict flow.



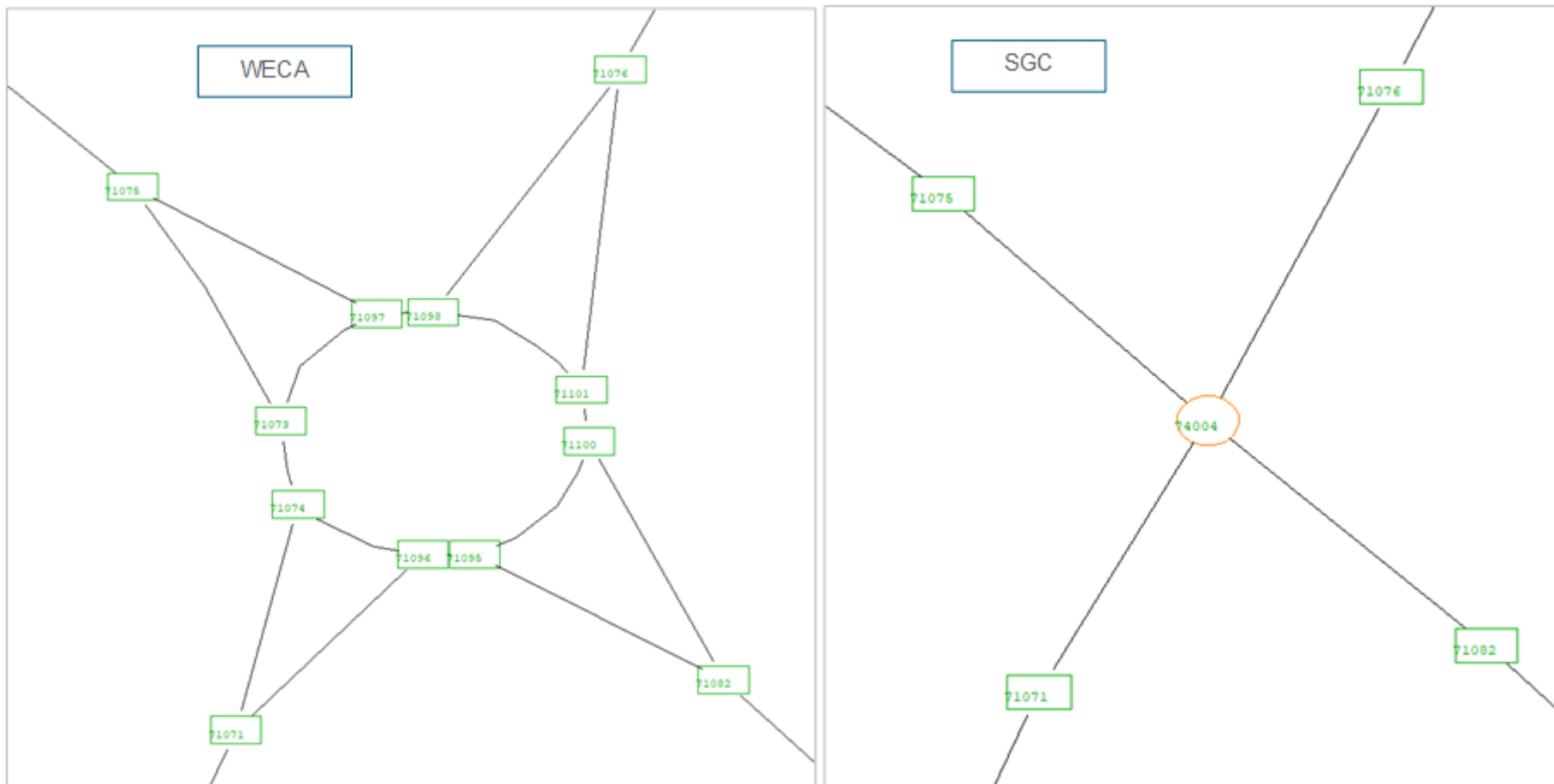
- **B4061/Morton Way:** New zone connector added on to Morton Way (at node 71061) for zone 12205 in addition to the one onto Butt Lane via link 73012-73011.



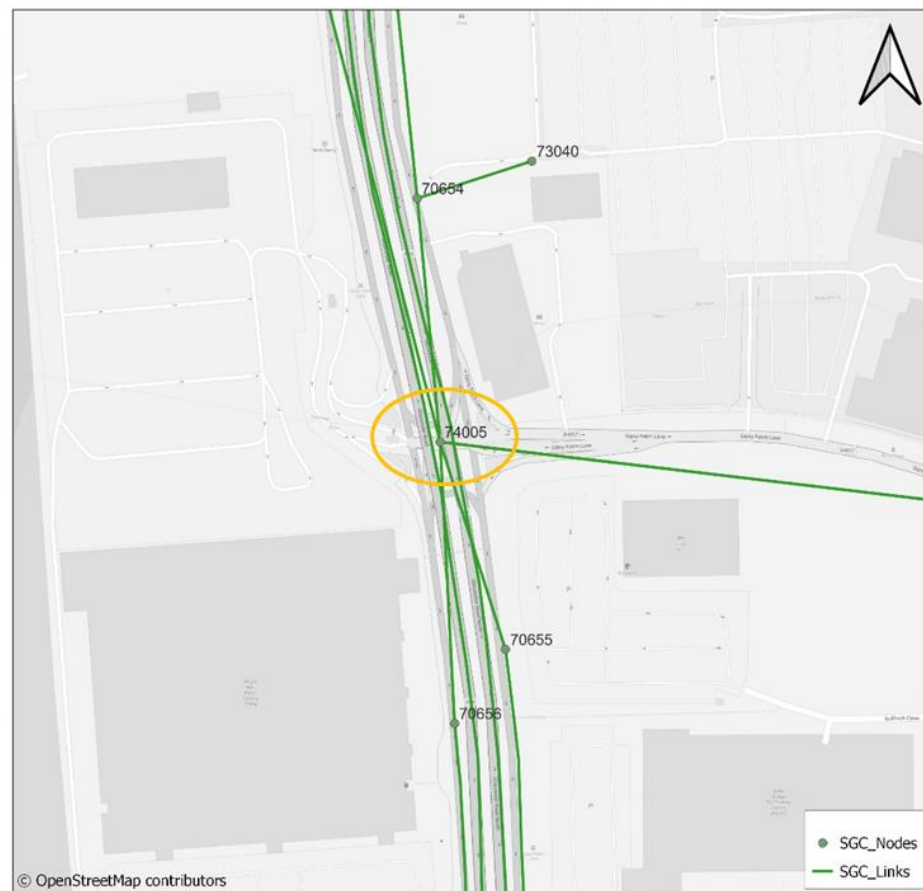
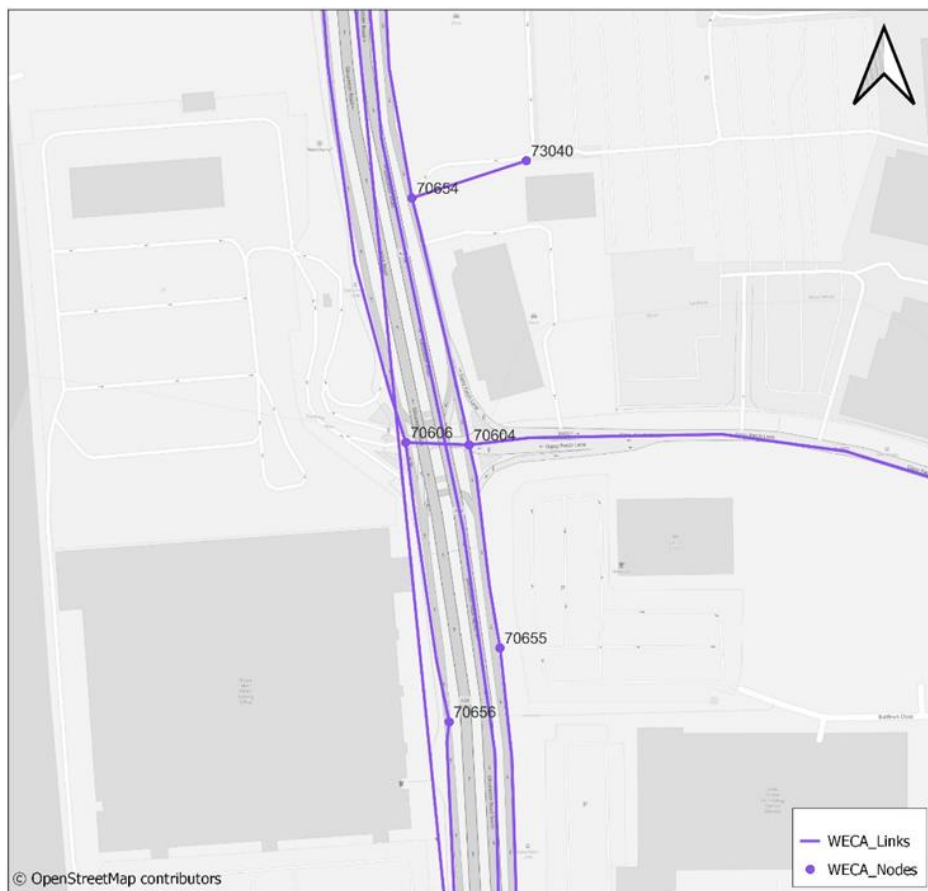
- **B4061 – Alveston Hill:** Link split with new node 74002 and provided additional zone connector for zone 12349 at Thornbury Leisure Centre. Also converted junction type from 5 to 2 i.e., roundabout with U turn to roundabout without U turn for node 70690.



- **Morton Way/ Grovesend Road:** Converted the multi-node (split) roundabout to single node (normal) roundabout (new node 74004).

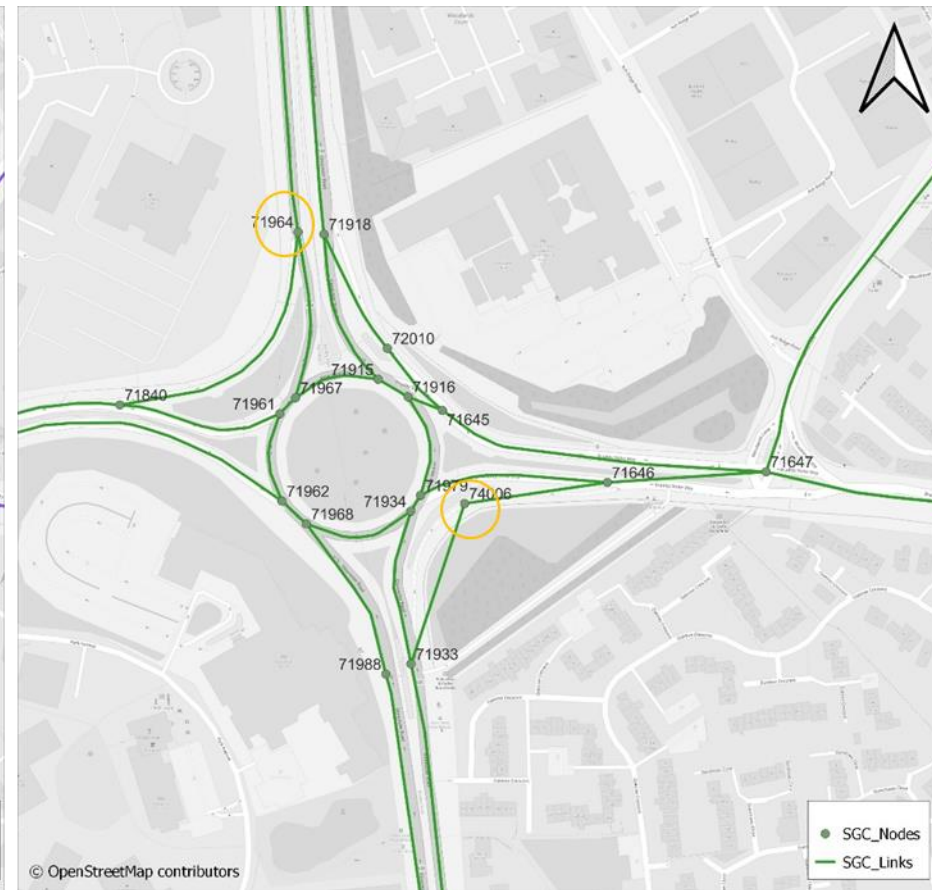
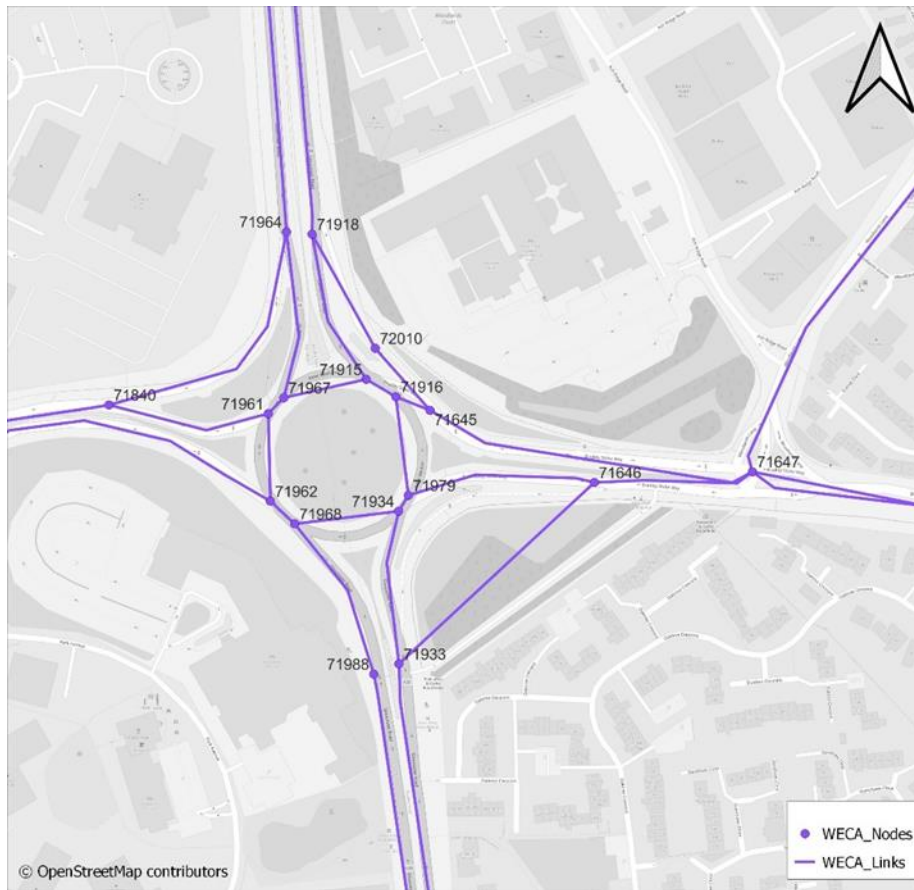


- A38 Gloucester Road/Gipsy Patch Lane:** The signalised junction was coded as two separate signals as 70604 and 70606, which is now updated as a single signalised junction (74005) i.e., single signal controller and signal times are updated from observed data.

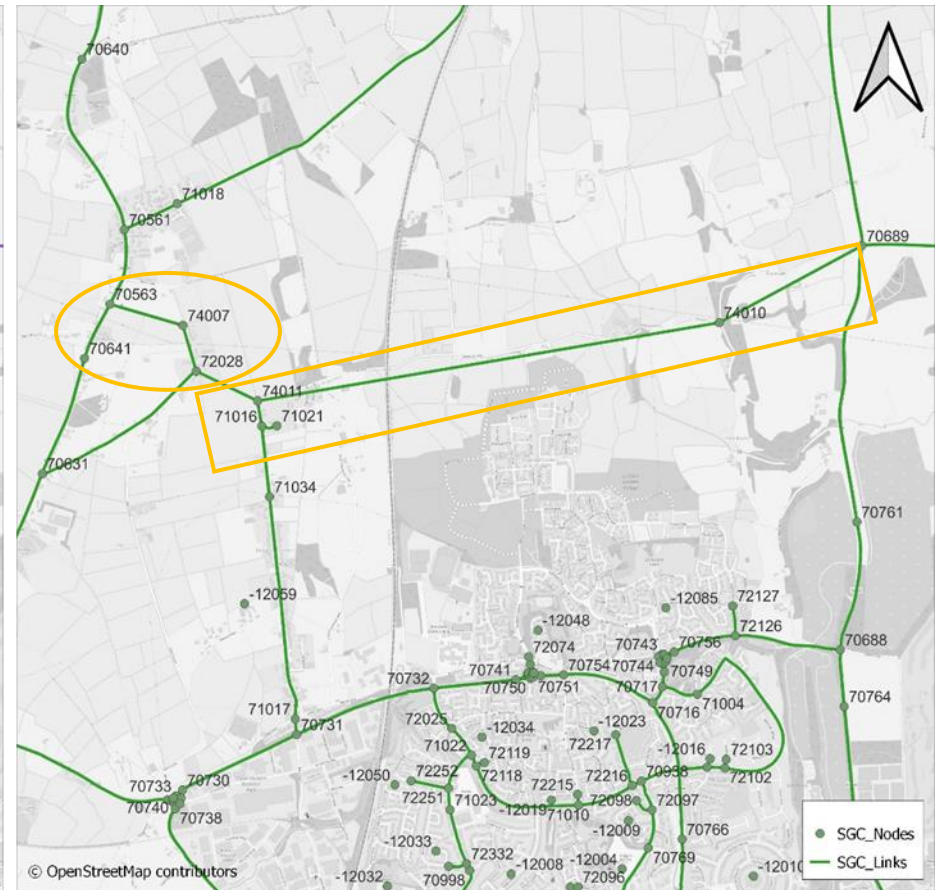




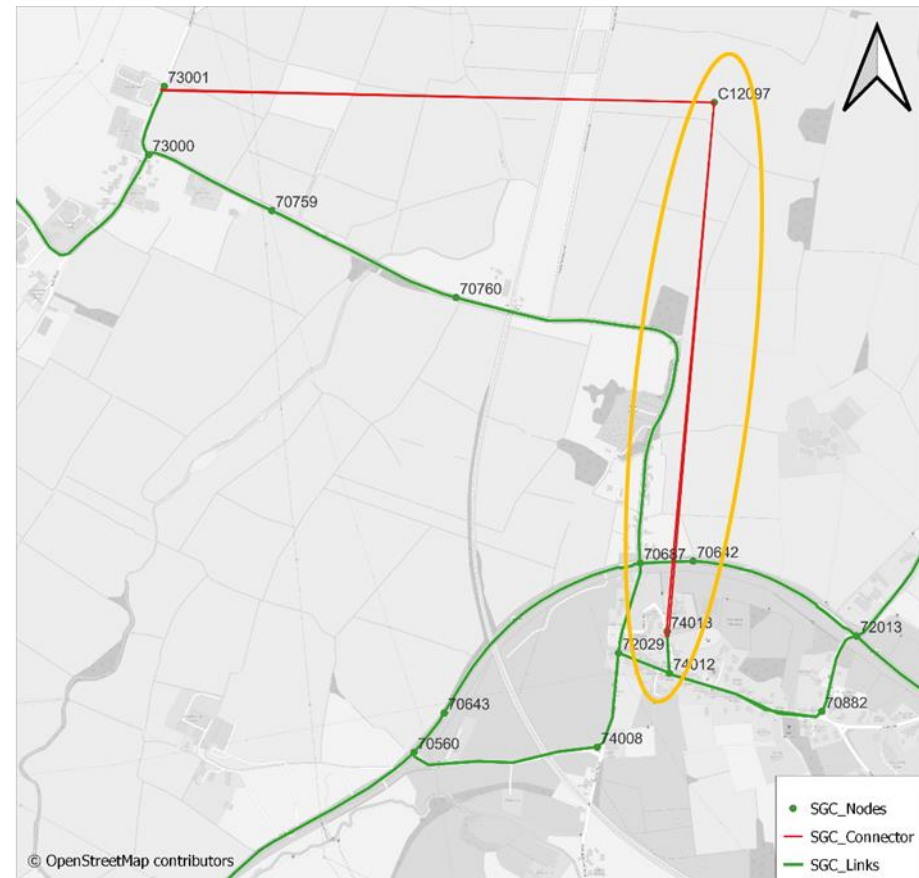
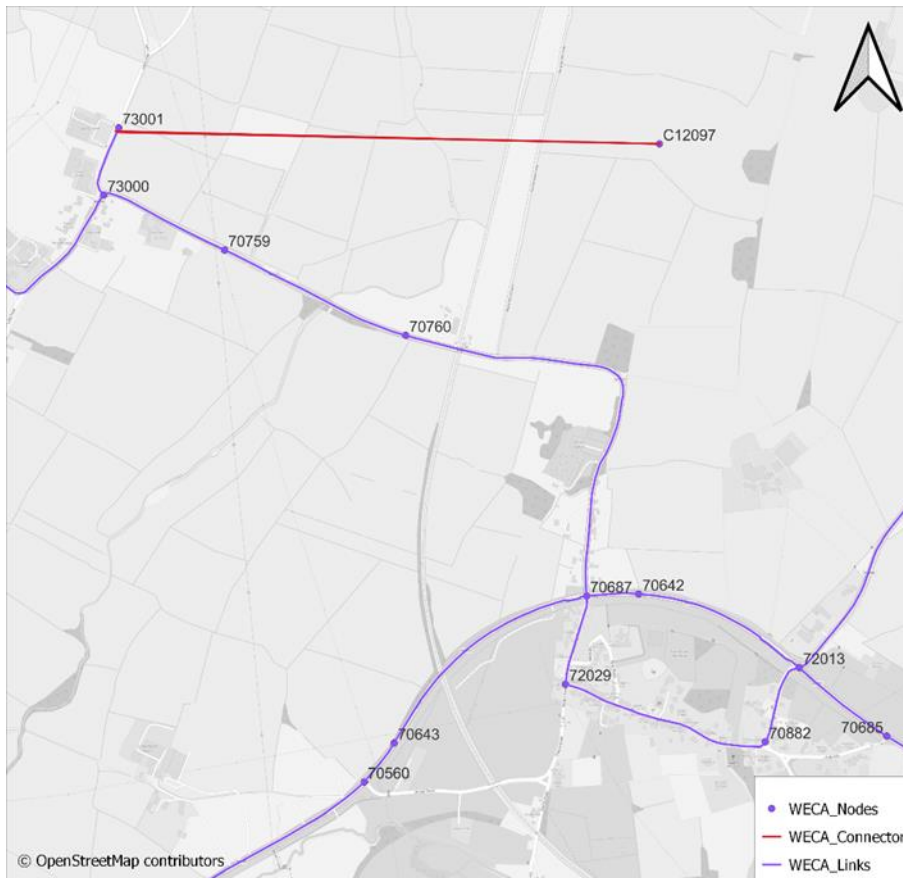
- **A38 Gloucester Road/Aztec Roundabout:** Coded pedestrian signal on link from Bradley Stoke Way to A38 South, a new node 74006. Junction of A38 North and NB approach from park avenue (node 71964) is converted to signalised junction as seen in street view.



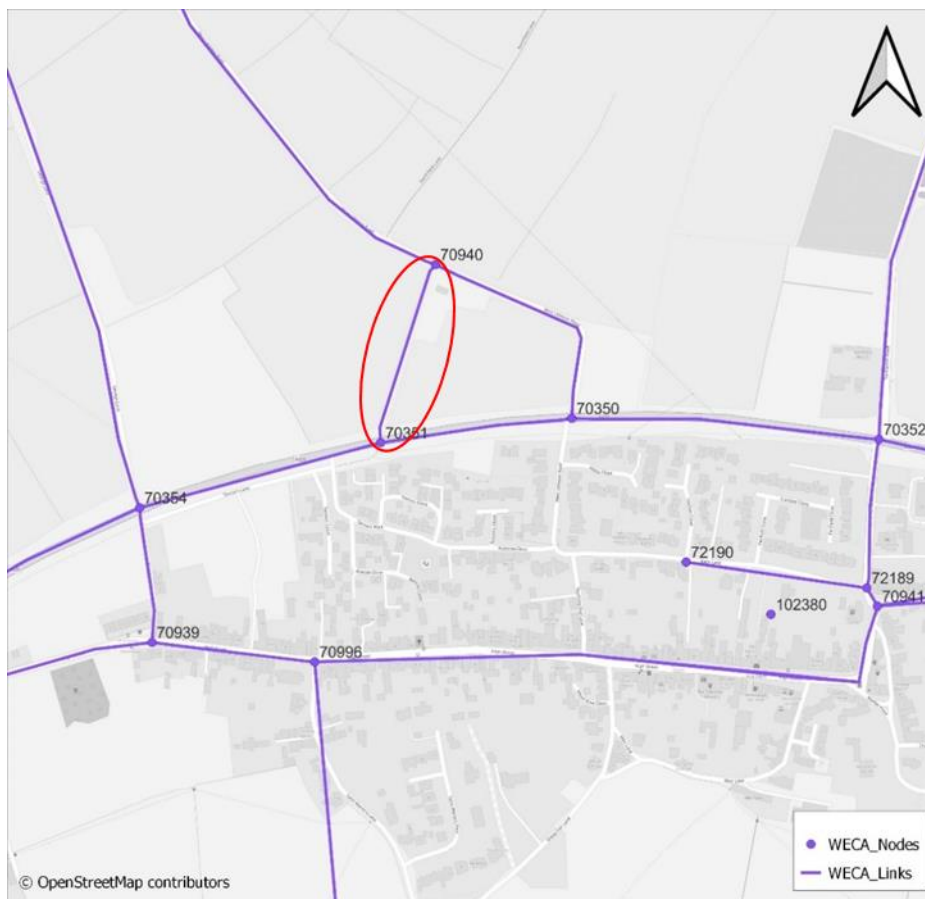
- **Tanhouse Lane/Bury hill:** Tanhouse Lane/Bury Hill Lane connecting North Road B4060 Wickwar Road is included in model (connecting nodes 71016 & 70689 via new nodes 74010 & 74011).
- **B4058 Manor Road:** Manor Road connecting North Road and B4058 is included in model (connecting nodes 70563 and 72028).



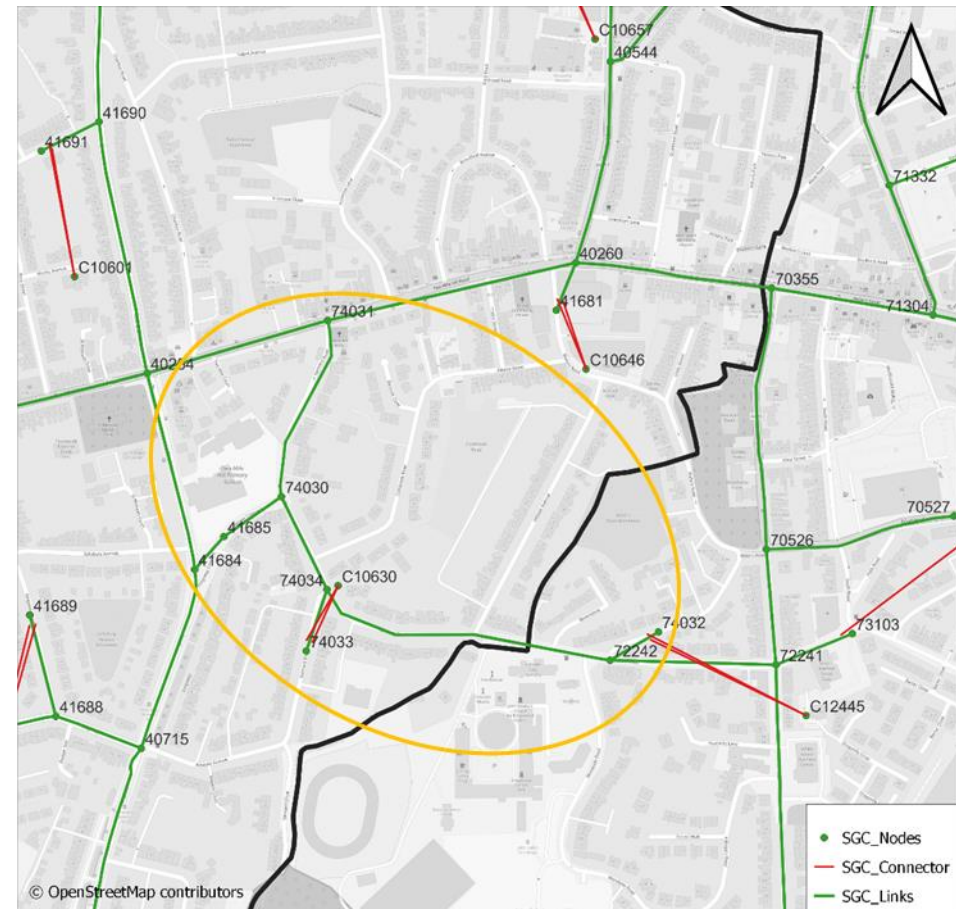
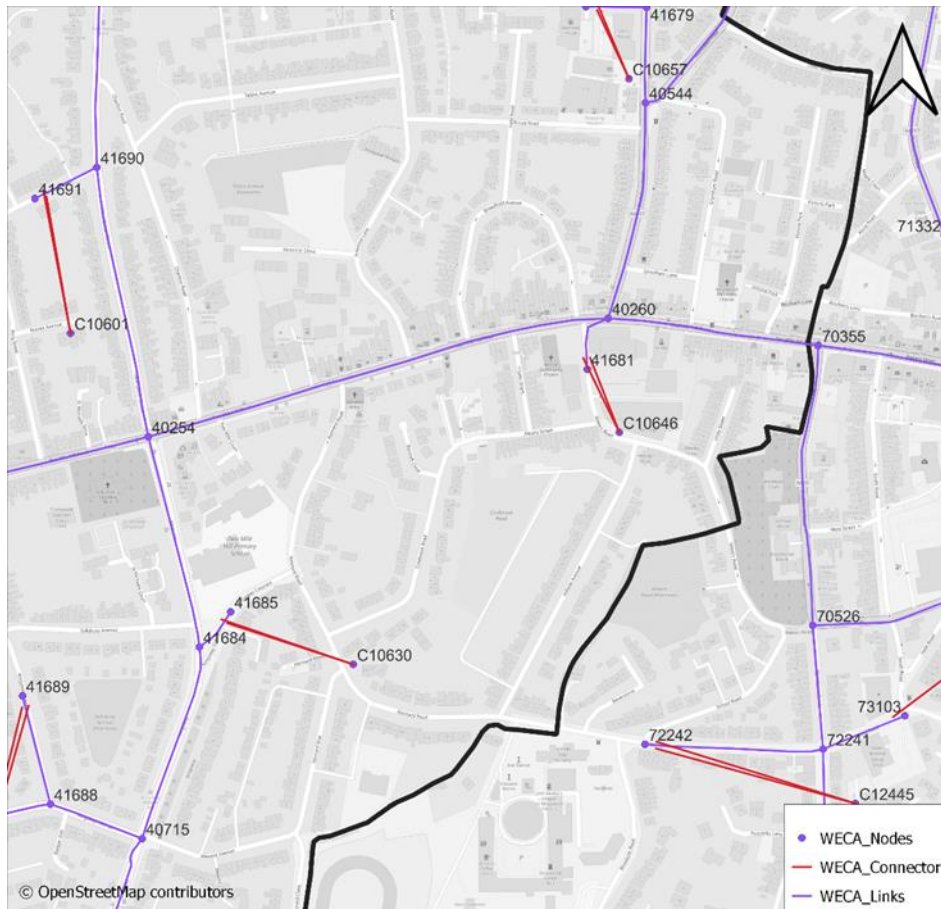
- **Iron Acton:** High Street is connected to B4058 Bristol Road via Station Road (connecting nodes 72029 and 70560). Also added additional zone connector for zone 12097 onto High Street. Speed and Capacity of High Street is also corrected.



- **A420 Marshfield:** Minor Road connecting A420 and West Littleton Road is removed as this is very narrow and not an all-weather road, and movement of vehicles is not possible through this road. This also prevents rat running.



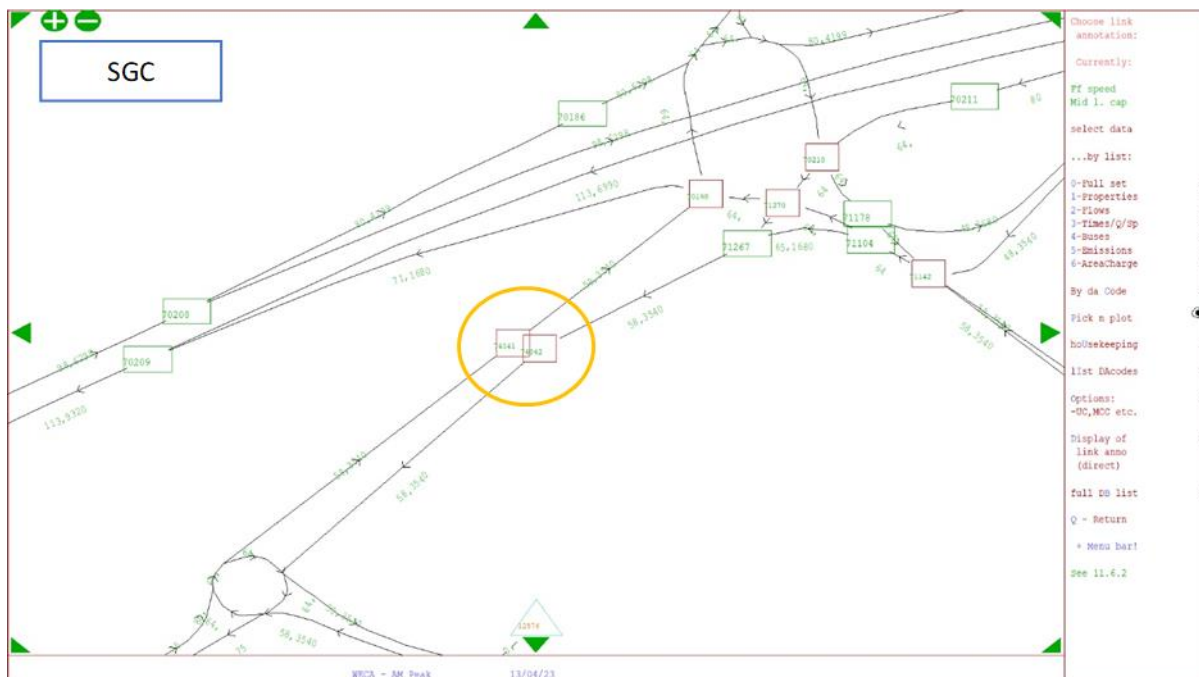
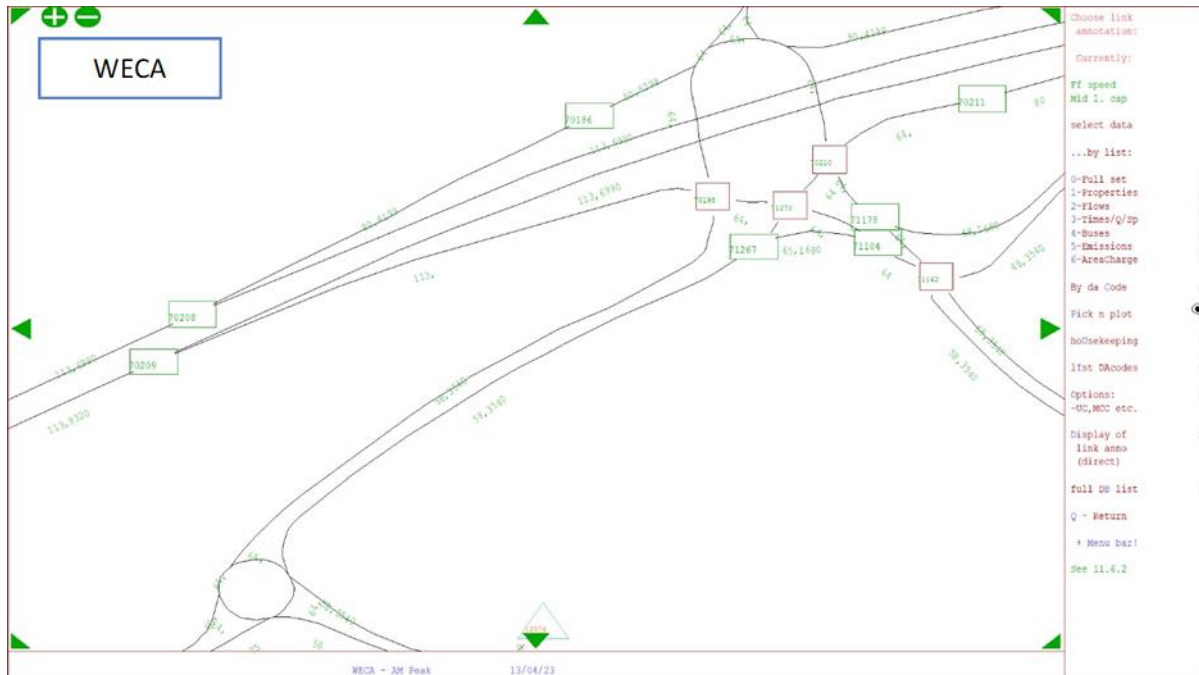
- Kingswood Britannia Road:** Britannia Road/Kennard Road connecting Blackhorse Road (node 72241) and A420 Two Mile Hill Road (node 74031) is included in the model. It also provides connectivity to Kingsway via Kingsway Crescent. Zone connectors of zones 12445 and 10630 are also updated.



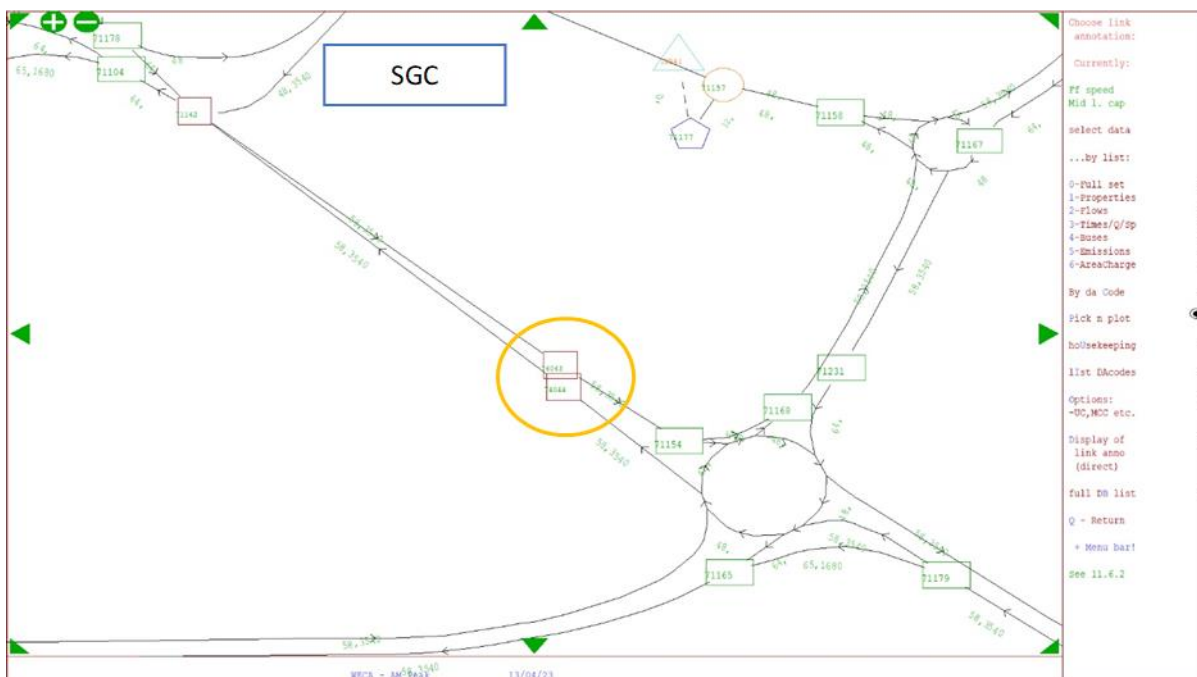
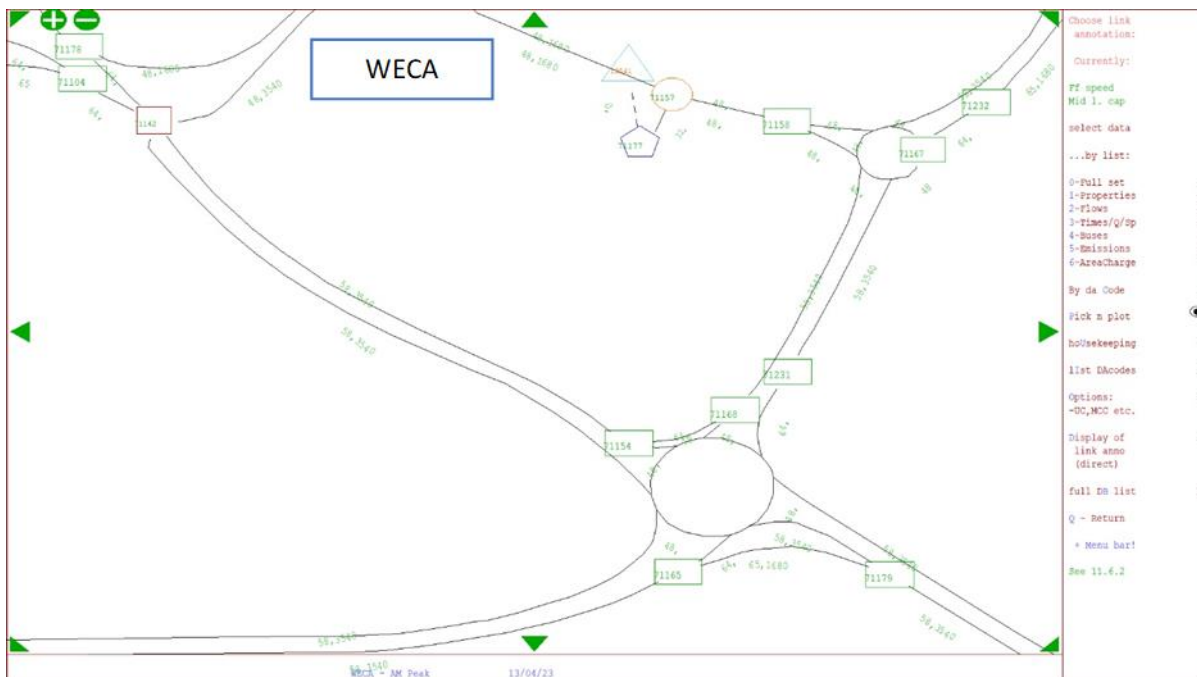
- Acton Turville Road:** Removed minor road connecting Acton Turville Road to local road south of M4 (link 70928-81324 removed) as this is very narrow and not an all-weather road, and movement of vehicles is not possible through this road. This also prevents rat running.



- **A4018 – Cribbs Causeway:** New nodes (nodes 74041, 74042) inserted for pedestrian signals on both directions.

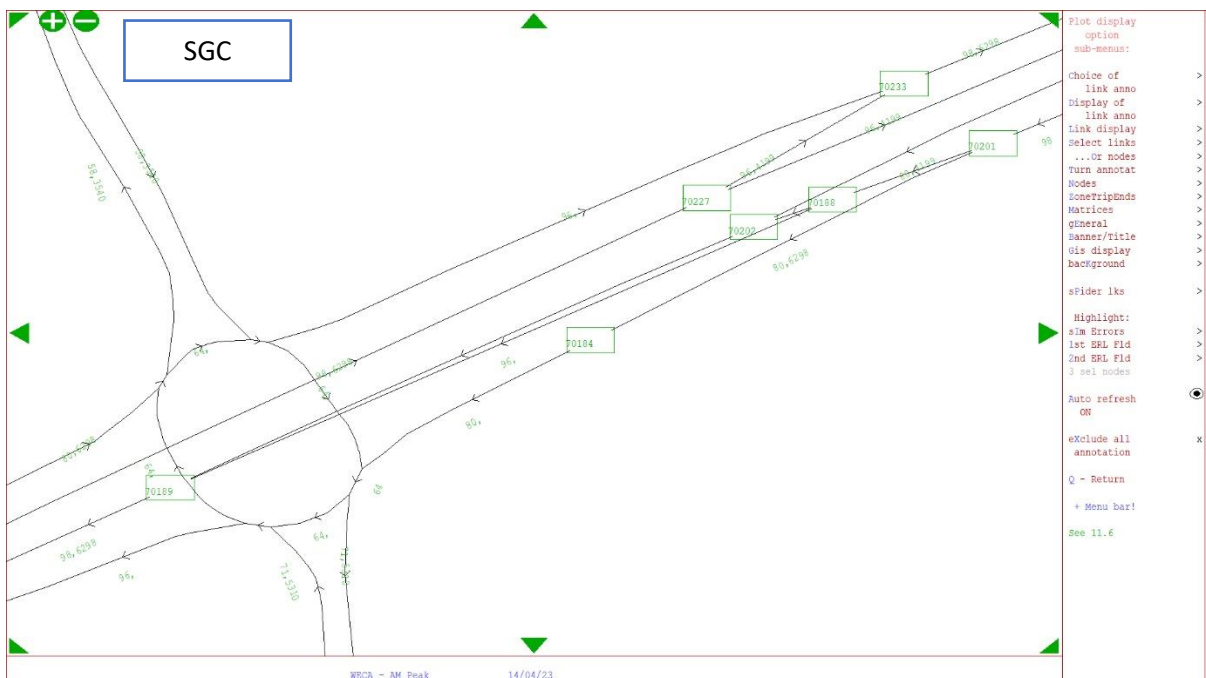
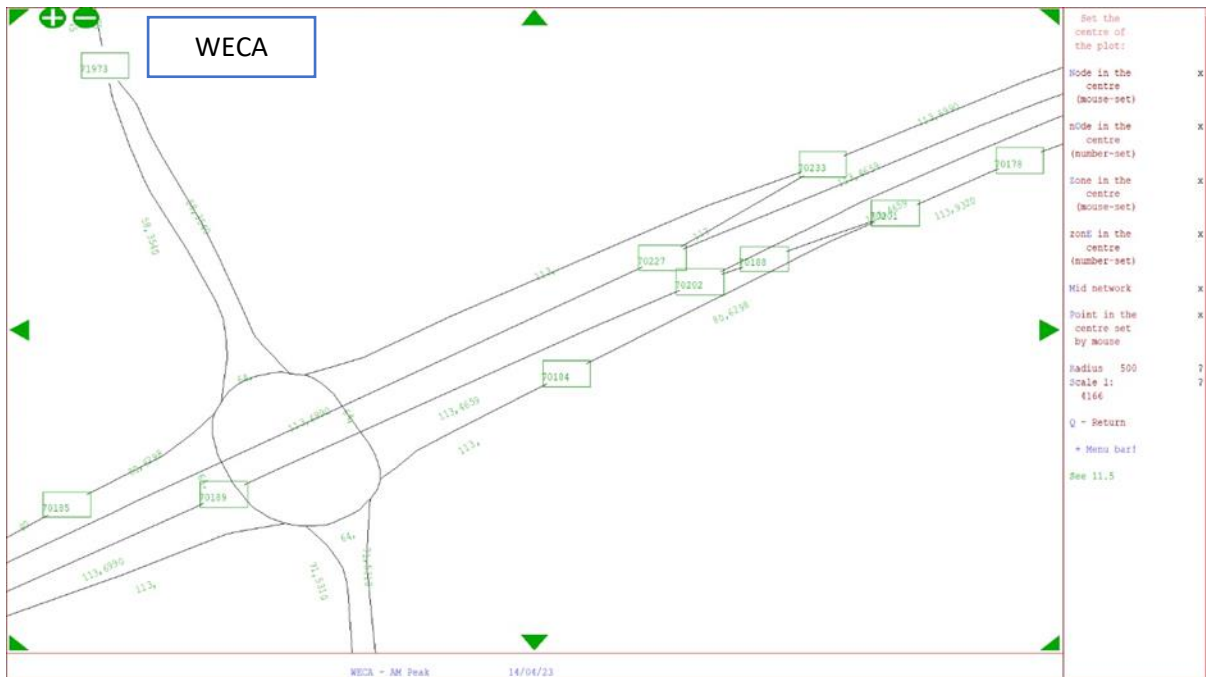


- **Merlin Road:** New nodes (nodes 74043, 74044) inserted for pedestrian signals on both directions.





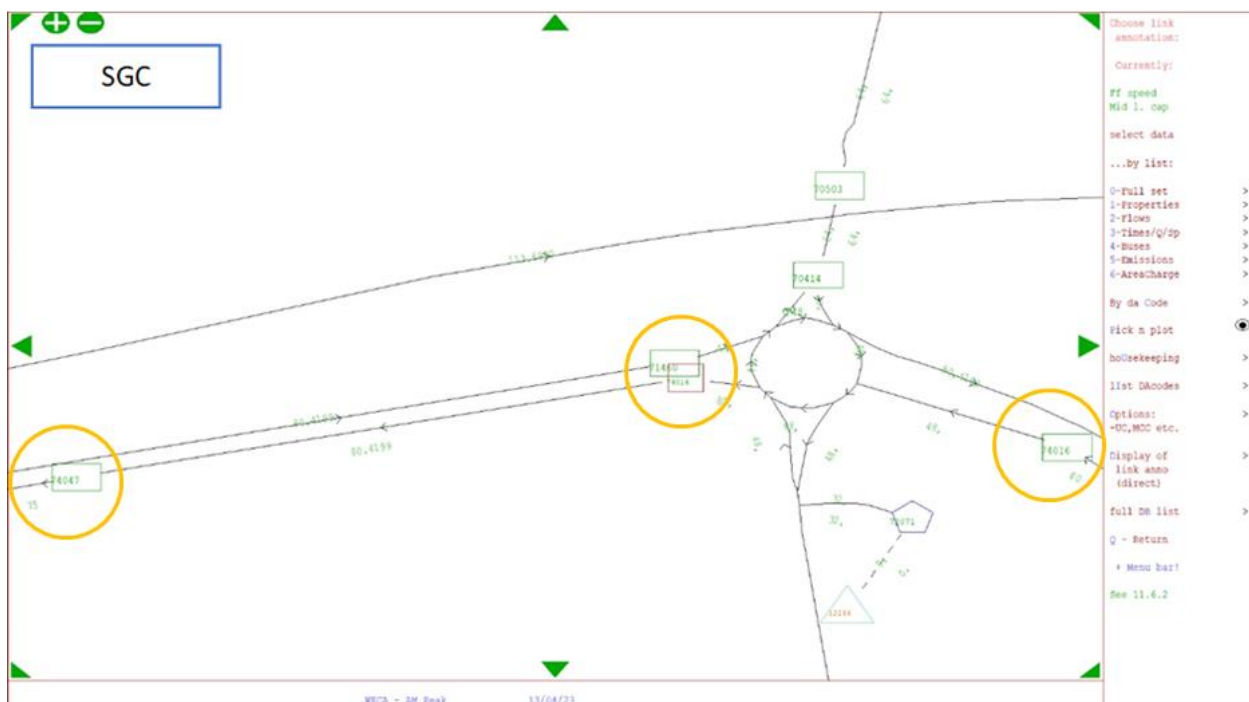
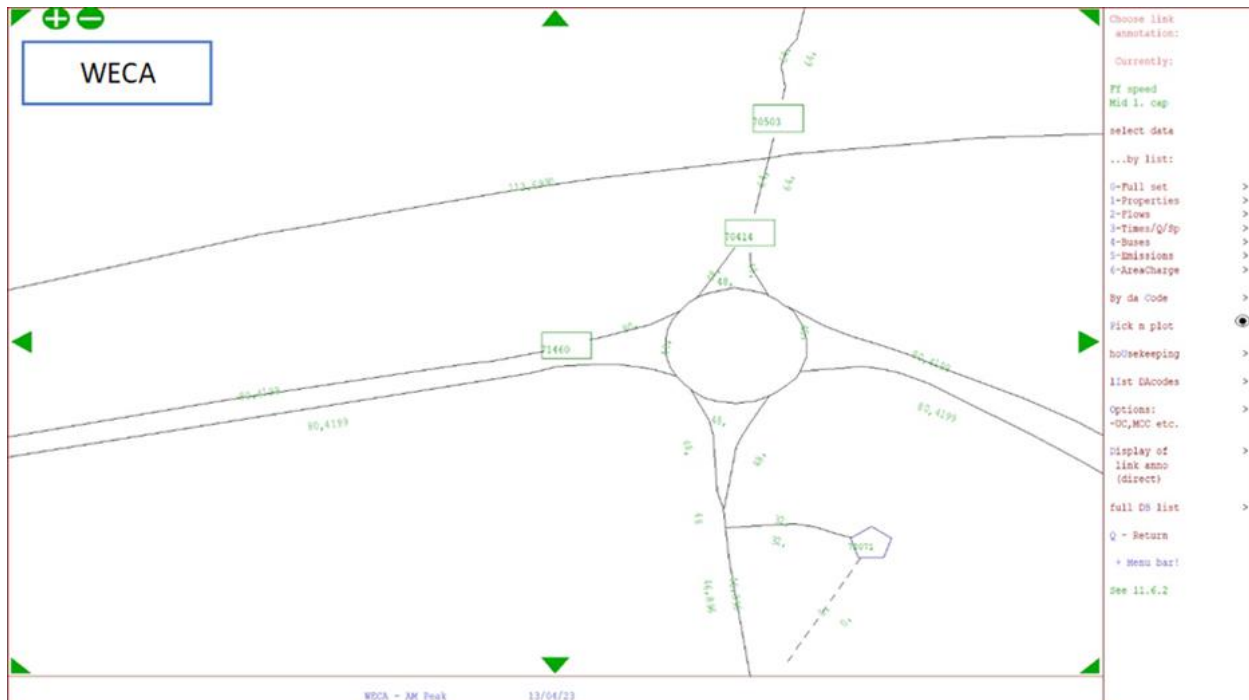
- **M5 Almondsbury Roundabout:** Lane gain Ghost Island merge coding – added one lane from 70188 to 70189 and converted signal node (70226) to priority node.



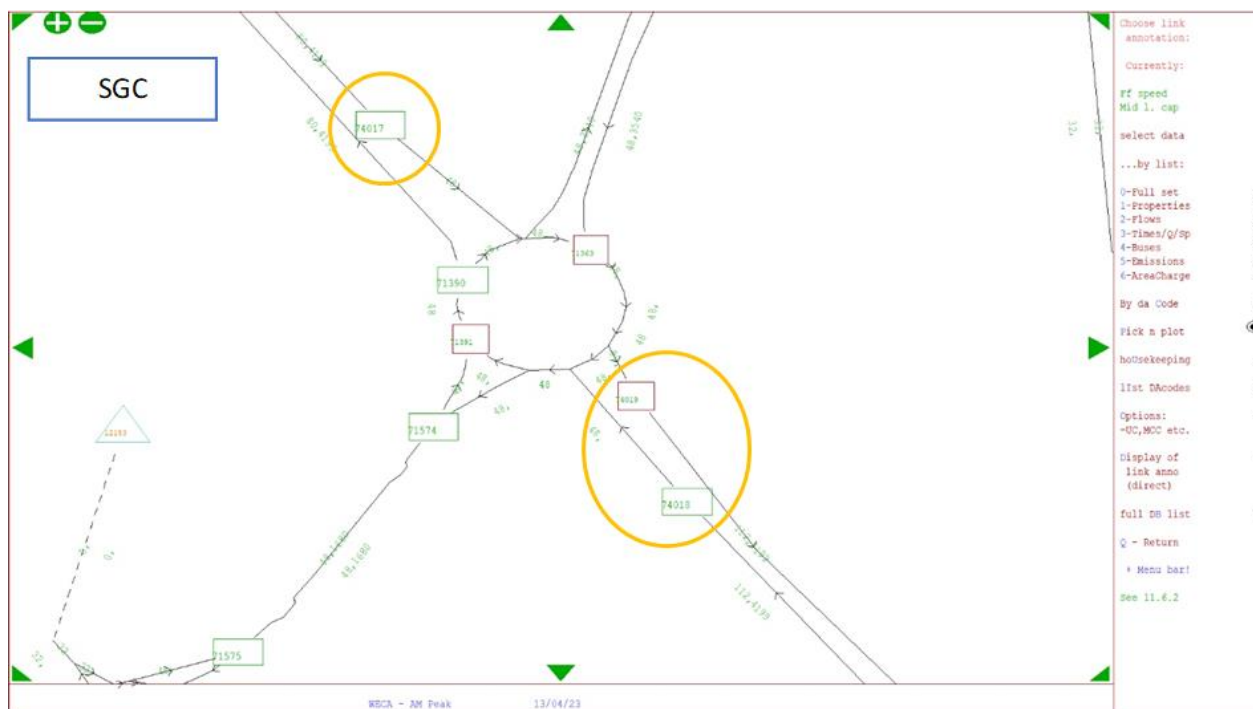
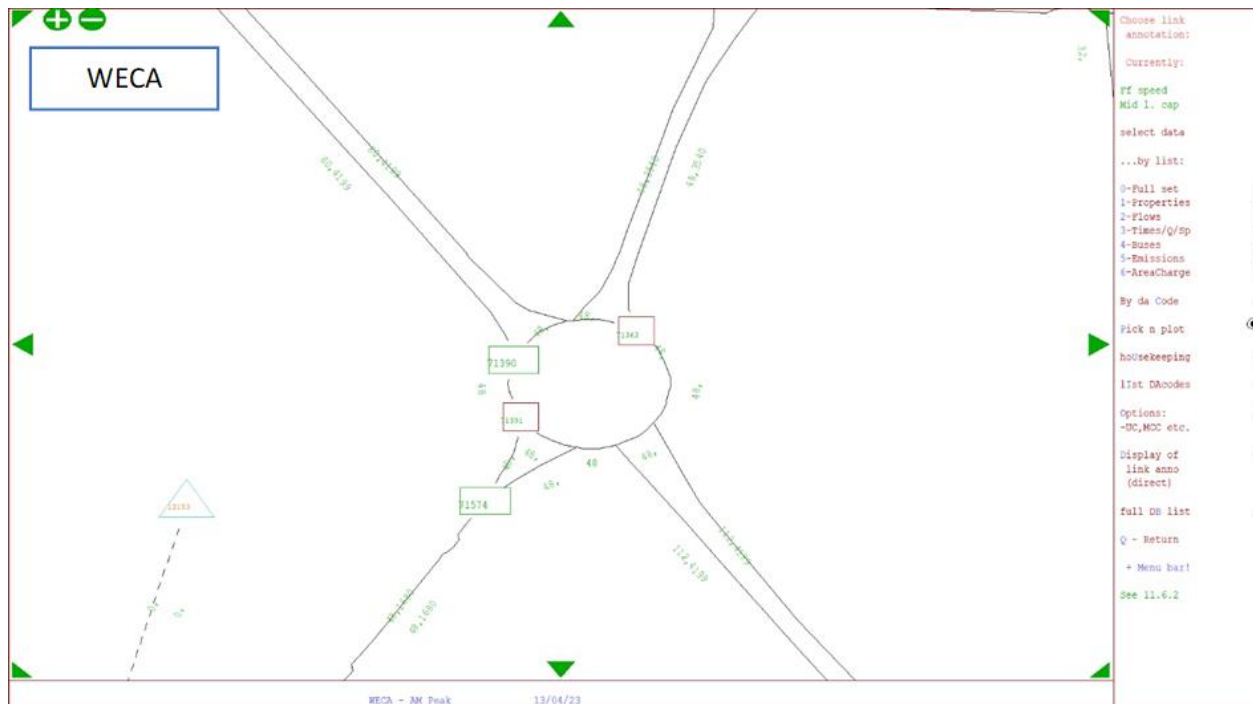
## 1.2.2. Network Updates along A4174

Updates along A4174 comprise the introduction of new nodes to cater for reduced speeds of 30 mph at the entry of roundabouts, capacity reduction for HOV lanes and signal updates. Snapshots from SATURN P1X are presented below showing the network updates carried out.

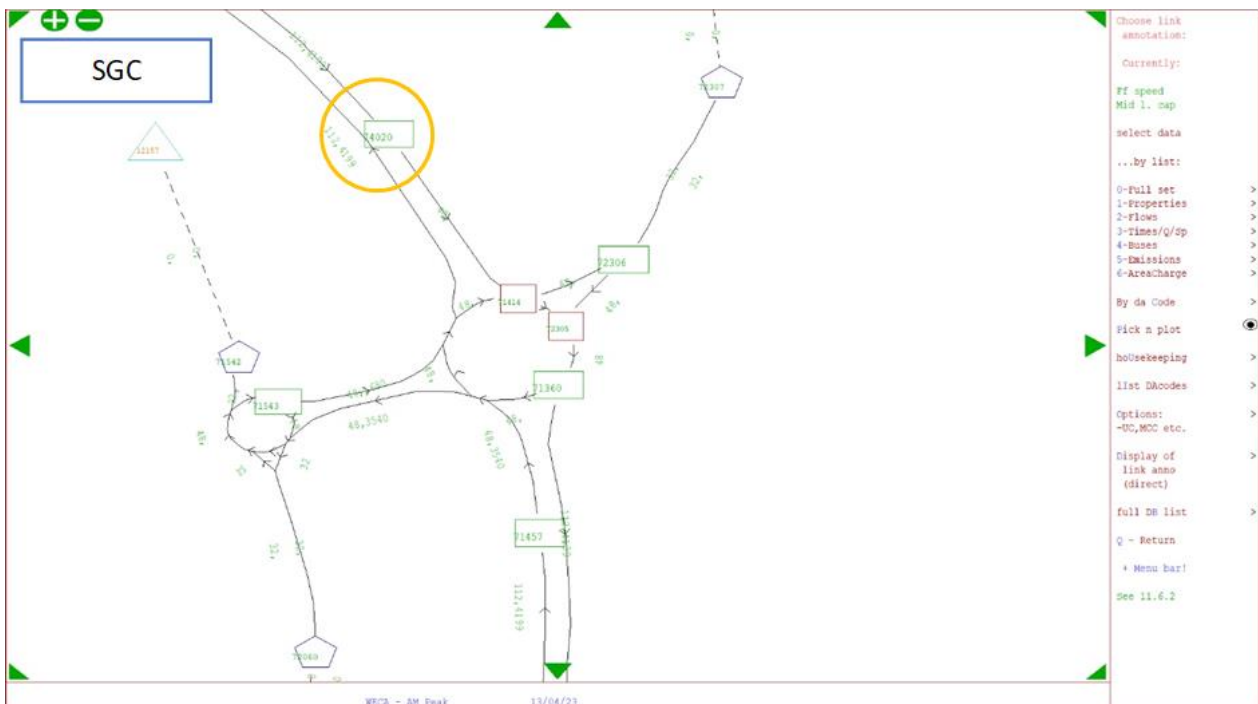
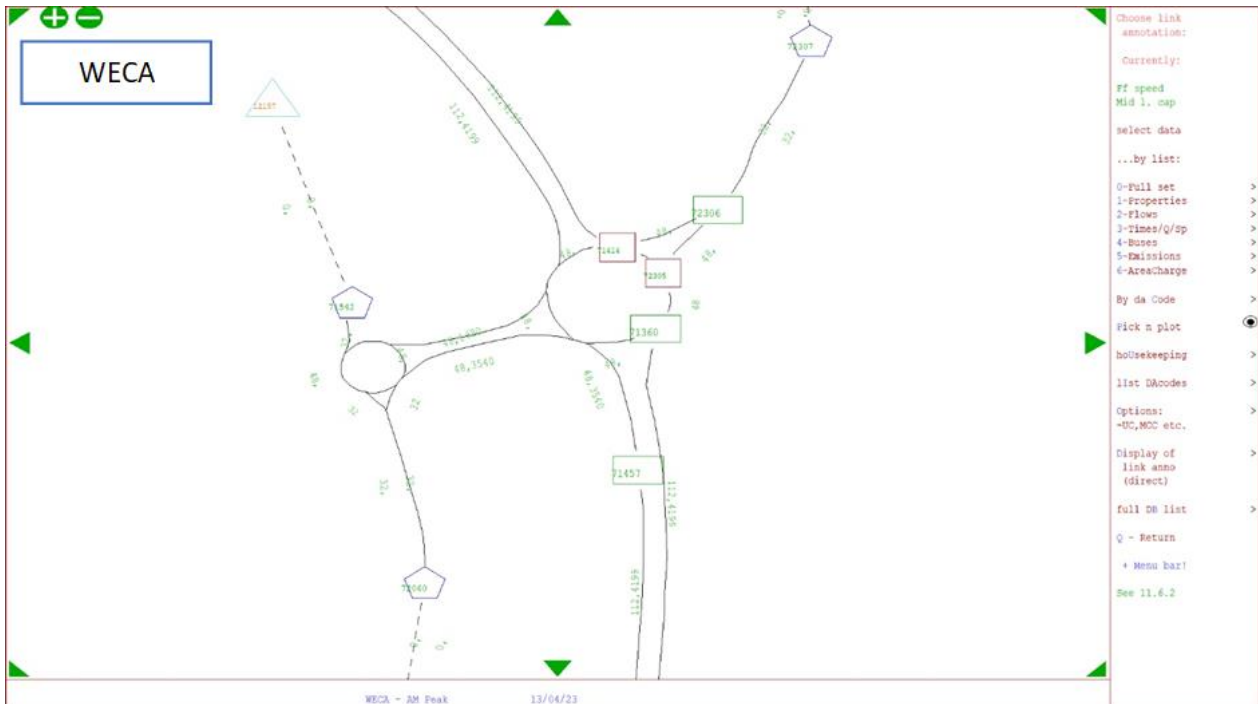
- Wick Wick Roundabout:** New nodes inserted on WB entry and exit arms to cater for reduced speed at the entry and pedestrian signal at exit arm. Speeds on both the entry arms on A4174 are reduced to 30mph. Signal timings are optimised for northbound direction entry arm (nodes 71388, 71380) and southbound direction (node 71384).



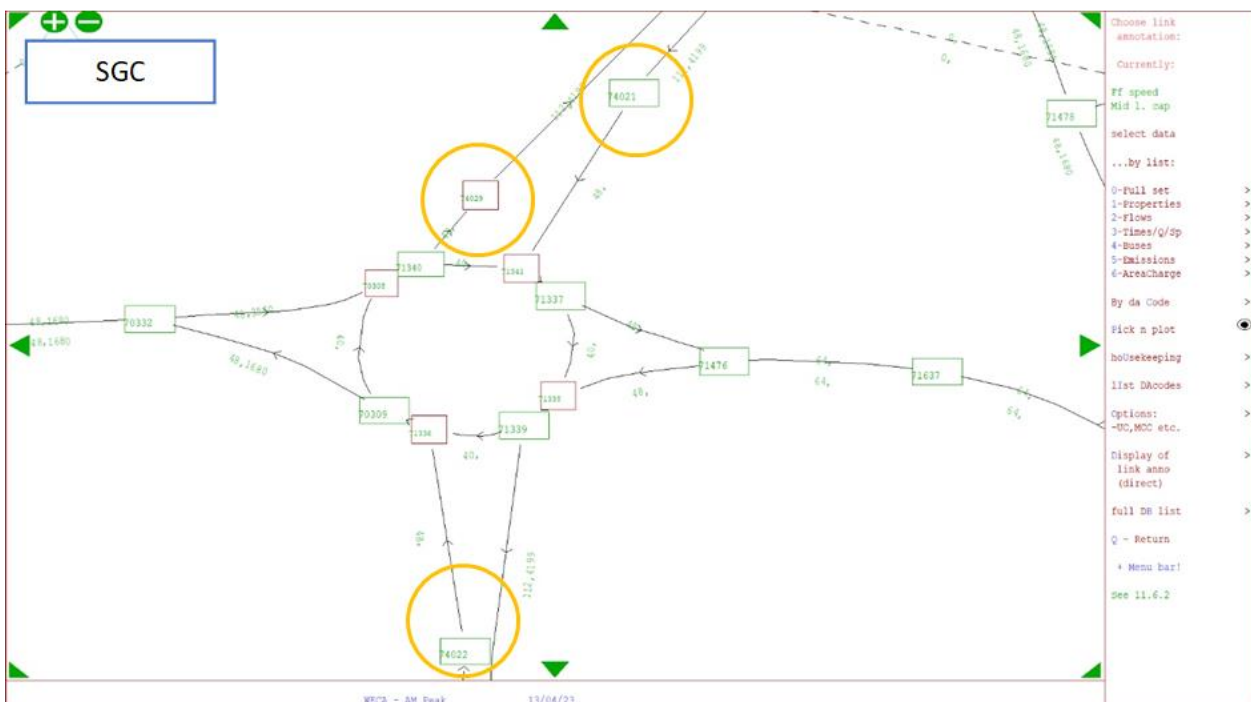
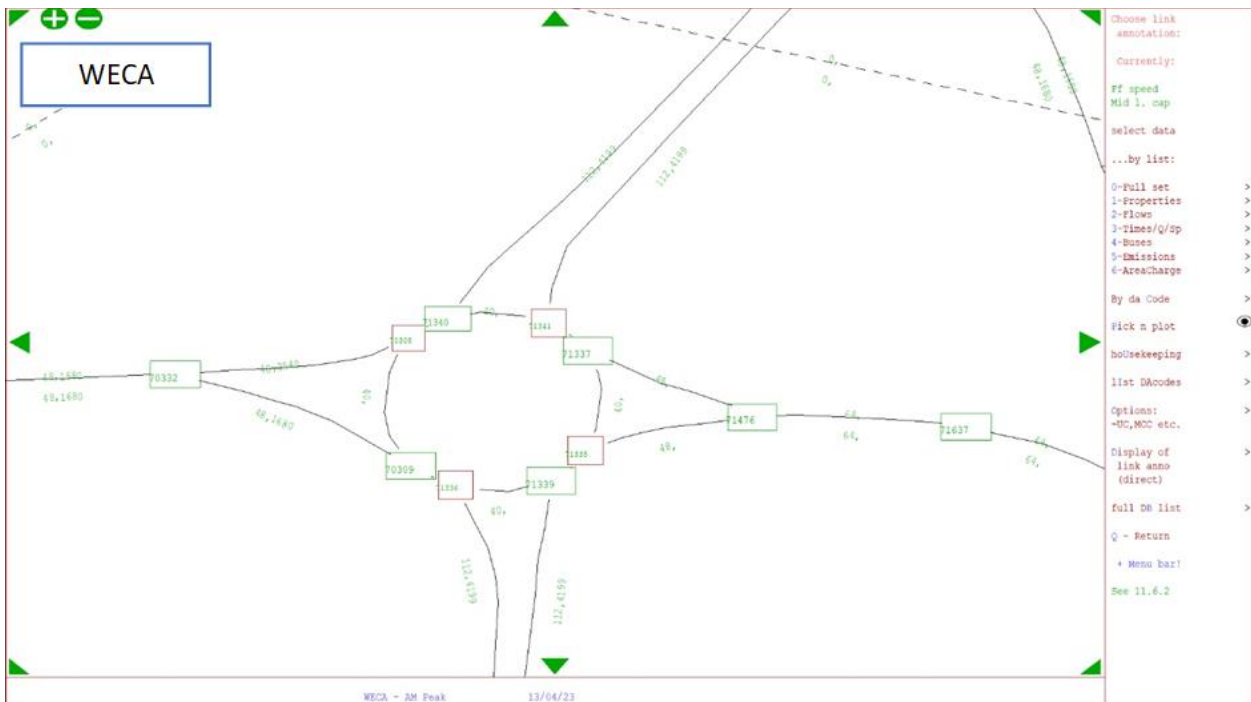
- **Lyde Green Roundabout:** New nodes inserted on both entry arms to cater for reduced speed of 30mph. Signal timings are optimised for northbound direction entry arm (nodes 71417, 71391).



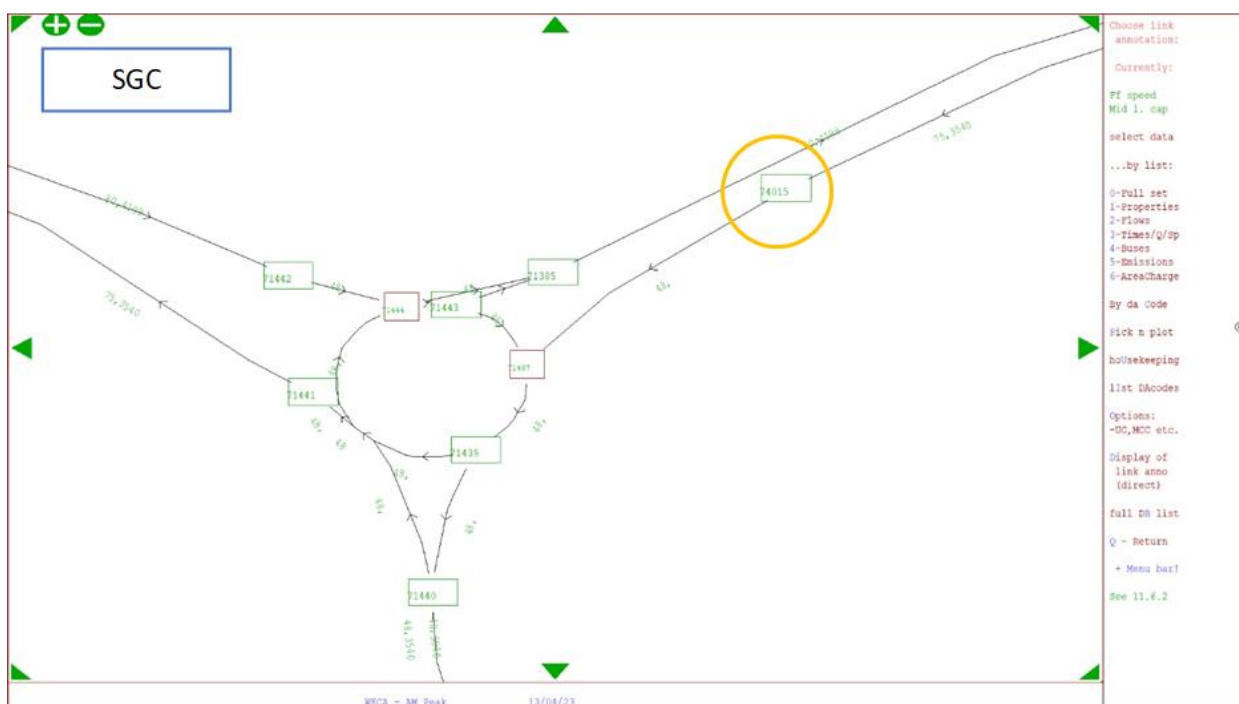
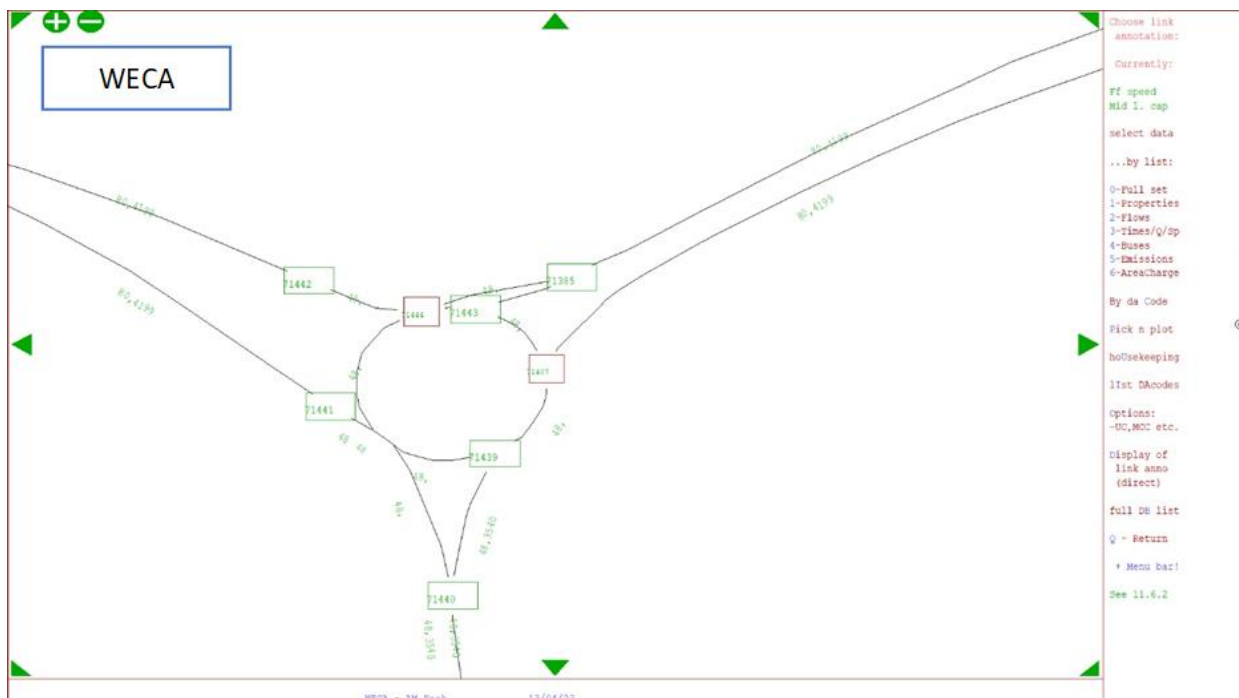
- Rosary Roundabout:** New nodes inserted on SB entry arm and speed reduced to 30mph. Signal timings are optimised for northbound direction entry arm (nodes 71361, 71356 - for PM peak only).



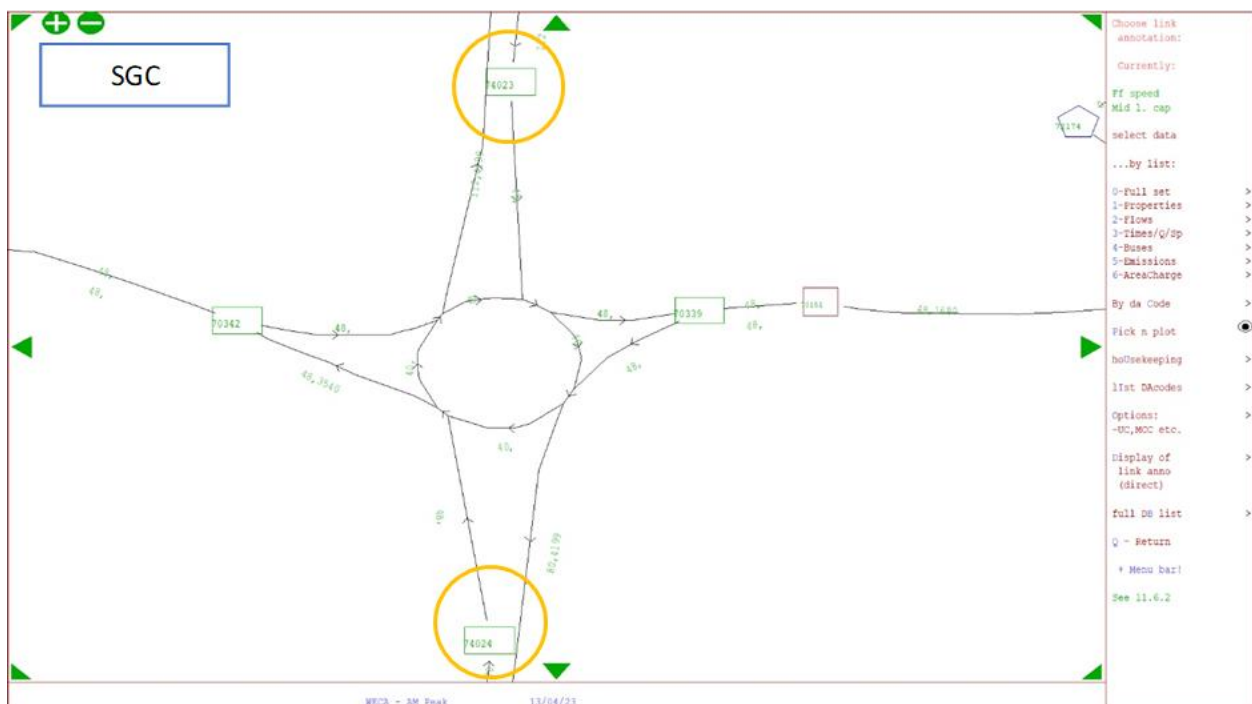
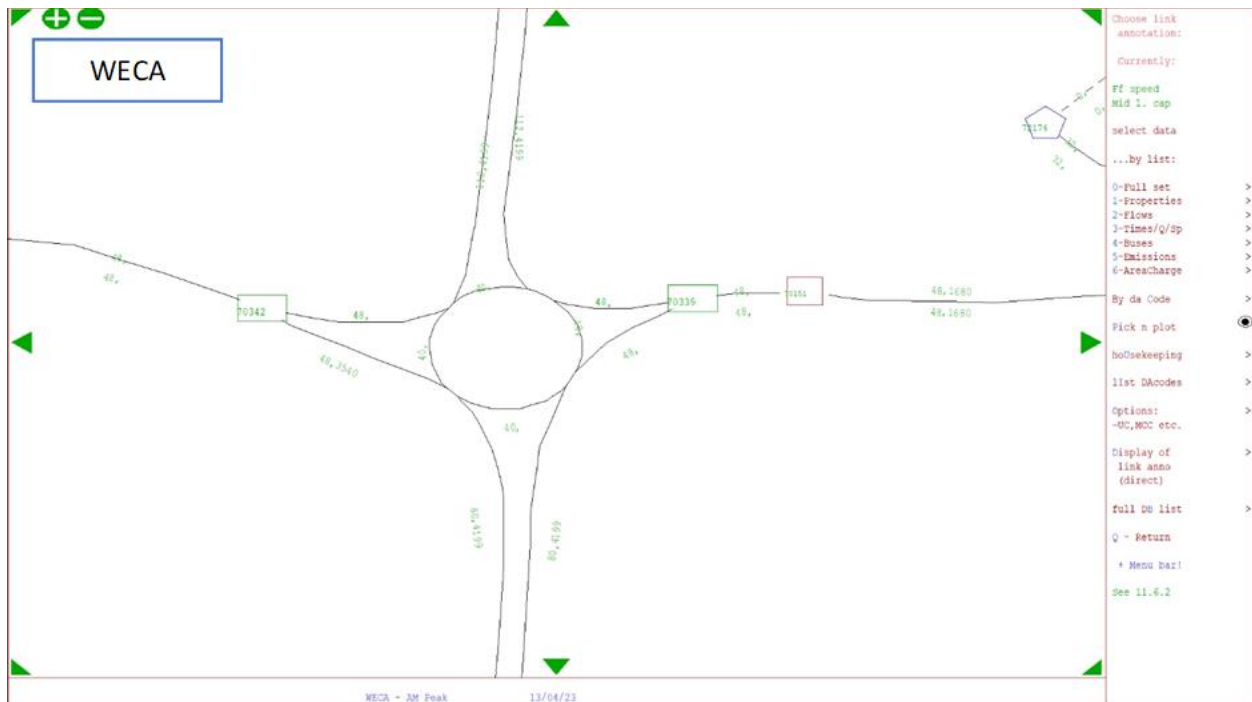
- Siston Hill Roundabout:** New nodes inserted on both entry arms of A4174 for reduced speed and pedestrian signal is coded on NB exit arm. Signal timings are optimised for northbound direction entry arm (node 71336 - for AM peak only).



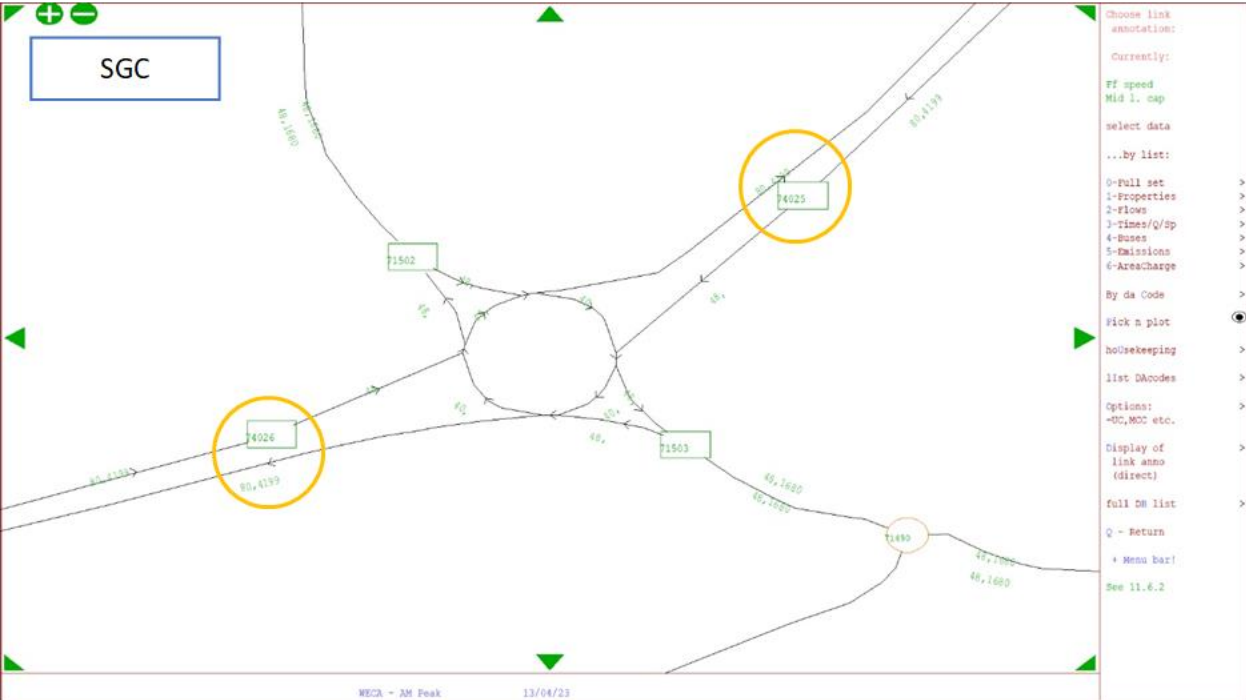
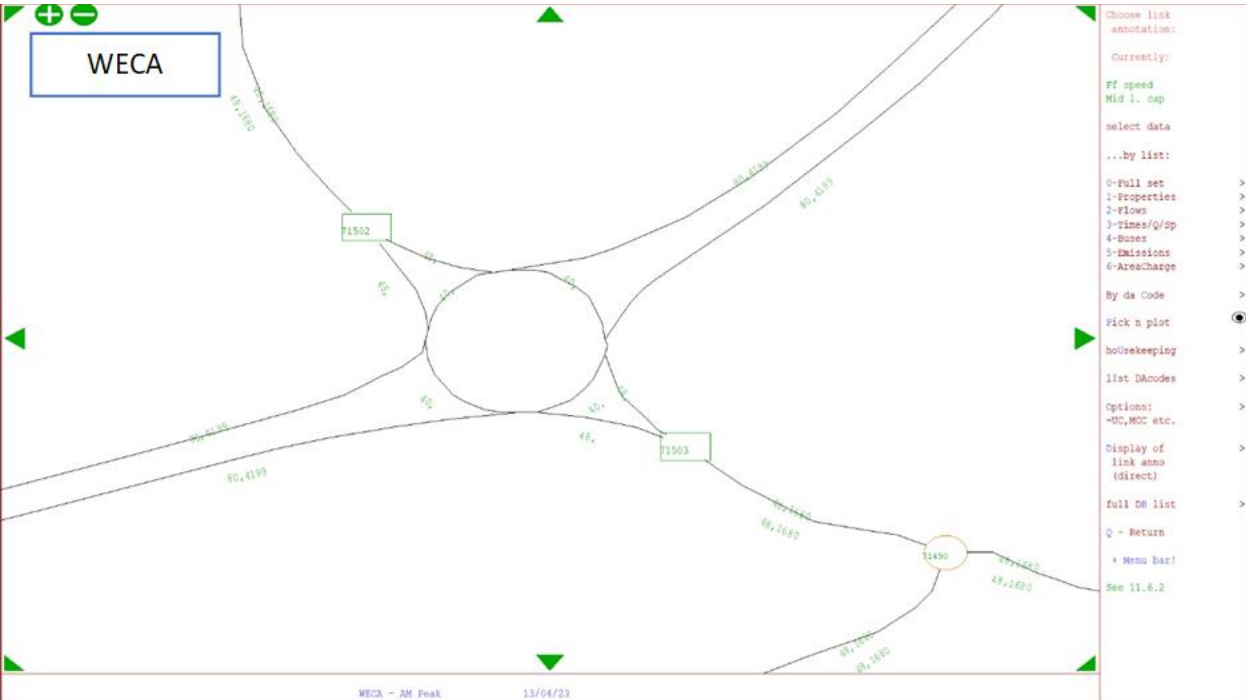
- Bromley Heath Roundabout:** New node (node 74015) inserted on westbound entry arm of A4174 for reduced speed and capacity is reduced to segregate HOV lane movement for westbound entry & exit arm. Updated signal timings for all peak periods from observed signal data received (nodes 71407, 71437, 71444).



- **Deanery Roundabout:** New nodes (node 74023, 74024) inserted on both entry arms of A4174 for reduced speed. Signal timings are optimised for northbound direction entry arm (nodes 70344, 70345) and southbound direction (node 71352).

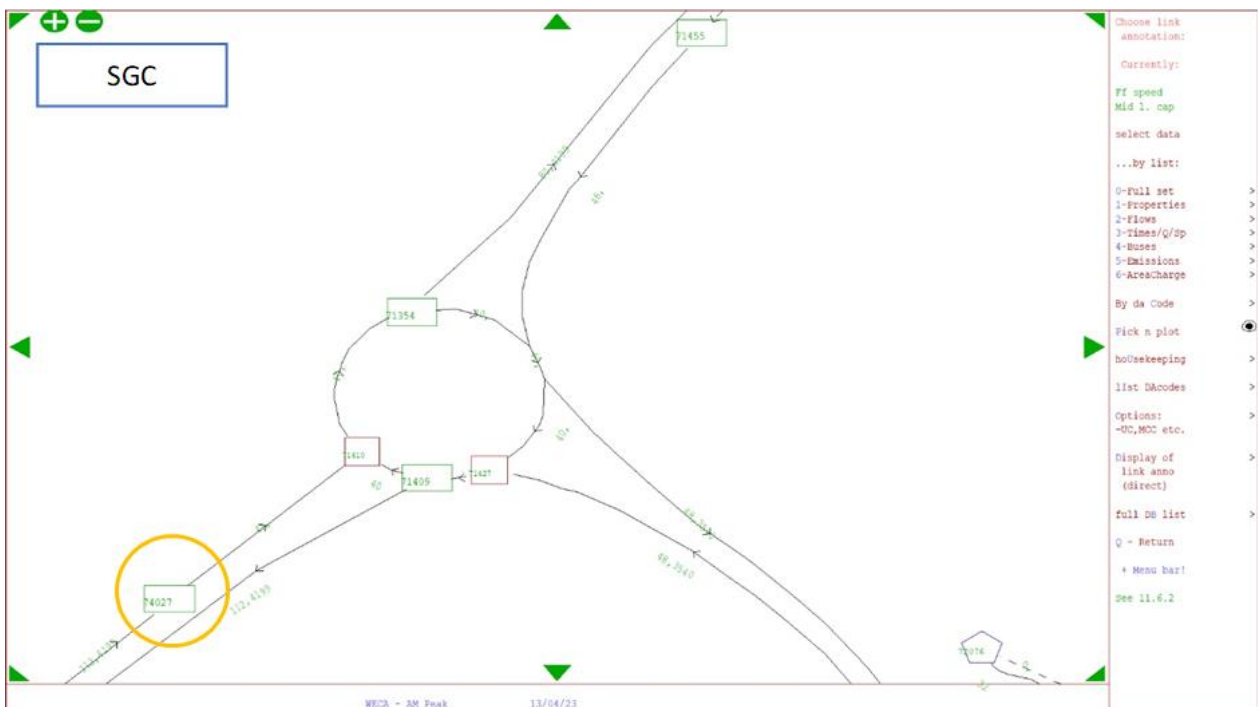
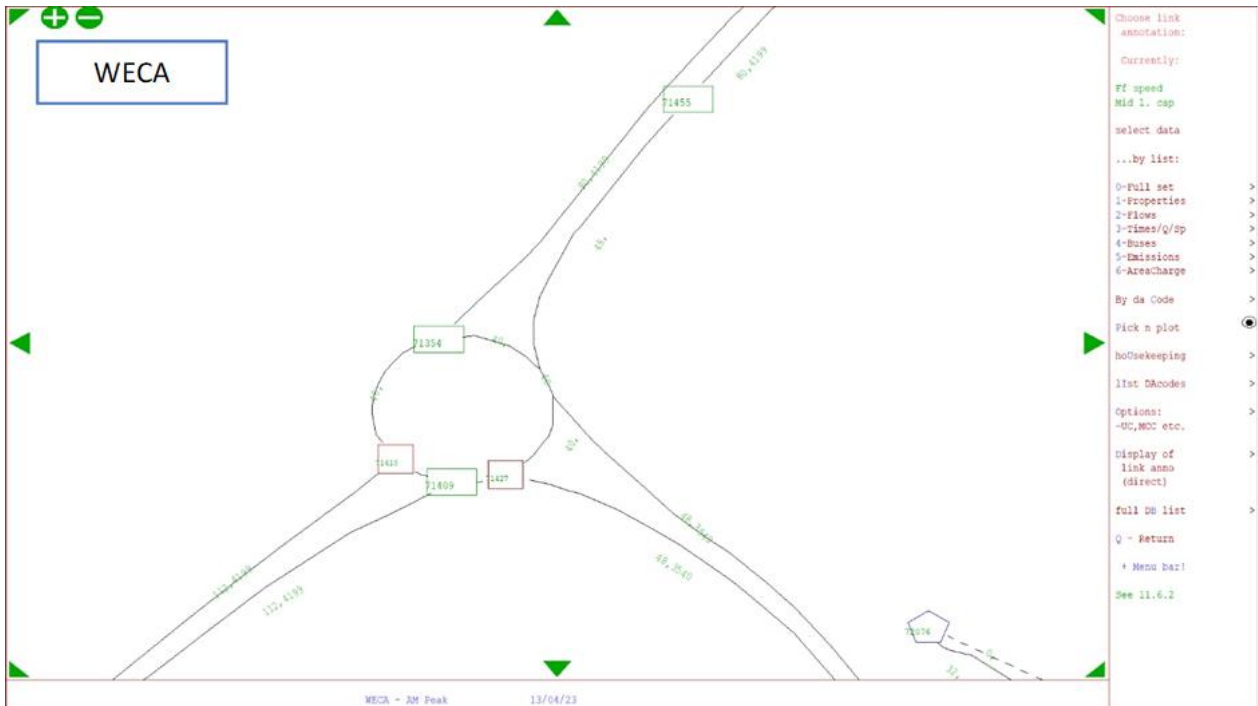


- Wraxall Road Roundabout:** New nodes (node 74025, 74026) inserted on both entry arms of A4174 for reduced speed. Signal timings are optimised for northbound direction entry arm (node 71410) and southbound direction (nodes 71351, 71427).

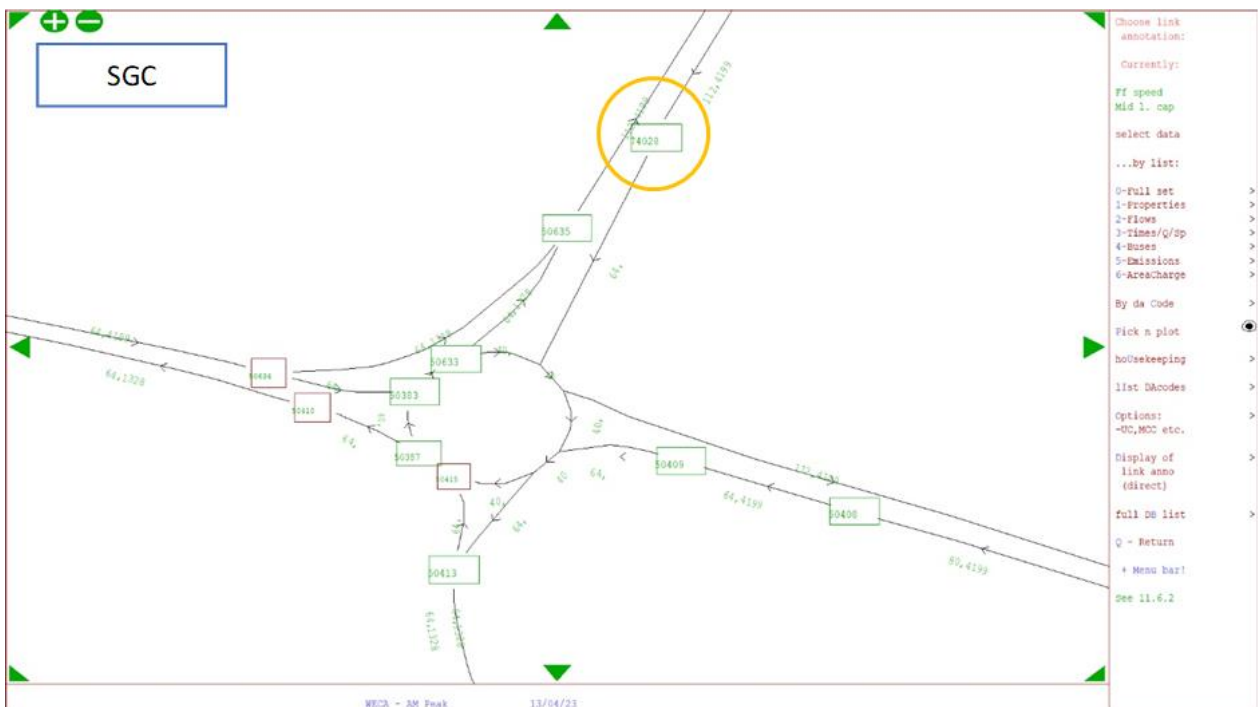
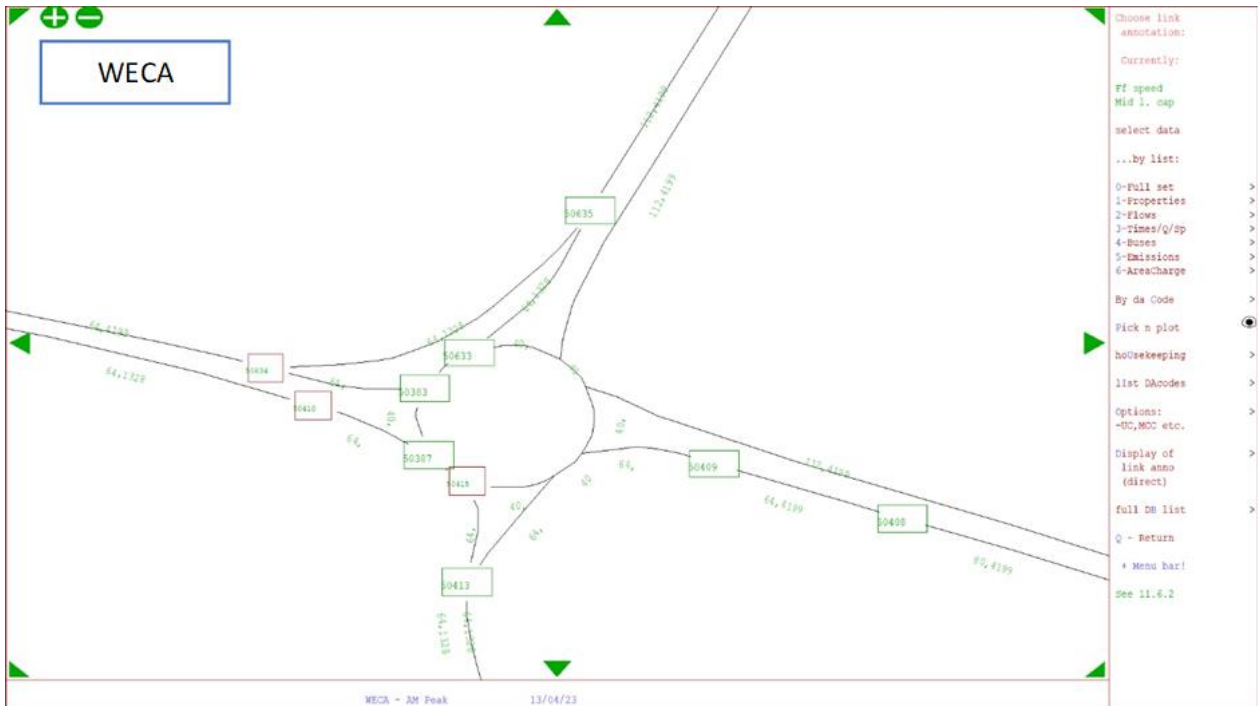




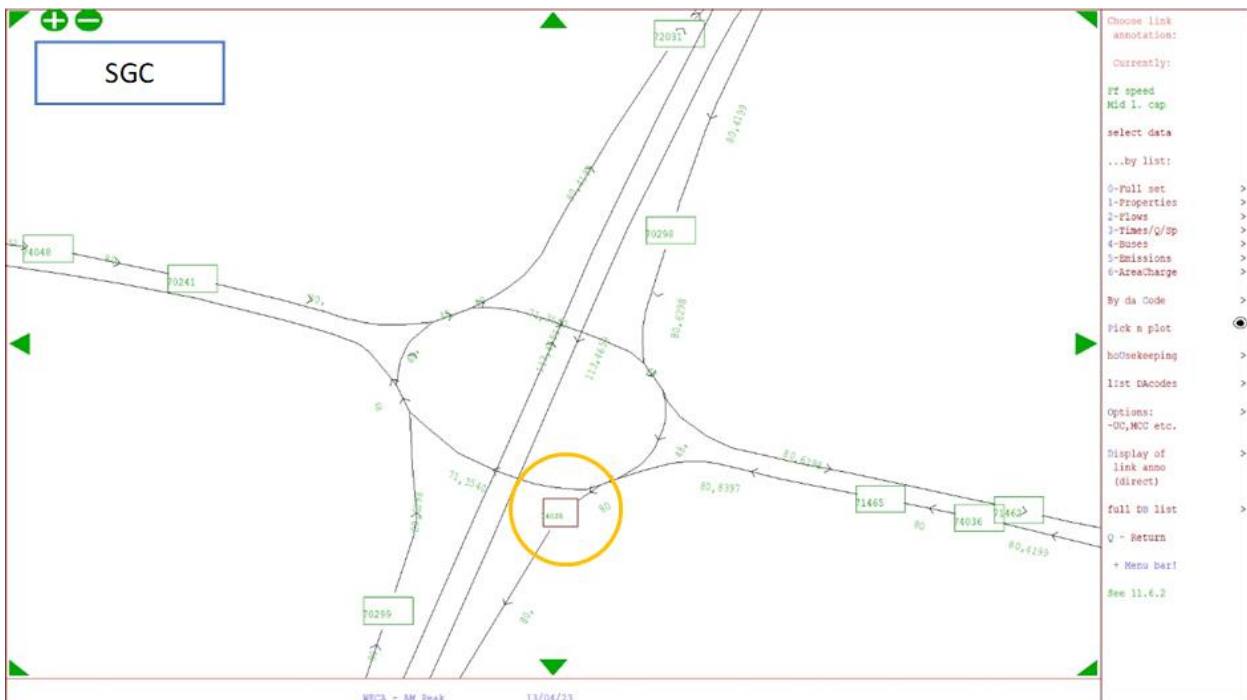
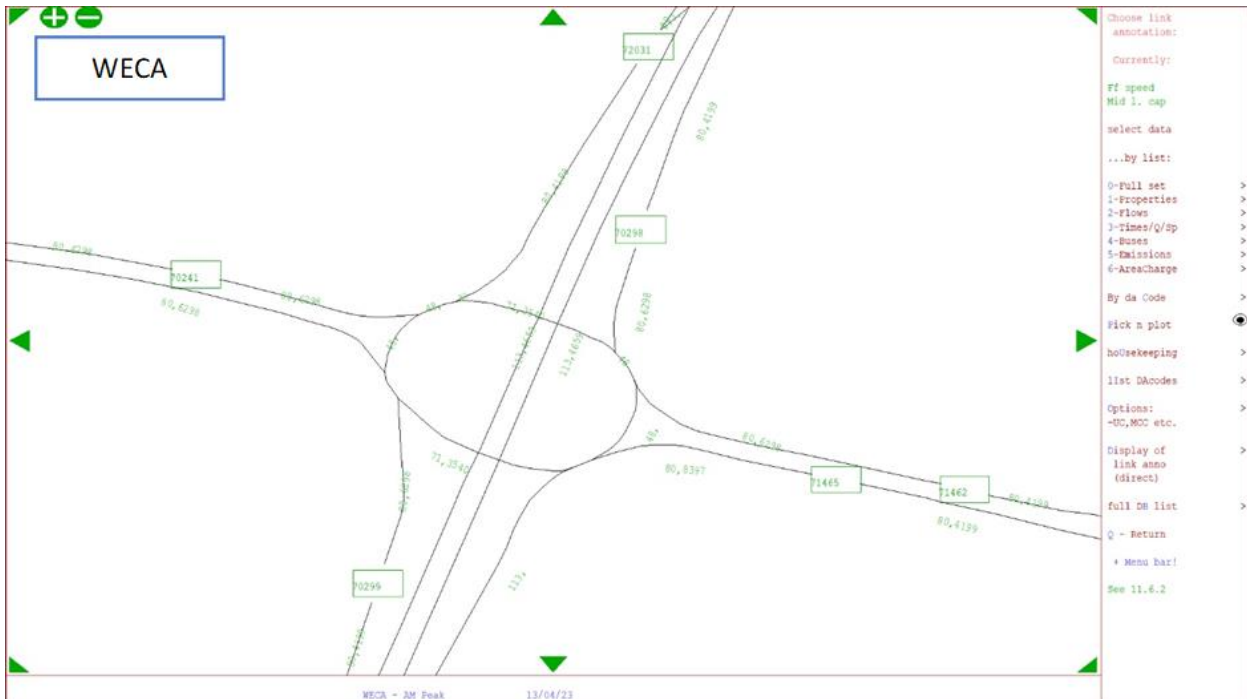
- **Marsham Way Roundabout:** New node (node 74027) inserted on northbound entry arm of A4174 for reduced speed.



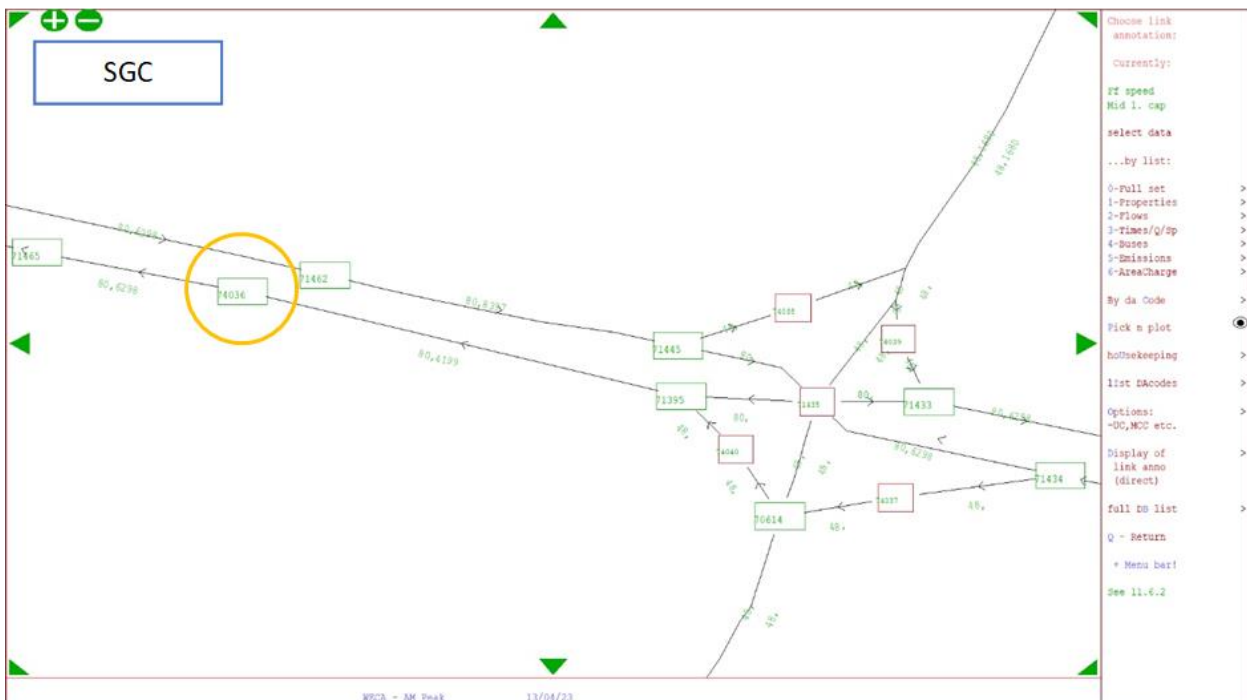
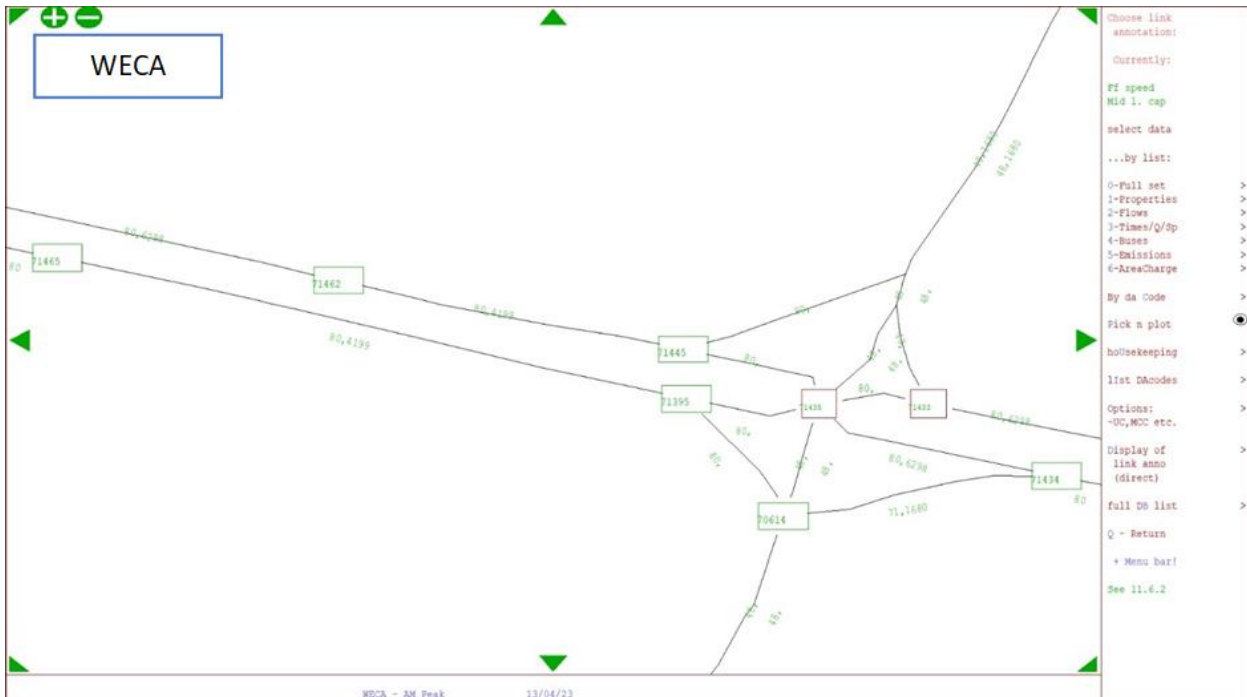
- **Hicks Gate Roundabout:** New node (node 74028) inserted on southbound entry arm of A4174 for reduced speed.



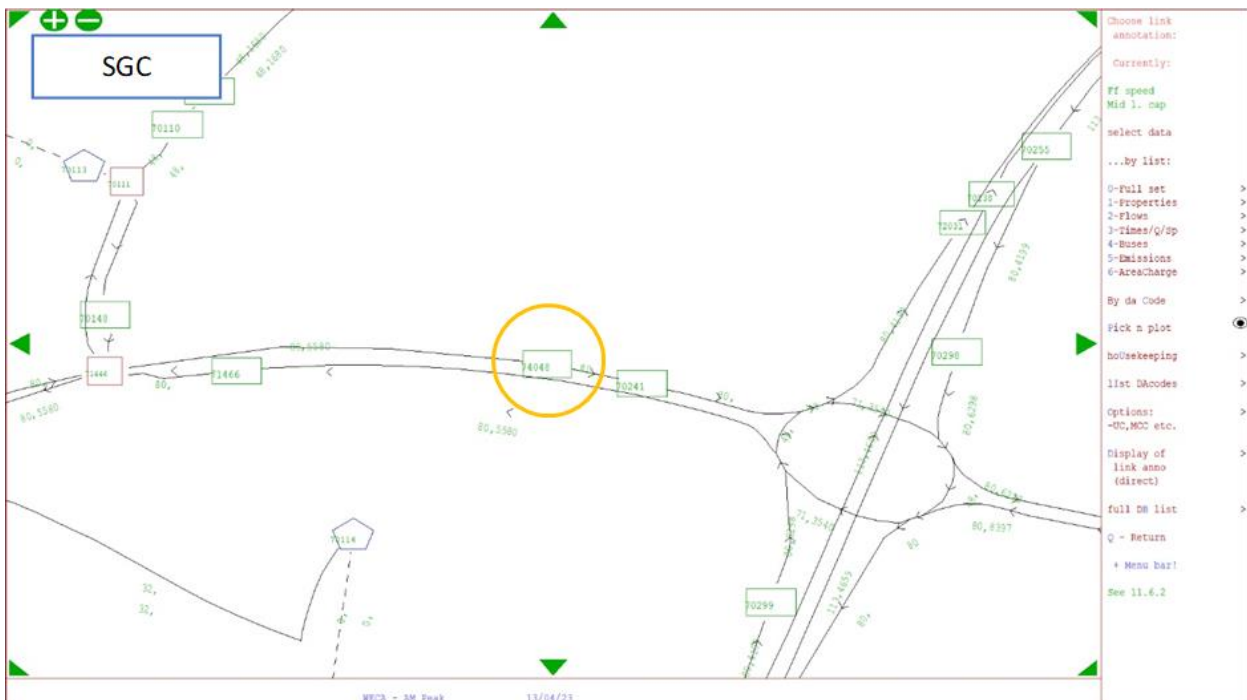
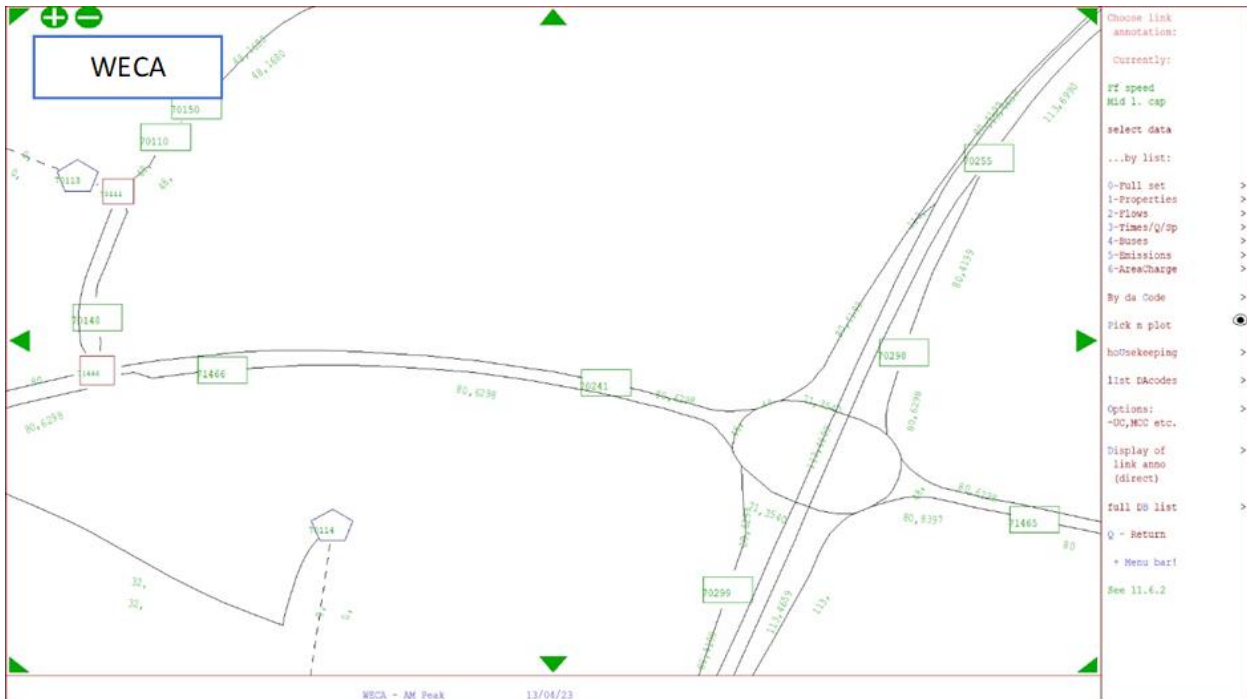
- **M32/A4174 Southbound:** New node (node 74035) inserted on southbound on-slip for pedestrian signal and speed on the slip road is reduced to 80kph.



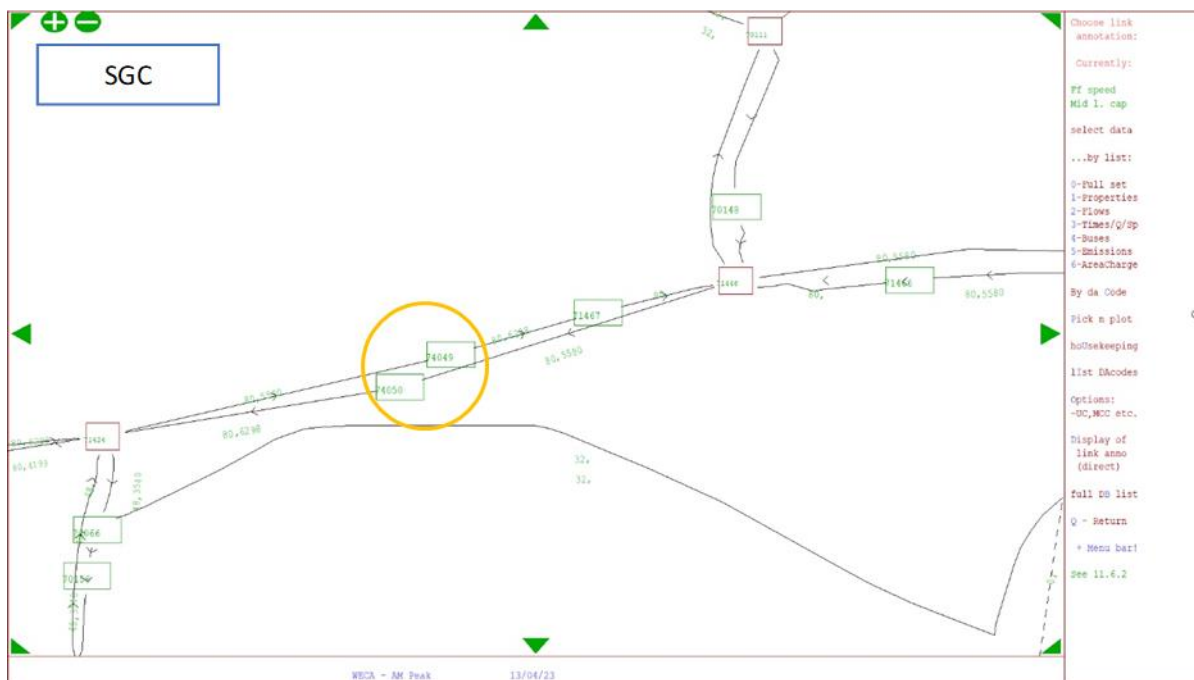
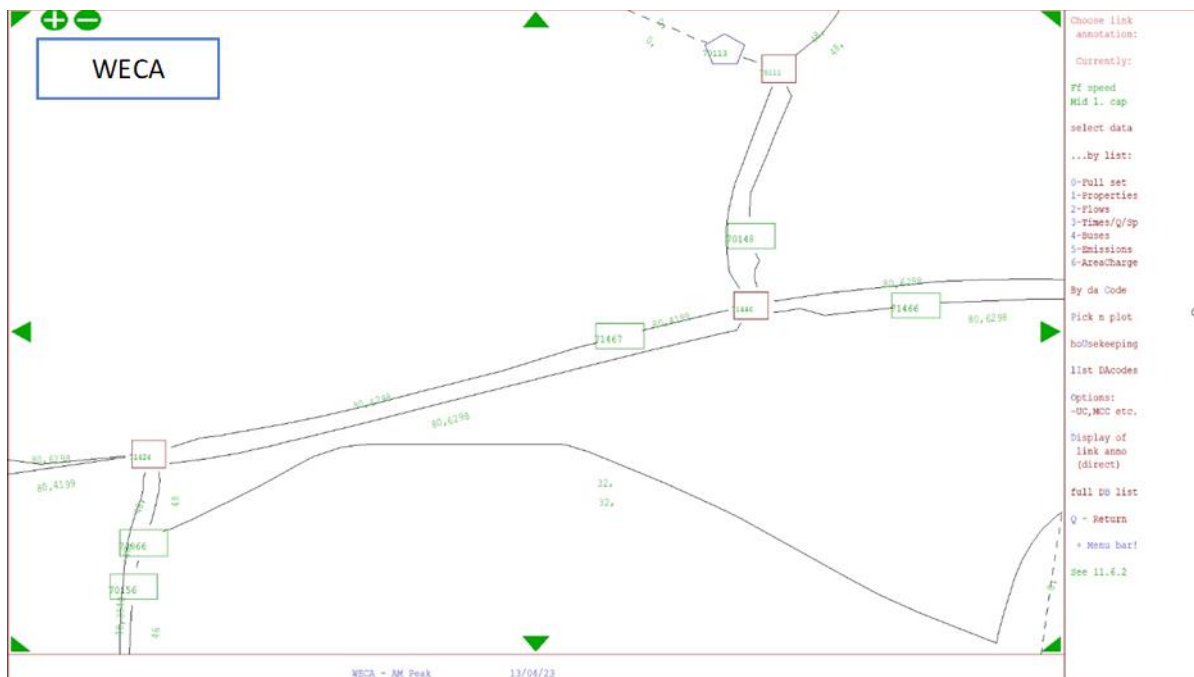
- Hambrook Cross Road:** New node (node 74036) inserted on westbound exit arm of A4174 for bus lane, inserted new nodes (node 74037, 74038, 74040) for two arm signals, inserted new node (node 74039) for southbound left turn movement, and converted nodes (node 71433, 70621) from signalised to priority junction i.e., all left turns at the junction are made to traverse via two arm signals.



- **A4174 Ring Road Path:** New node (node 74048) inserted on eastbound direction (on link 71446-70241) for segregating HOV lane movement with reduced capacity.



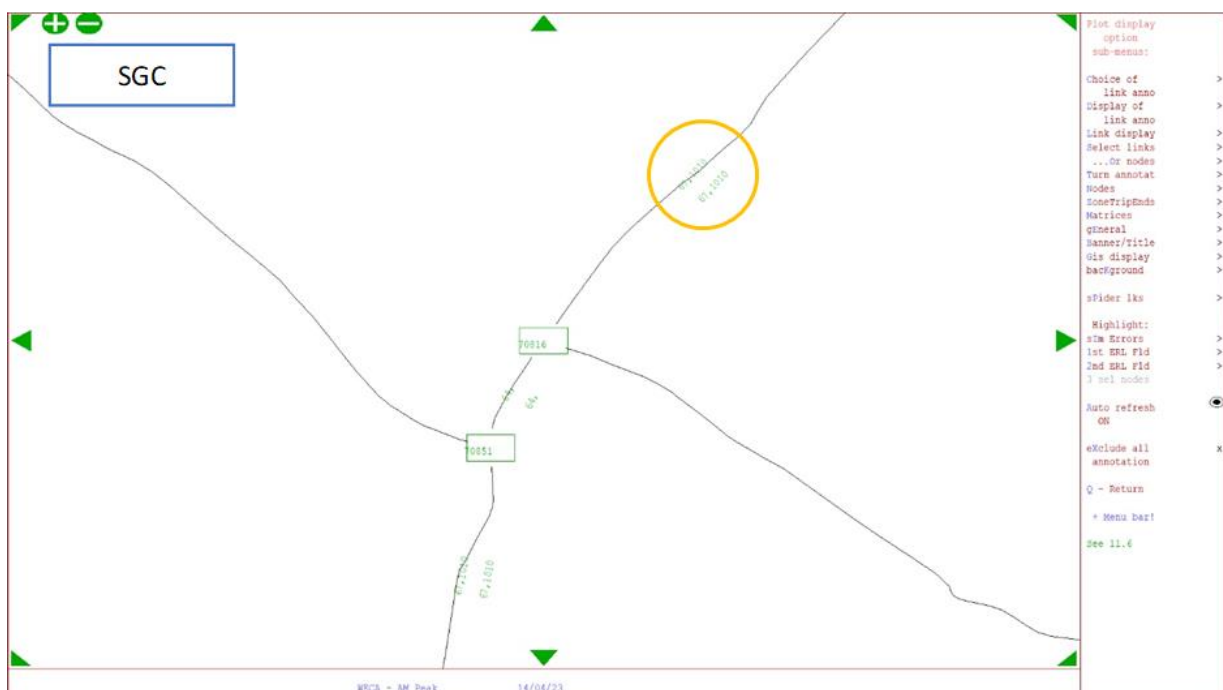
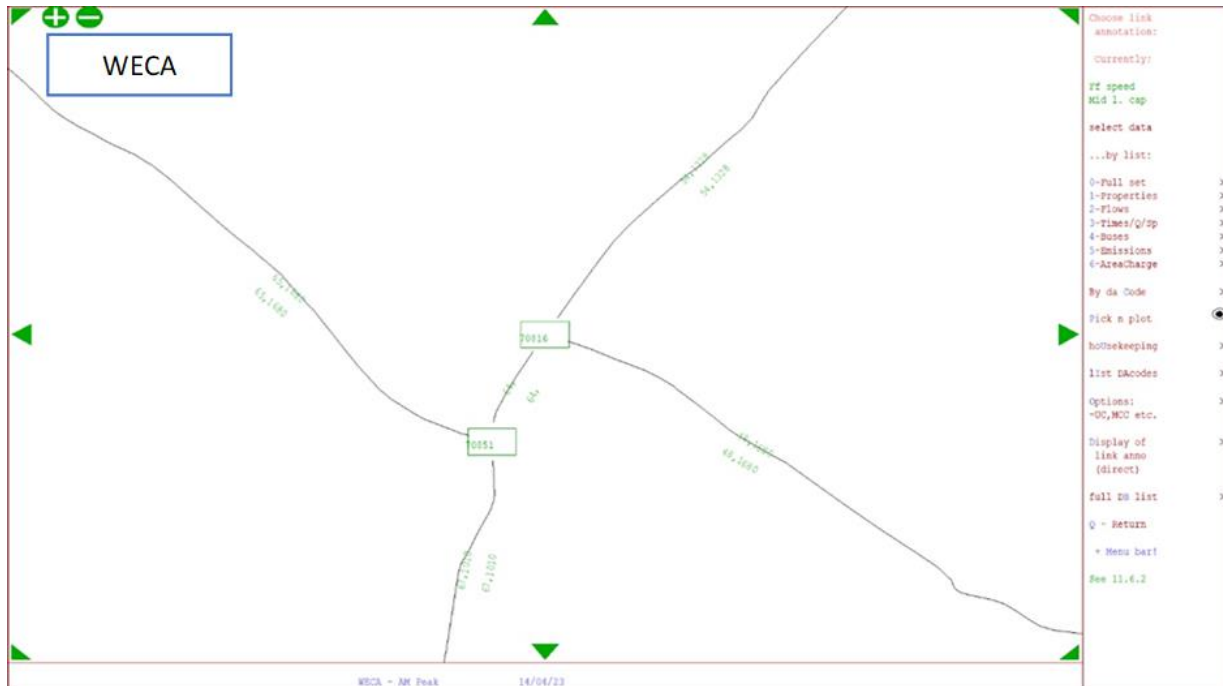
- A4174 Ring Road Path:** New node (node 74049) inserted on eastbound direction (between link 71424-71467) and (node 74050) on westbound direction (between link 71446-71424) for segregating HOV lane movement with reduced capacity.



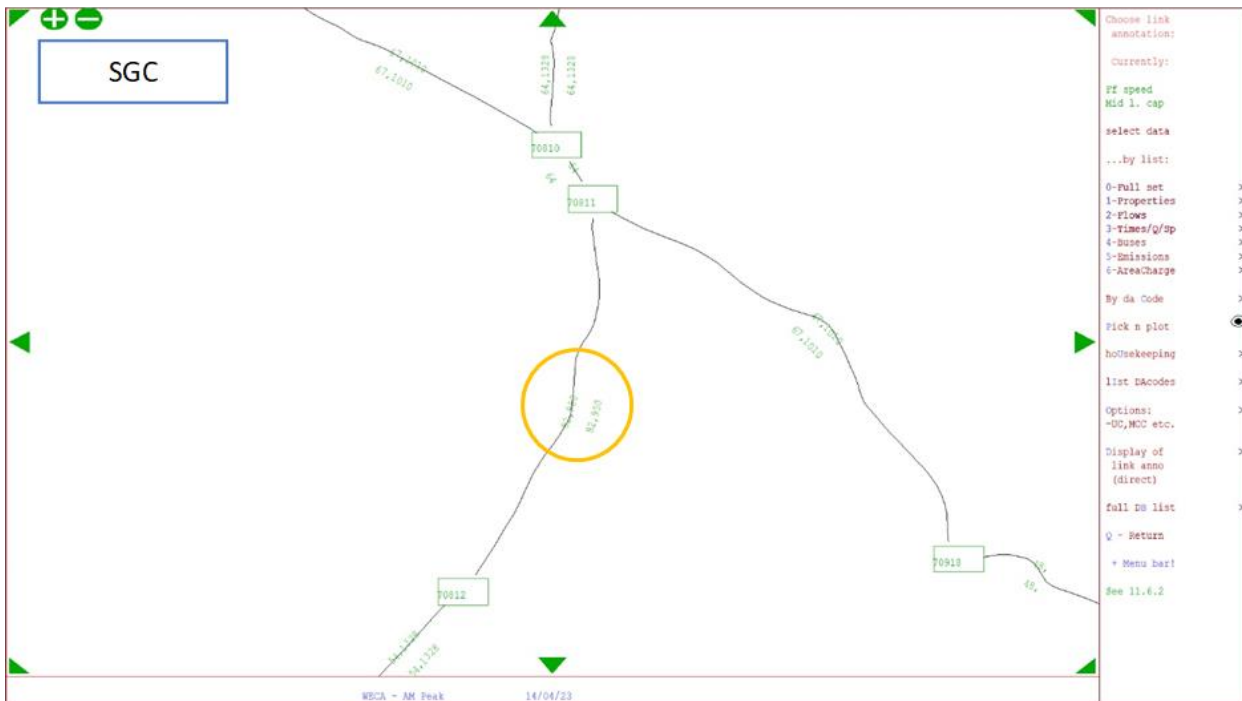
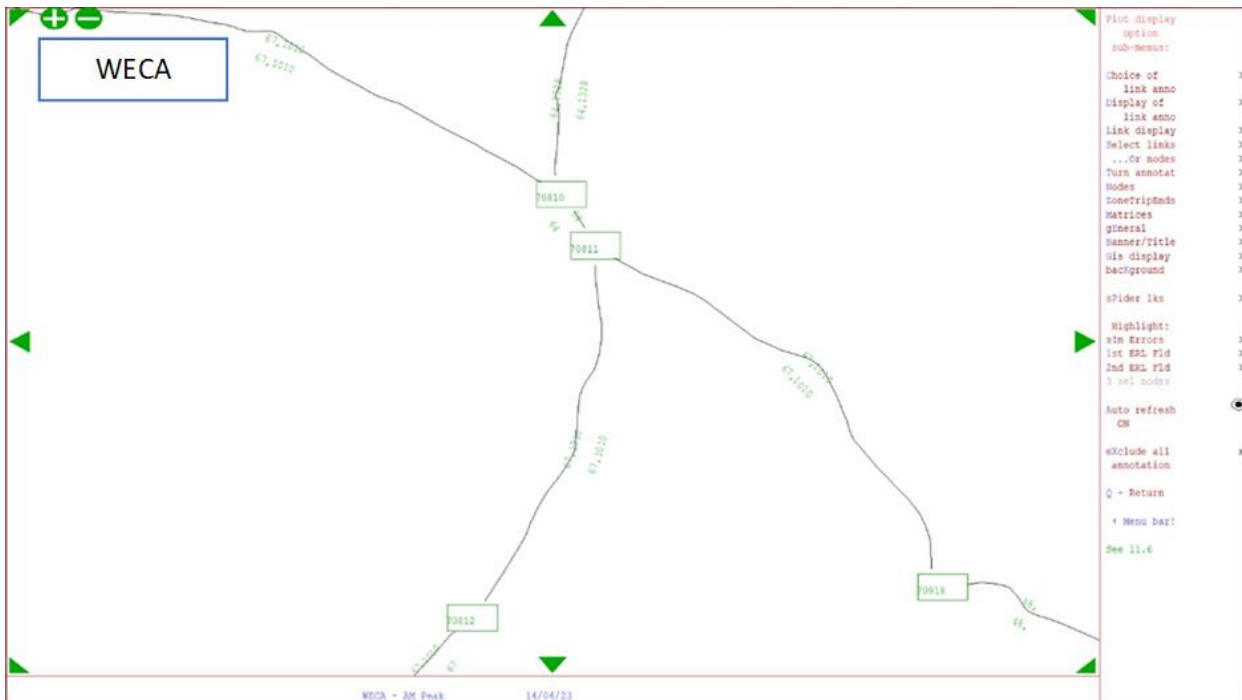
### 1.2.3. Network Updates in terms of SFC & Speed limit

This section presents the updates carried out in terms of speed flow curves and speed limits. The majority of these updates include change in SFC on the local roads with national speed limit but provided with higher capacities, capacities of such roads have been reduced. The SFCs that are now assigned are taken from WERTM network coding manual and no new SFCs have been created.

- **B4427 Old Gloucester Road/ Swan Lane:** Updated capacity index from 19 to 18 for both direction (70816-70812), from 52 to 51 for both direction (70816-70244).

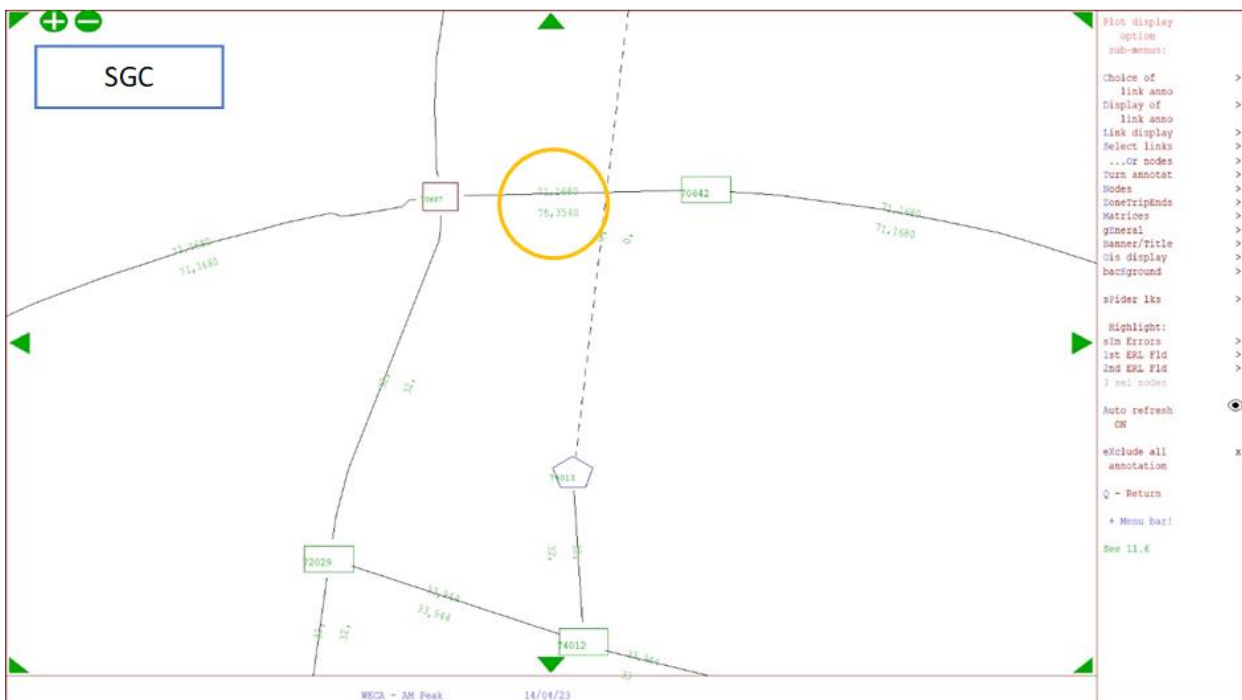
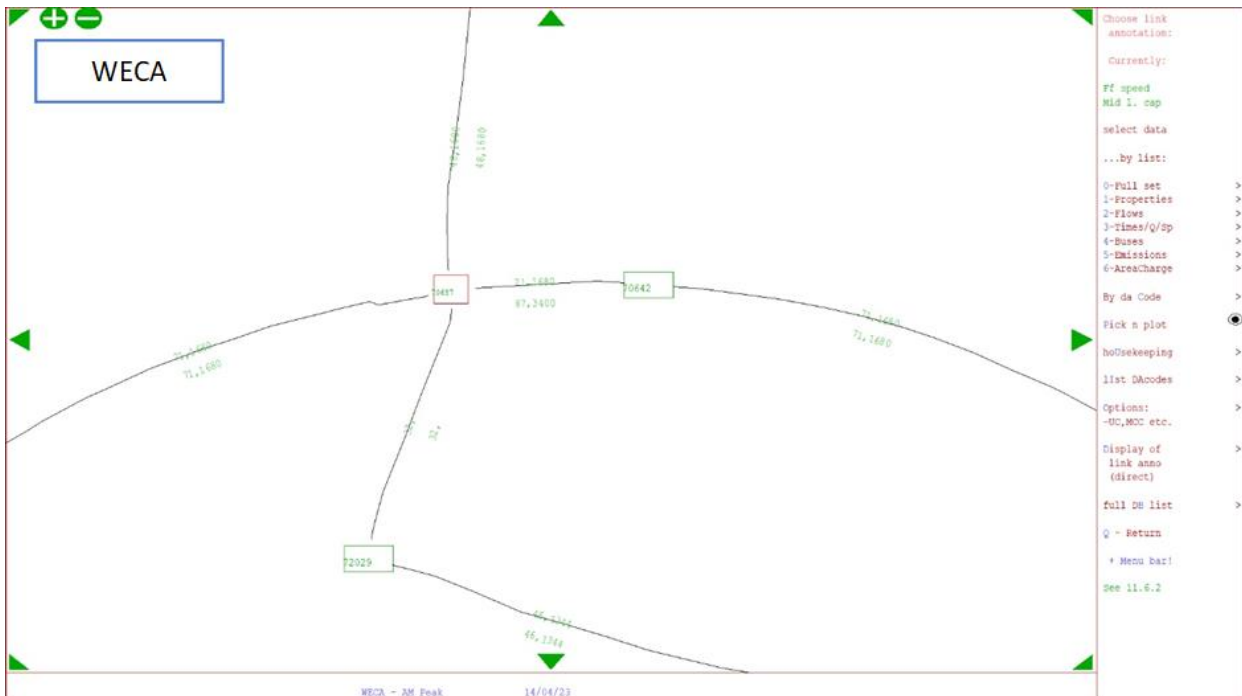


- **B4427 Old Gloucester Road:** Updated capacity index from 19 to 18 for both direction (70811-70812).

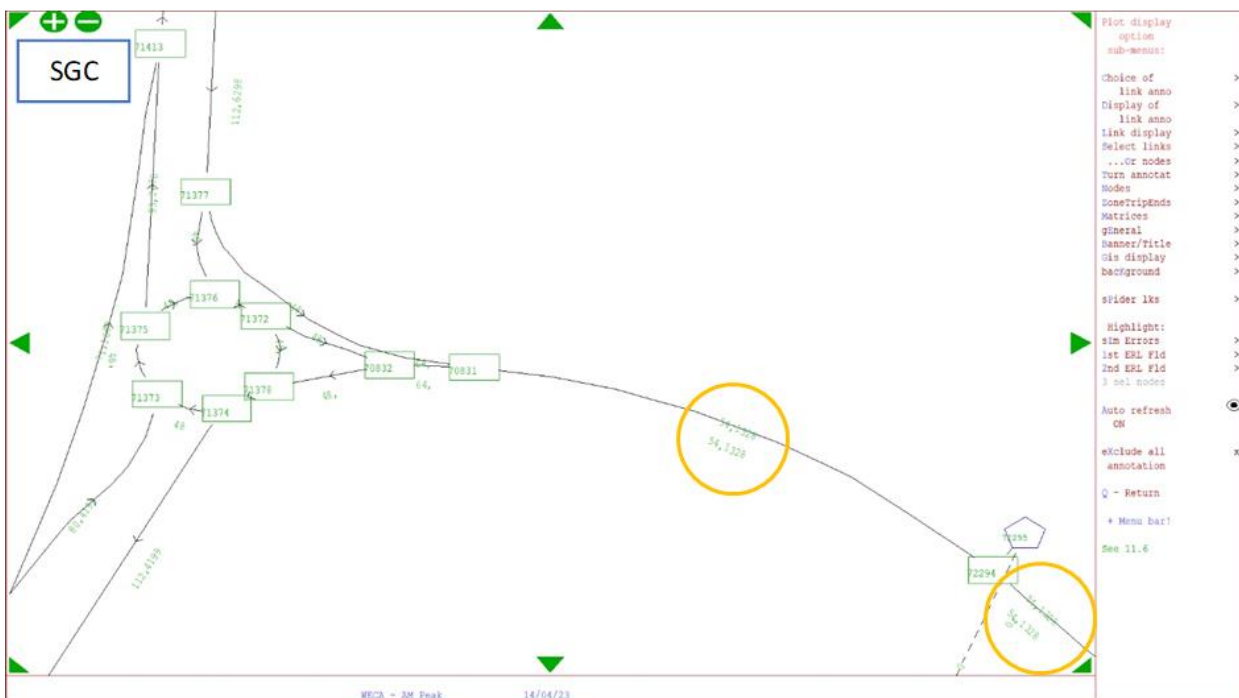
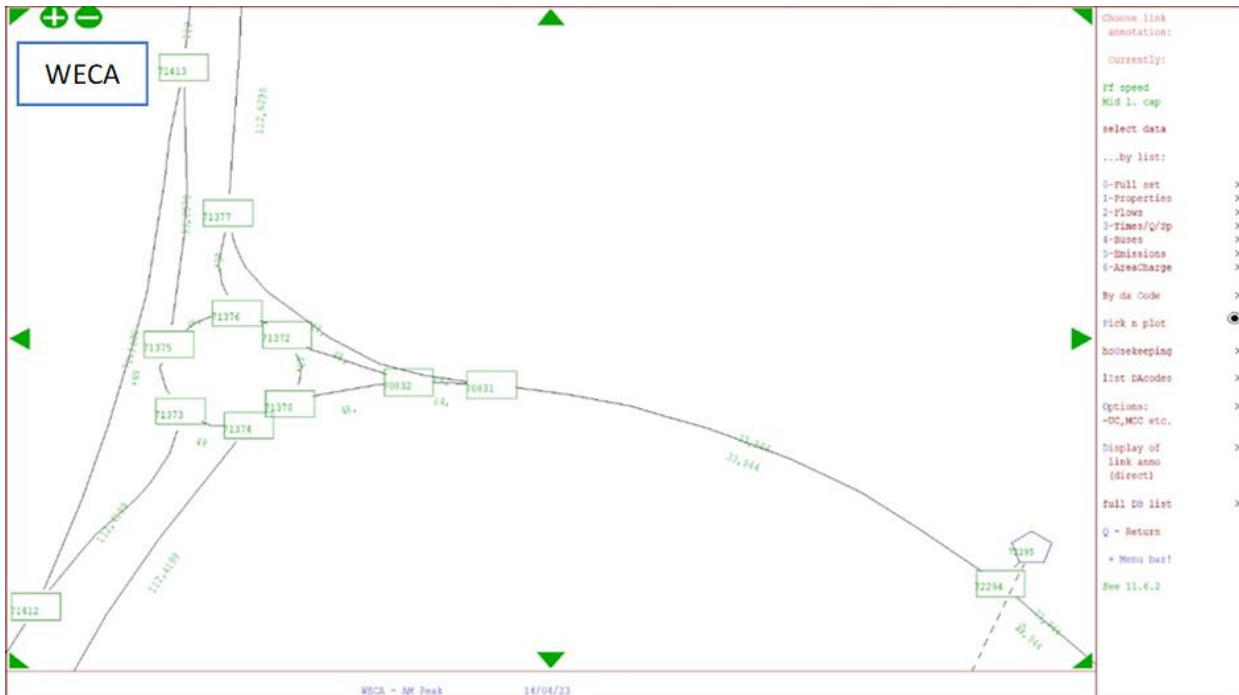




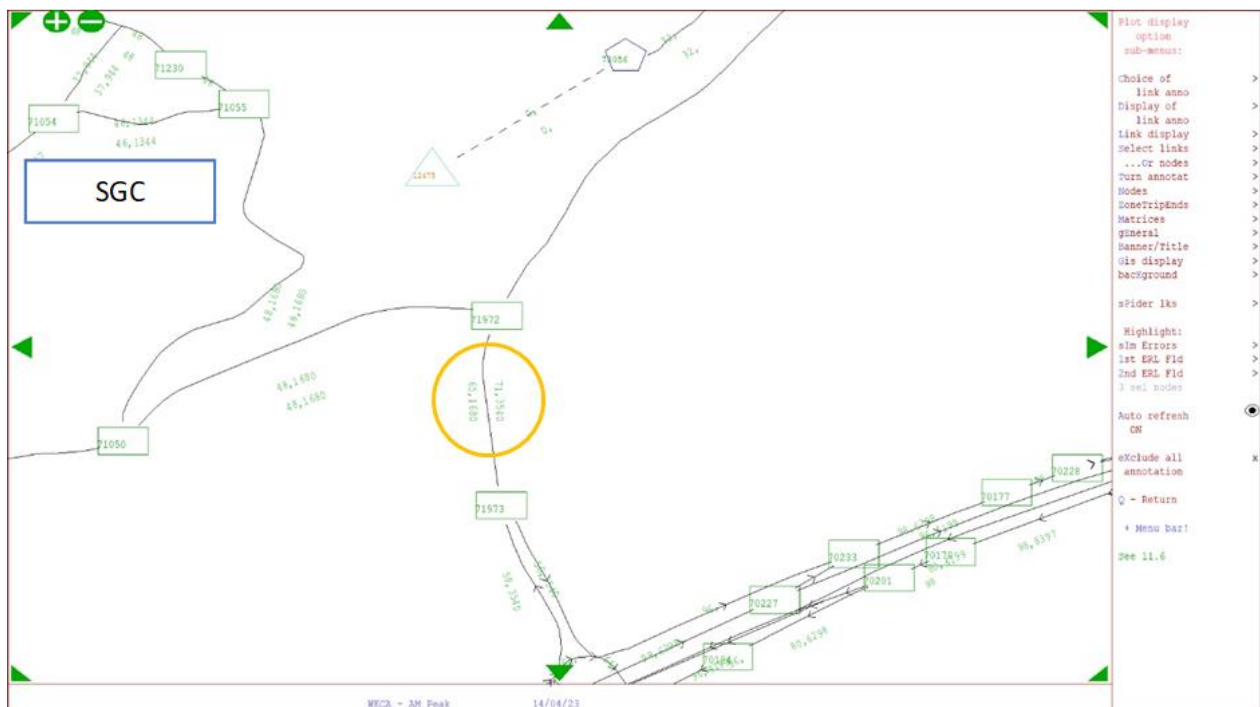
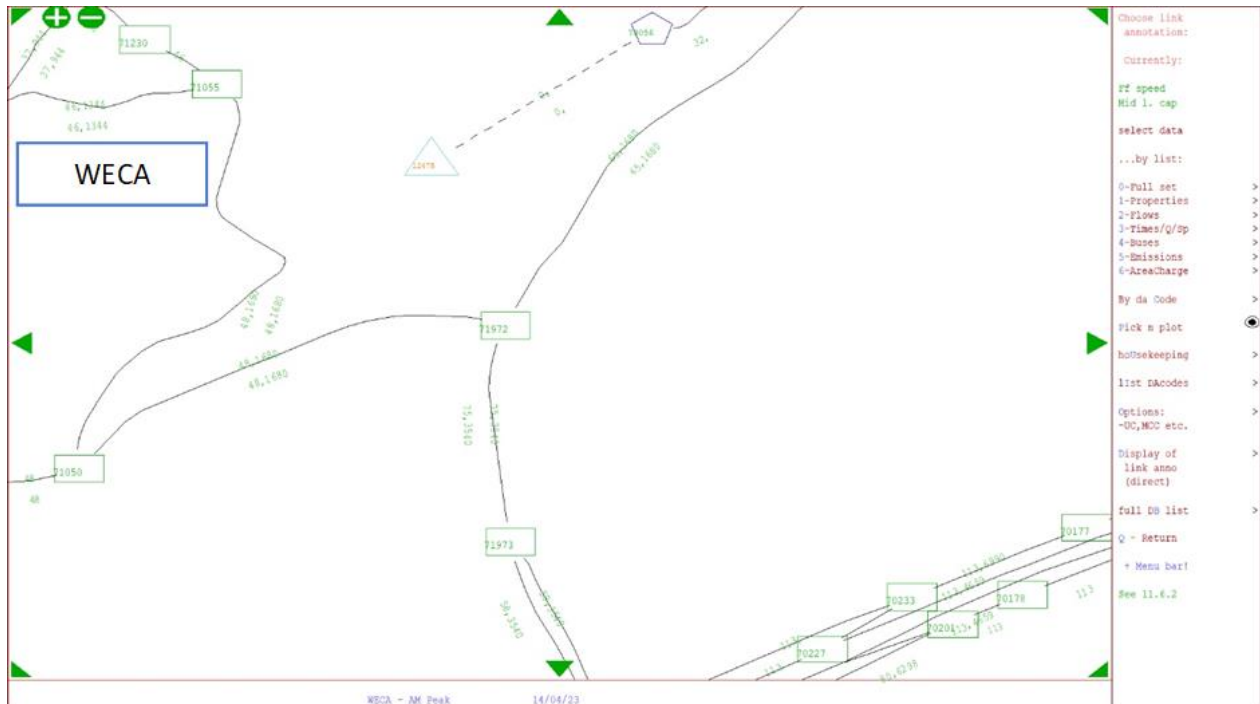
- **B4058/ Bristol Road:** Updated capacity index from 50 to 24 for westbound direction (70642-70687).



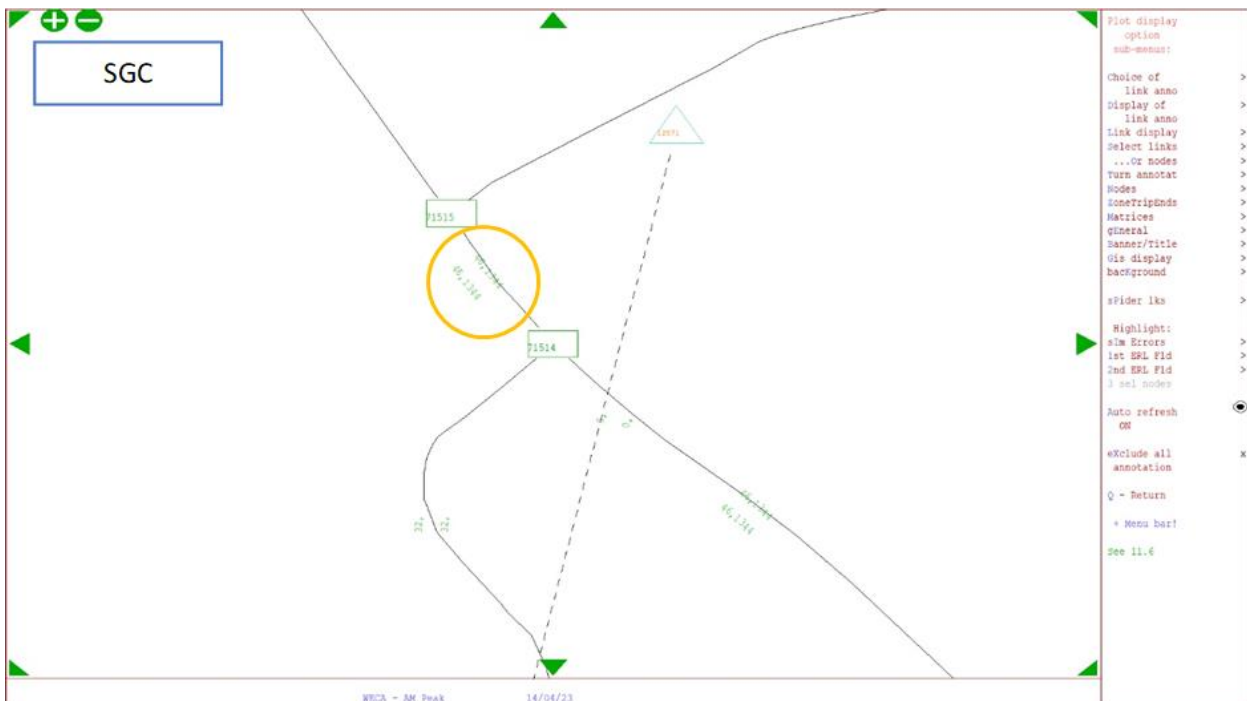
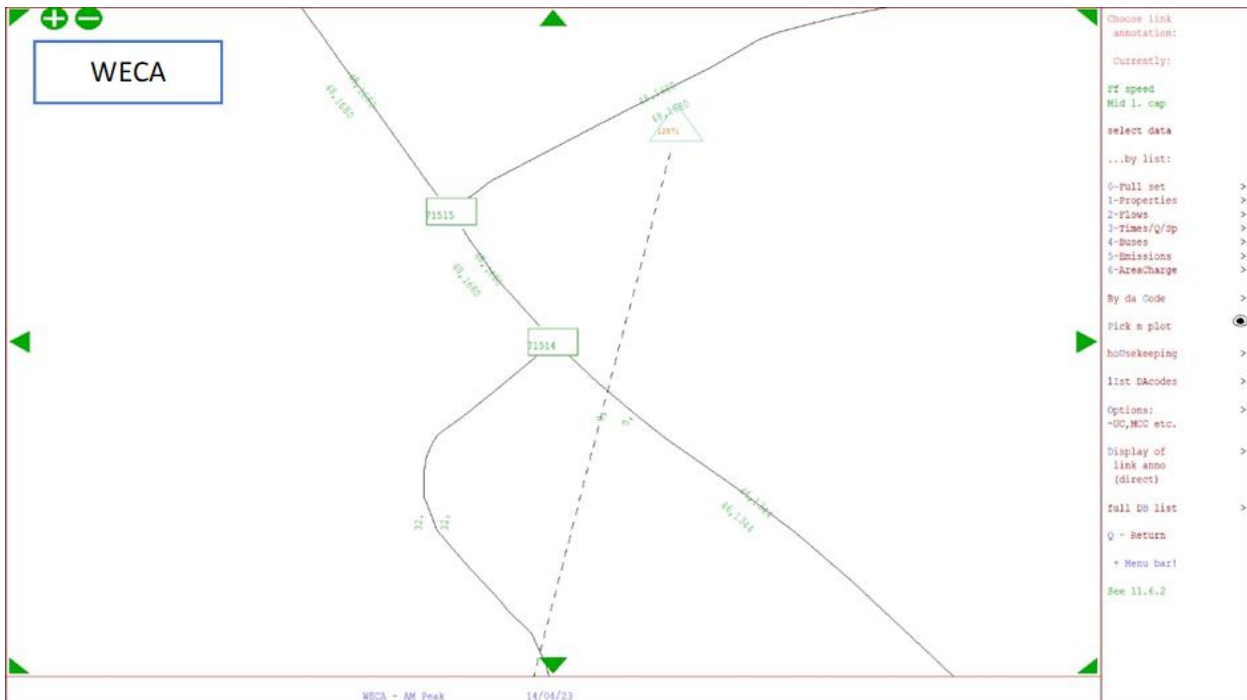
- **B4465 (East of A4174 – Dramway Roundabout):** Updated capacity index from 39 to 19 for both direction (70831-72294-70830).



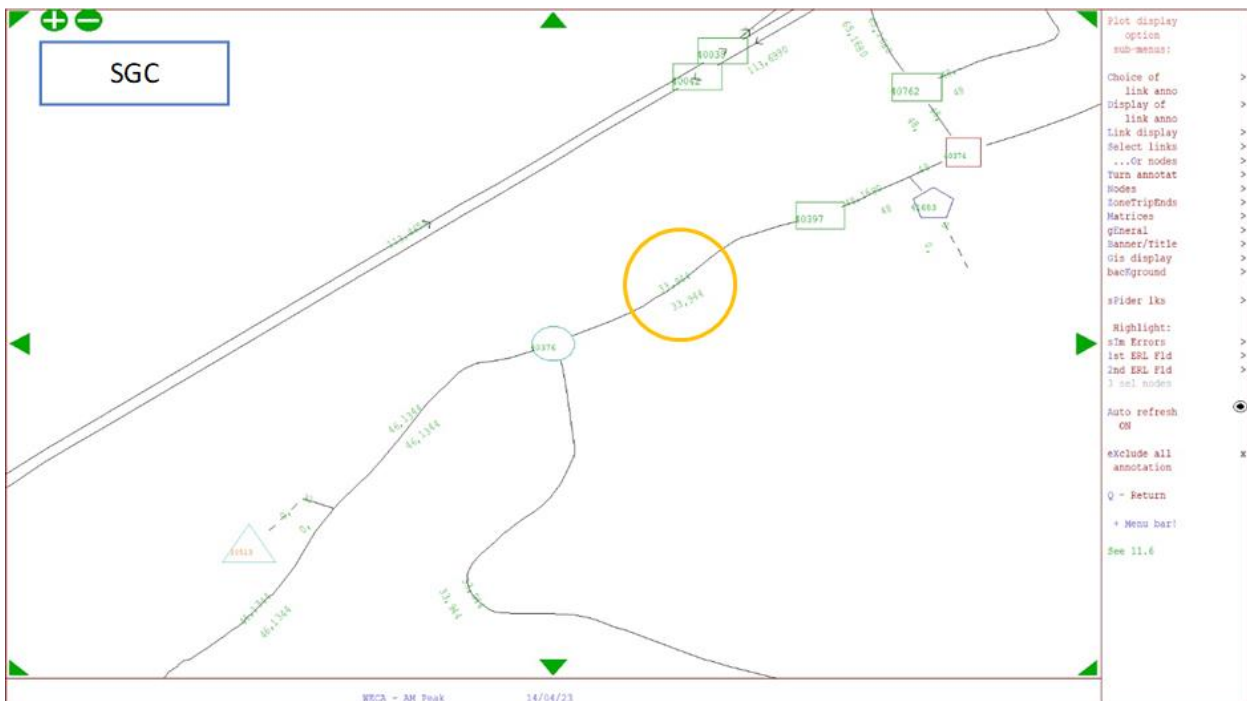
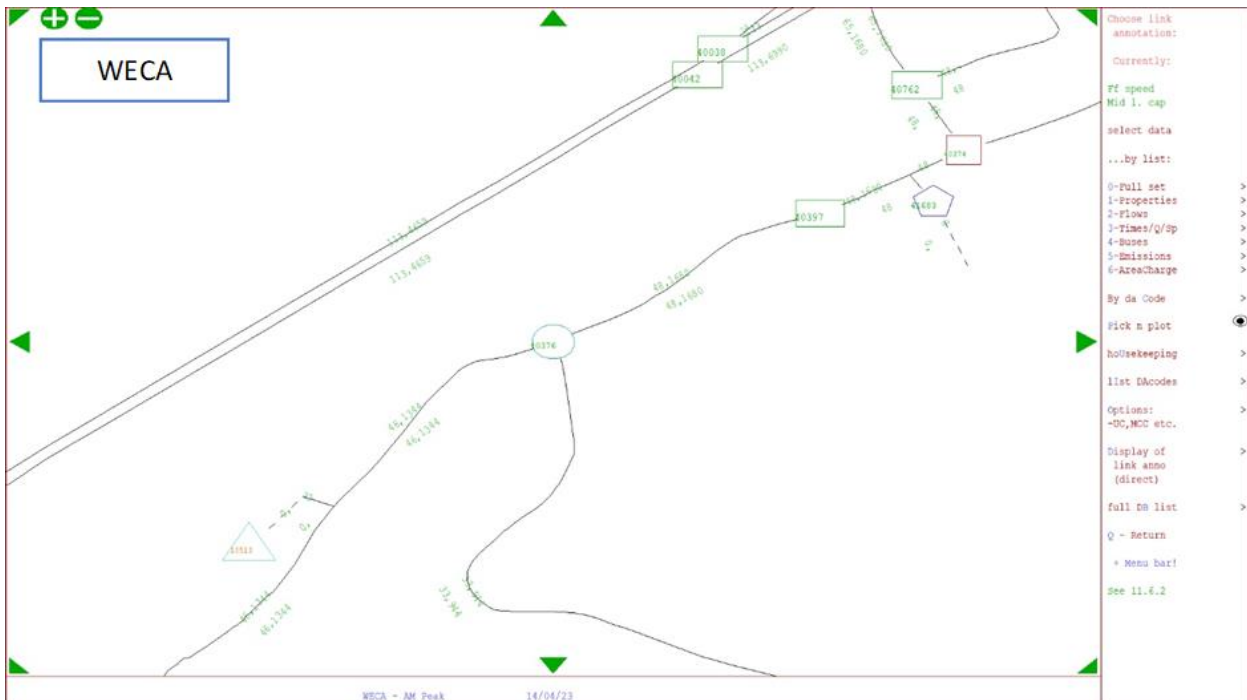
- **Gloucester Road/ Over Lane:** Updated capacity index from 24 to 31 for northbound direction (71973-71972), and from 24 to 25 for southbound direction (71972-71973).



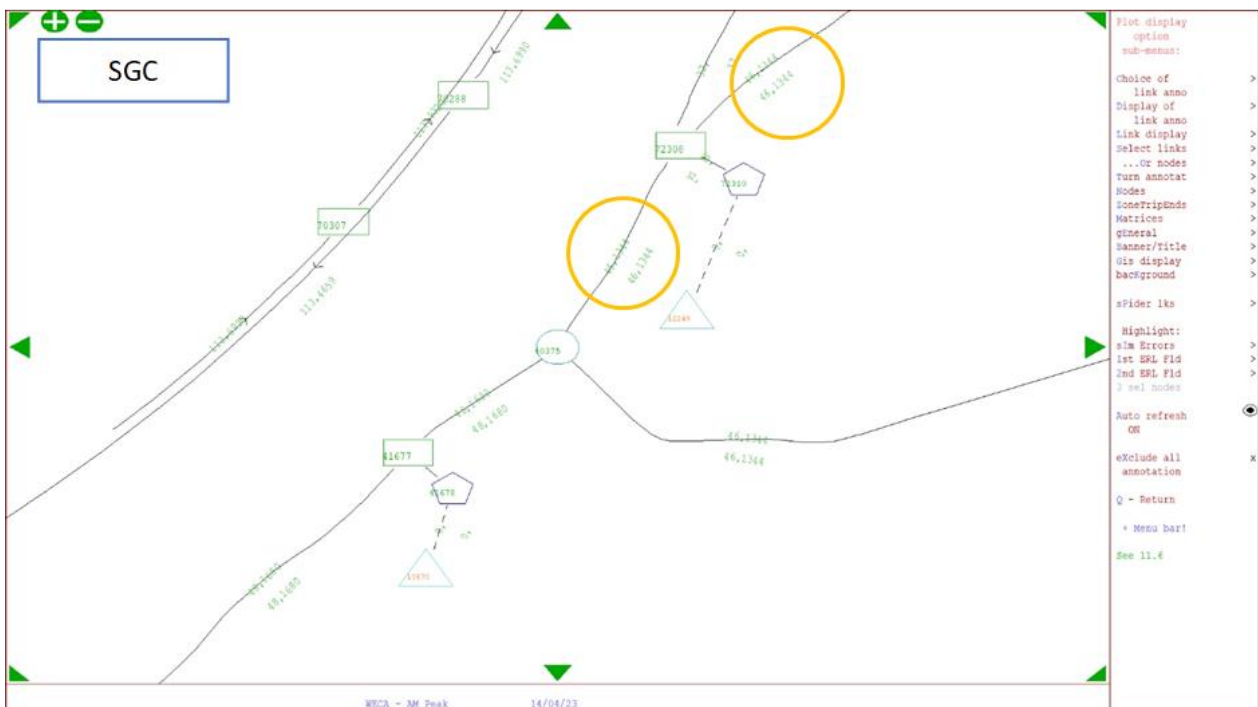
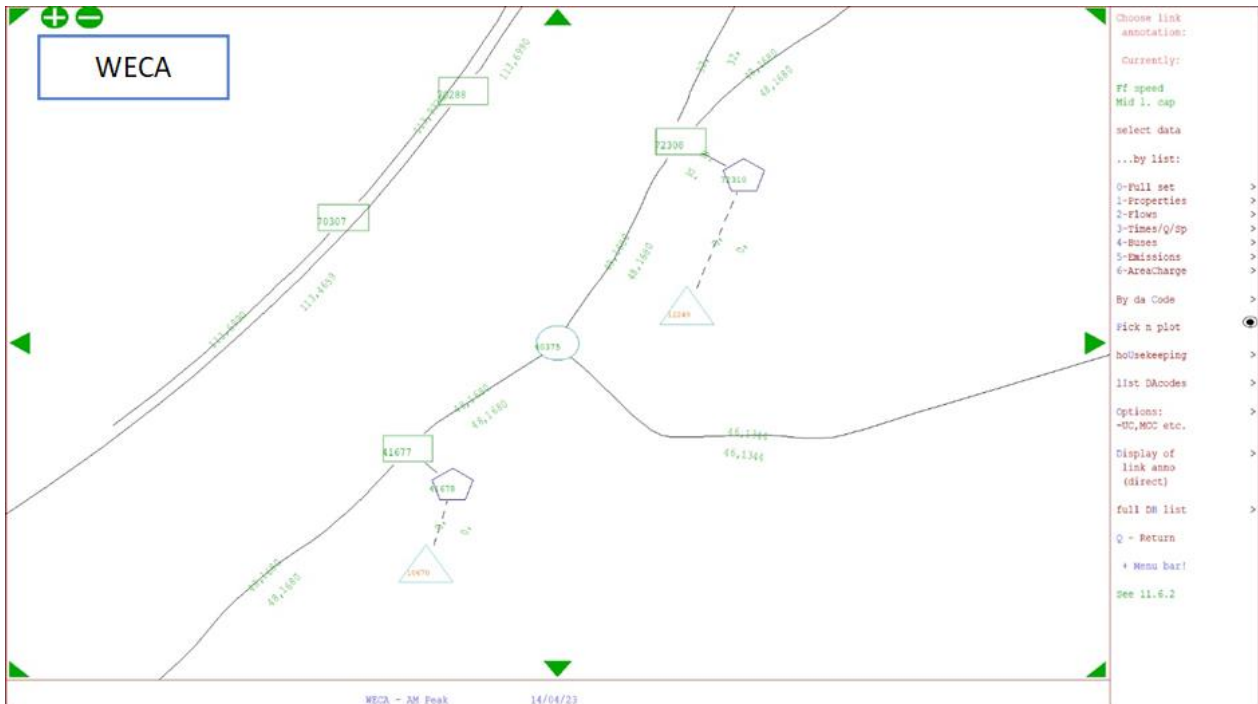
- **Abbots Road:** Updated capacity index from 34 to 43 for both direction (71514-71515).



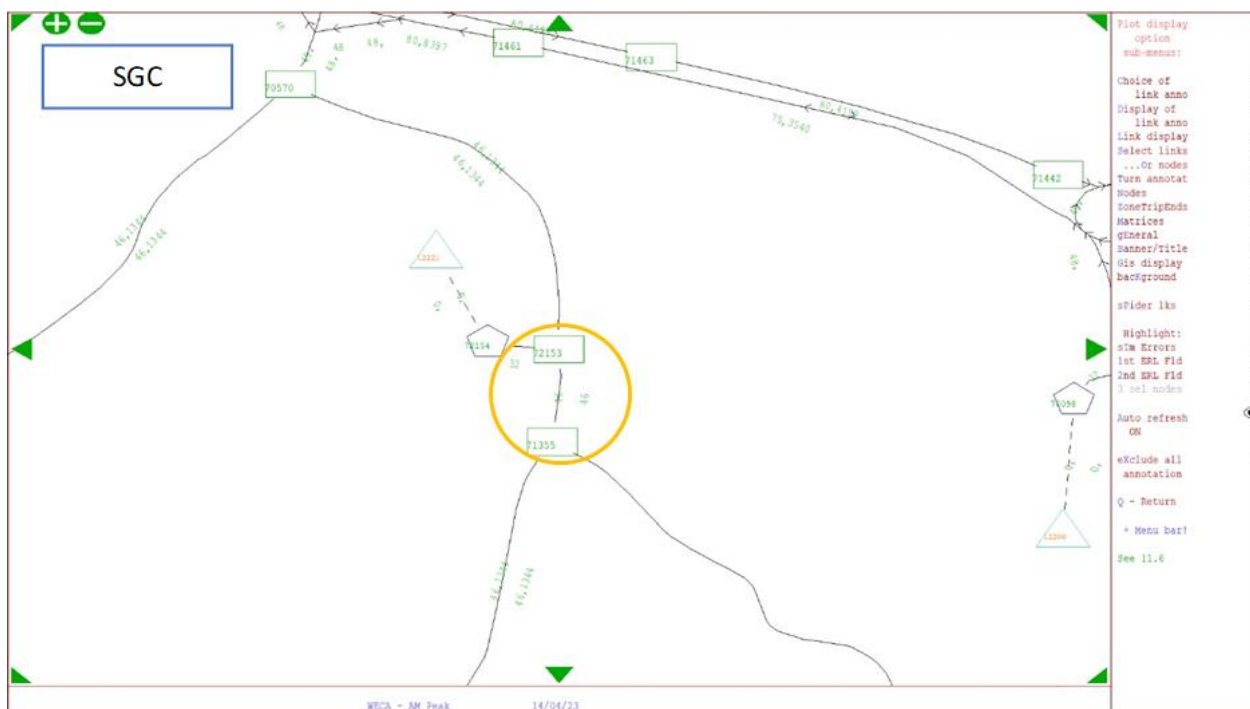
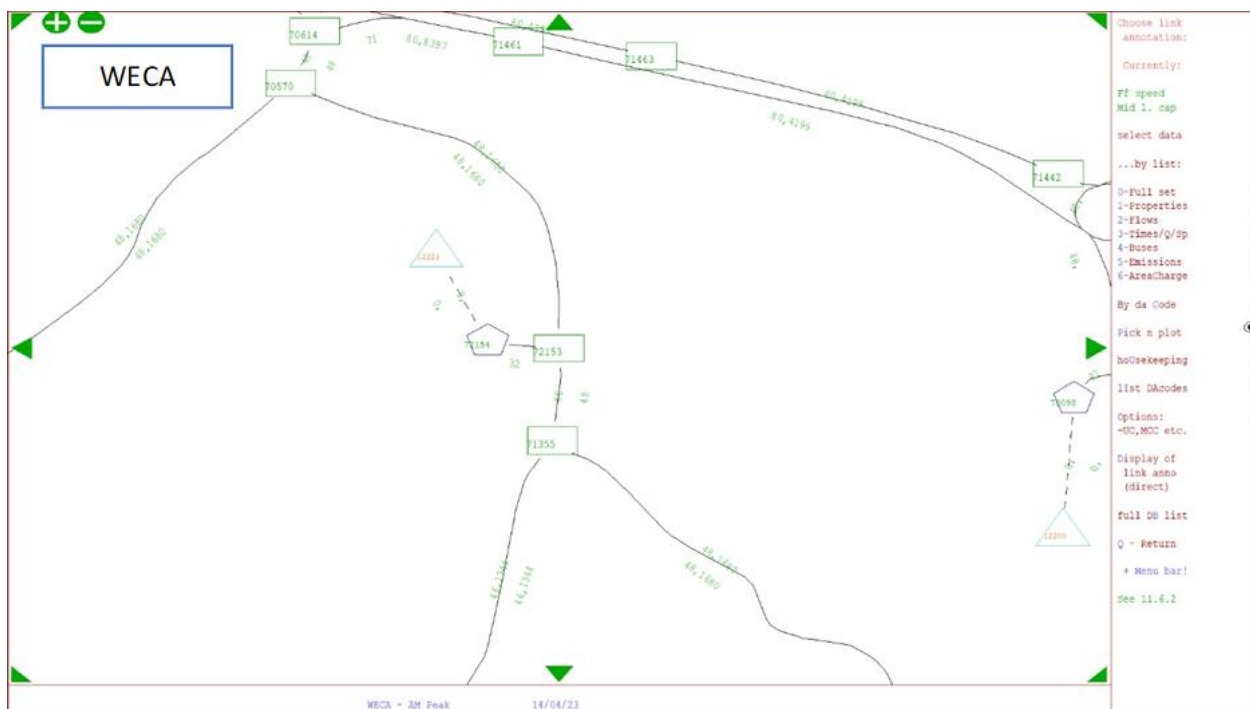
- **B4058 - Frenchay Park Road: Updated capacity index from 34 to 39 for both direction (40376-40397).**



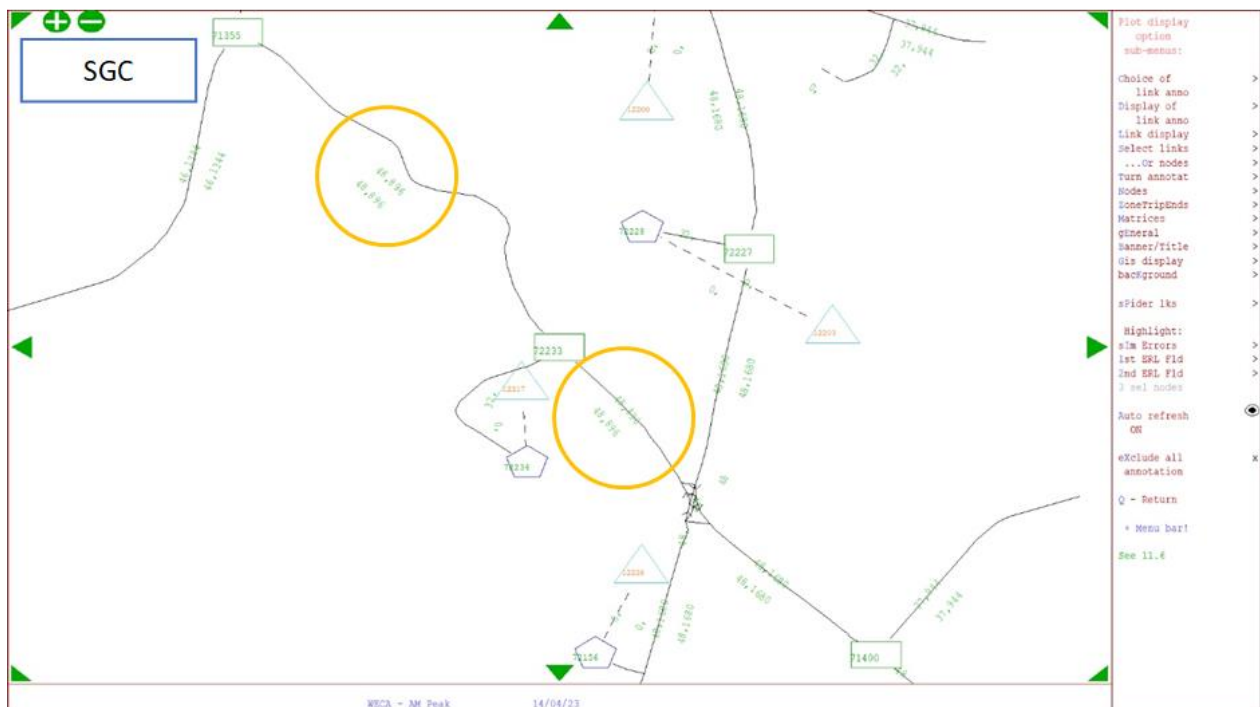
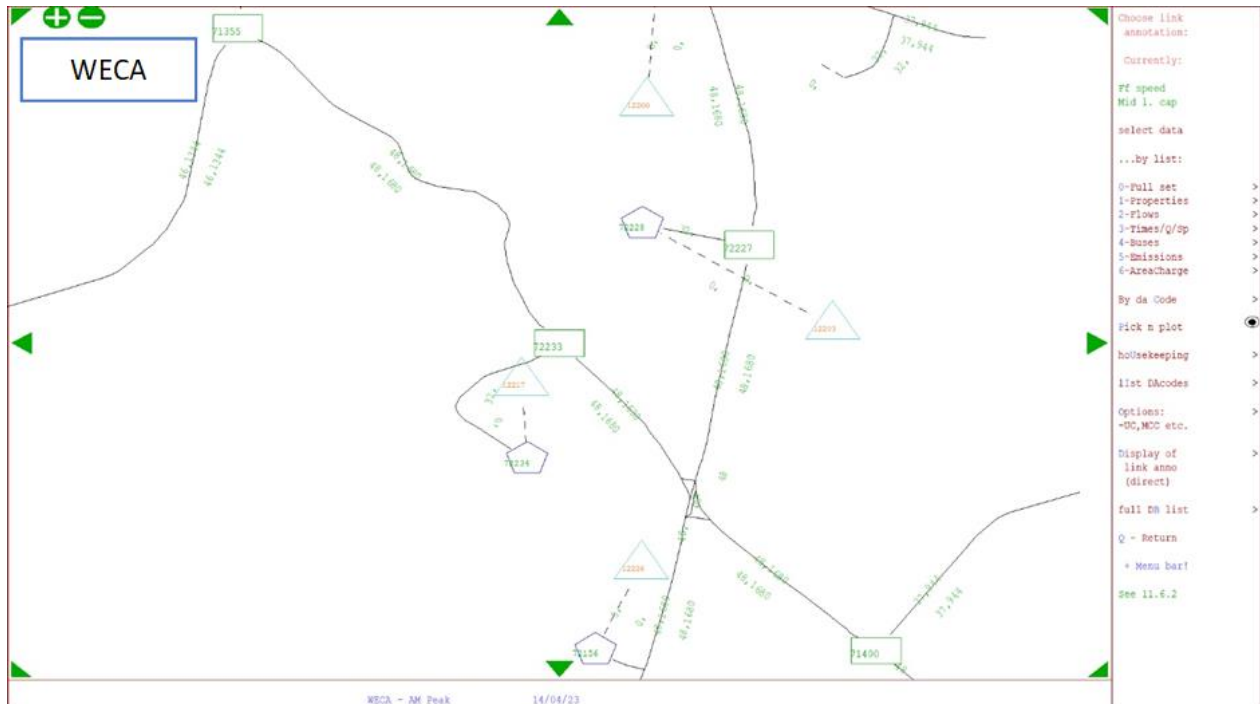
- **B4058 - Frenchay Park Road/ Bristol Road:** Updated capacity index from 34 to 43 for both direction (40375-72308-70570).



- **Beckspool Road:** Updated capacity index from 34 to 43 for both direction (71355-72153) with mid link capacity of 1344 replacing 1680.

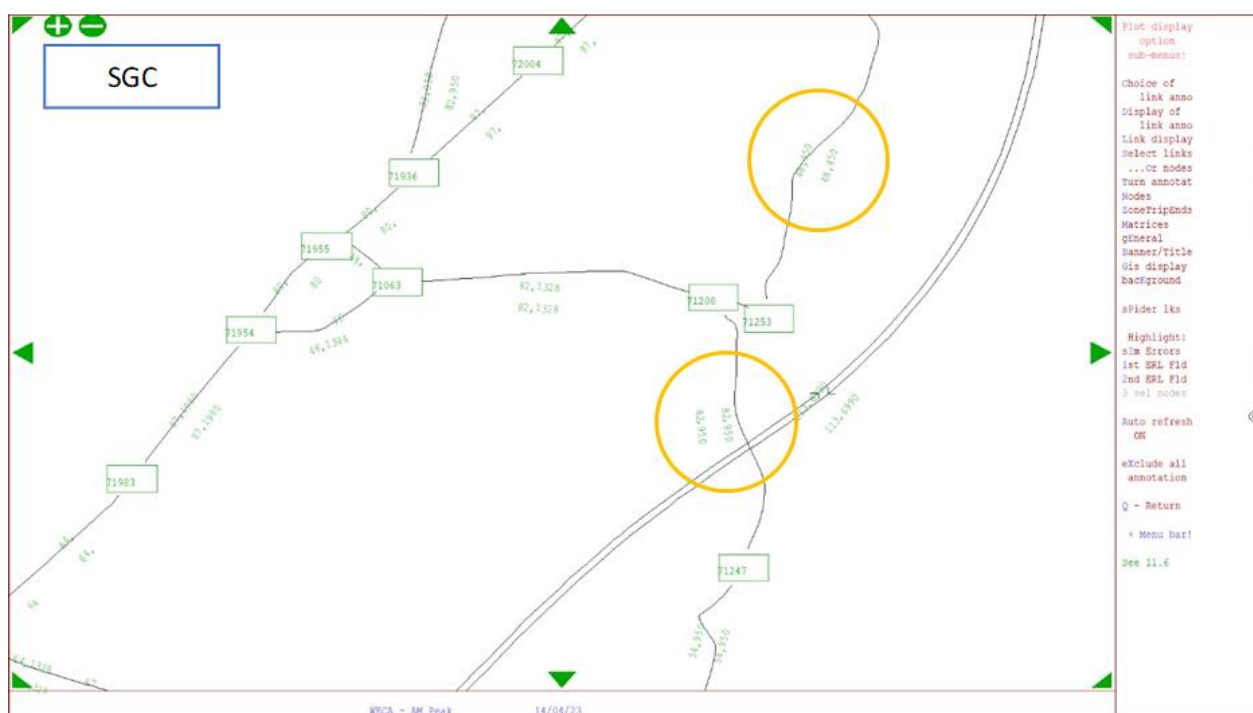
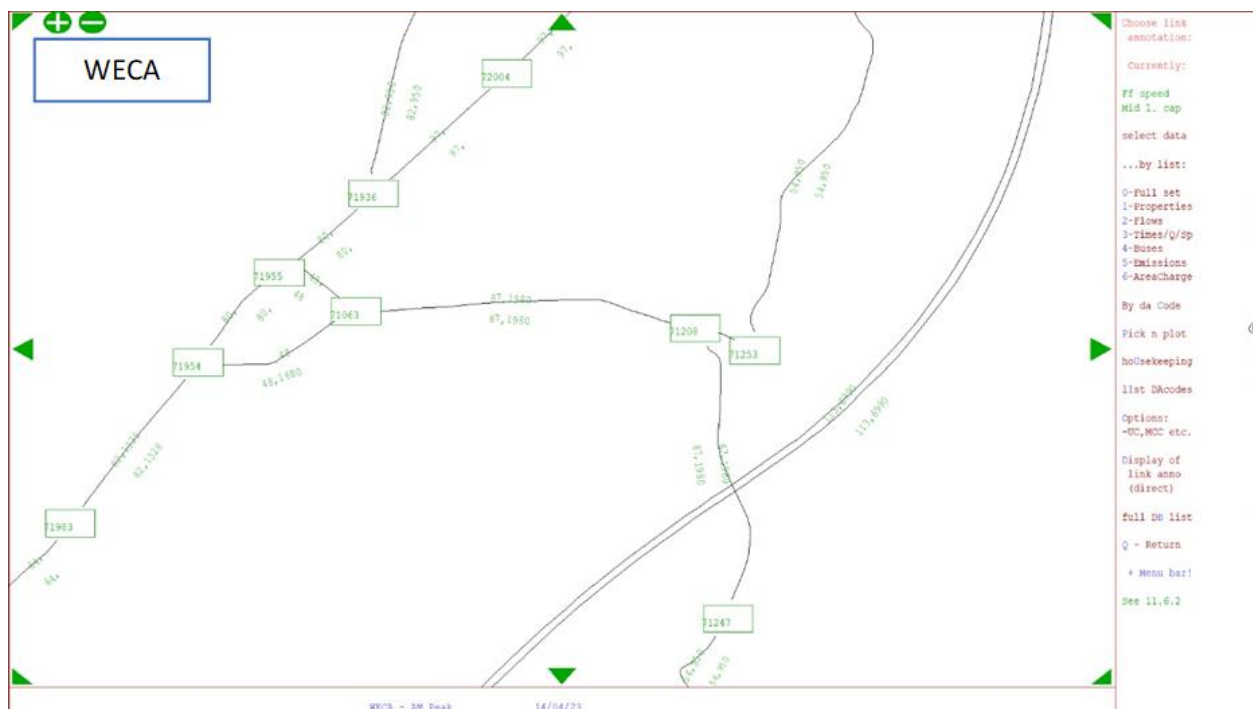


- **Cleeve Wood Road:** Updated capacity index from 34 to 36 for both direction (70015-72233) with mid link capacity of 896 replacing 1680.

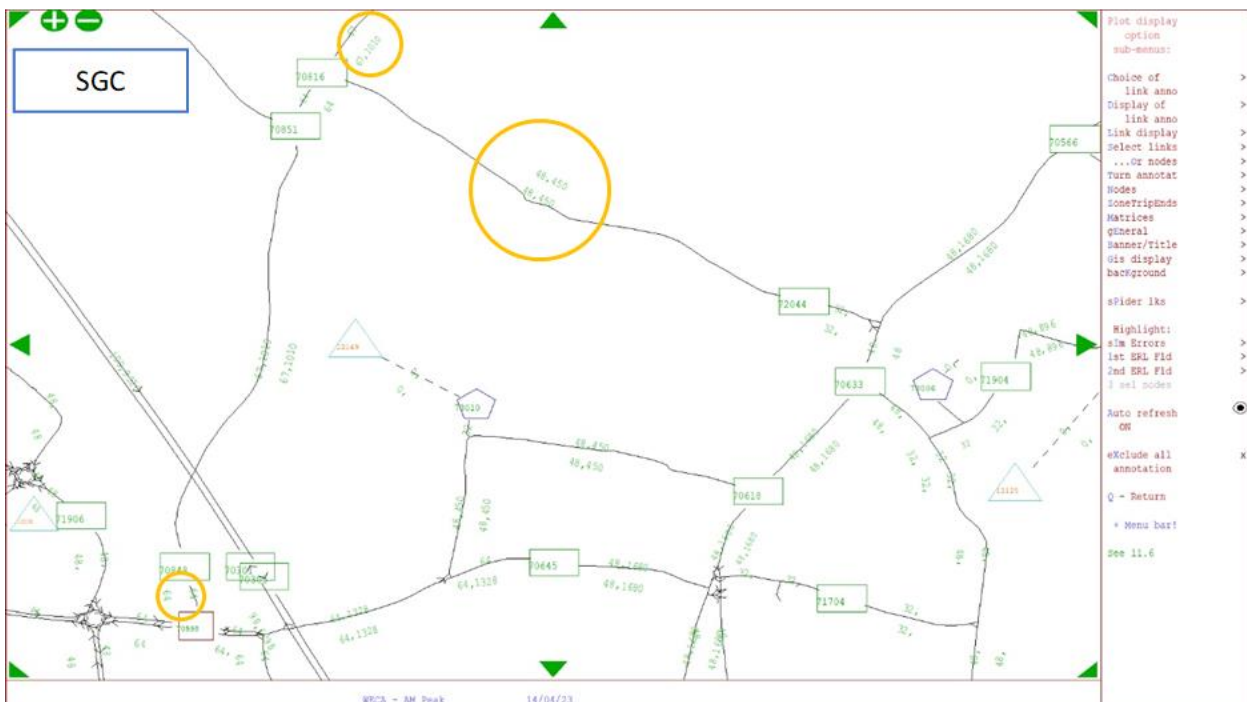
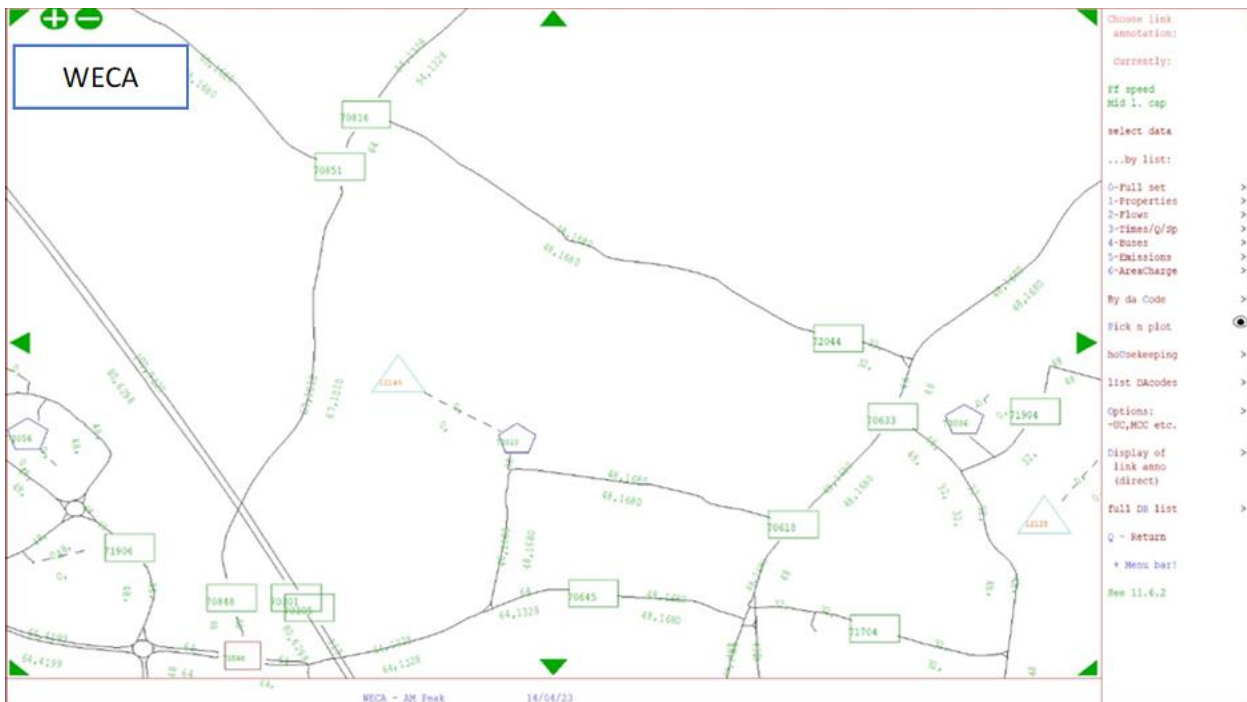




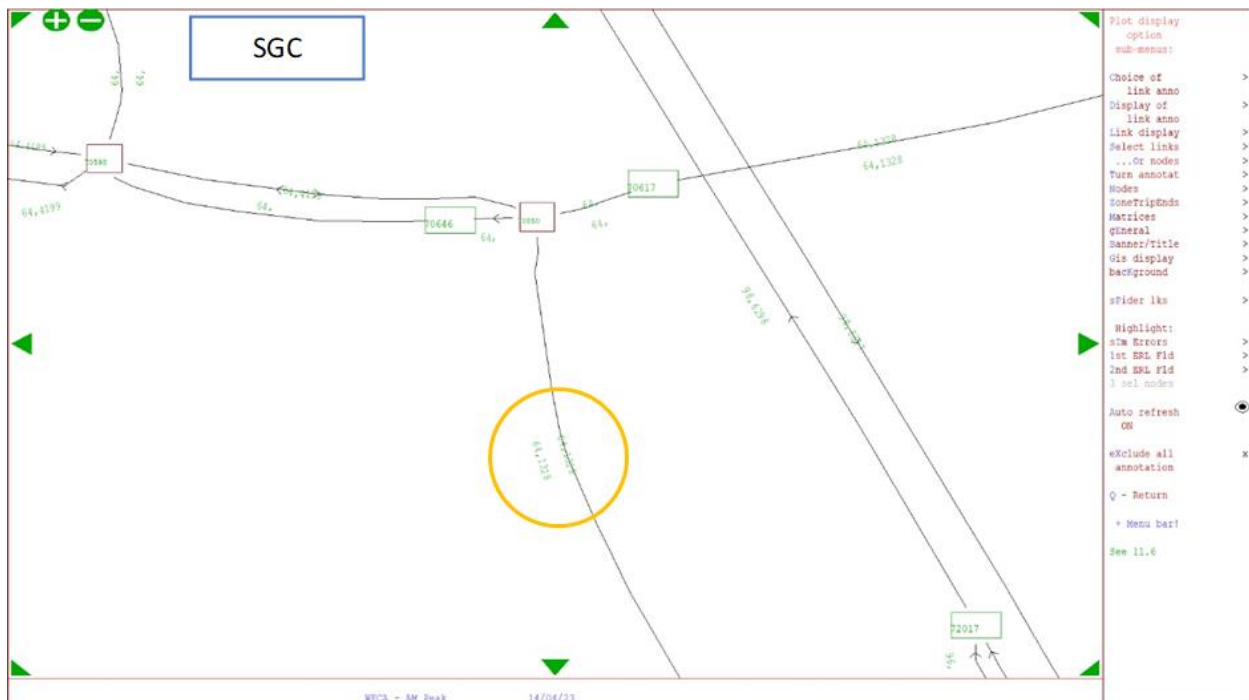
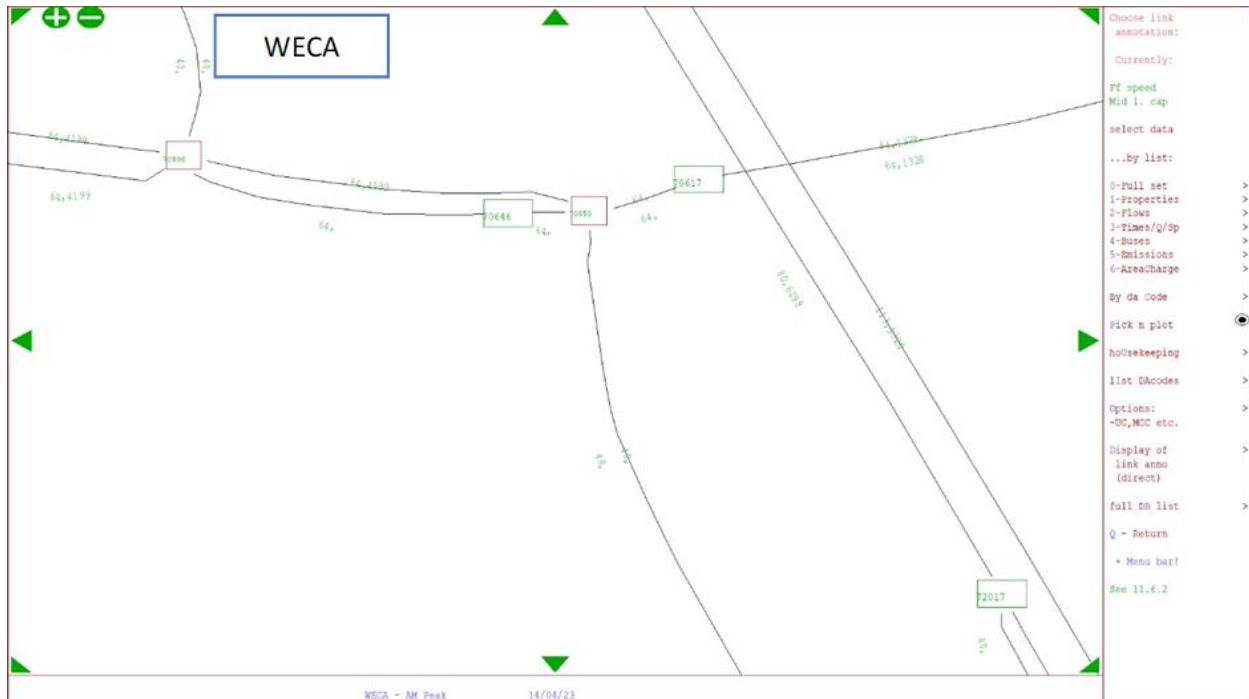
- **Cuttsheath Road:** Updated capacity index from 16 to 20 for both directions (71208-71247), and from capacity index 34 to 43 for one direction (71954-71063).
- **Brinkmarsh Lane:** Updated capacity index from 21 to 51 for both directions (71253-71938).



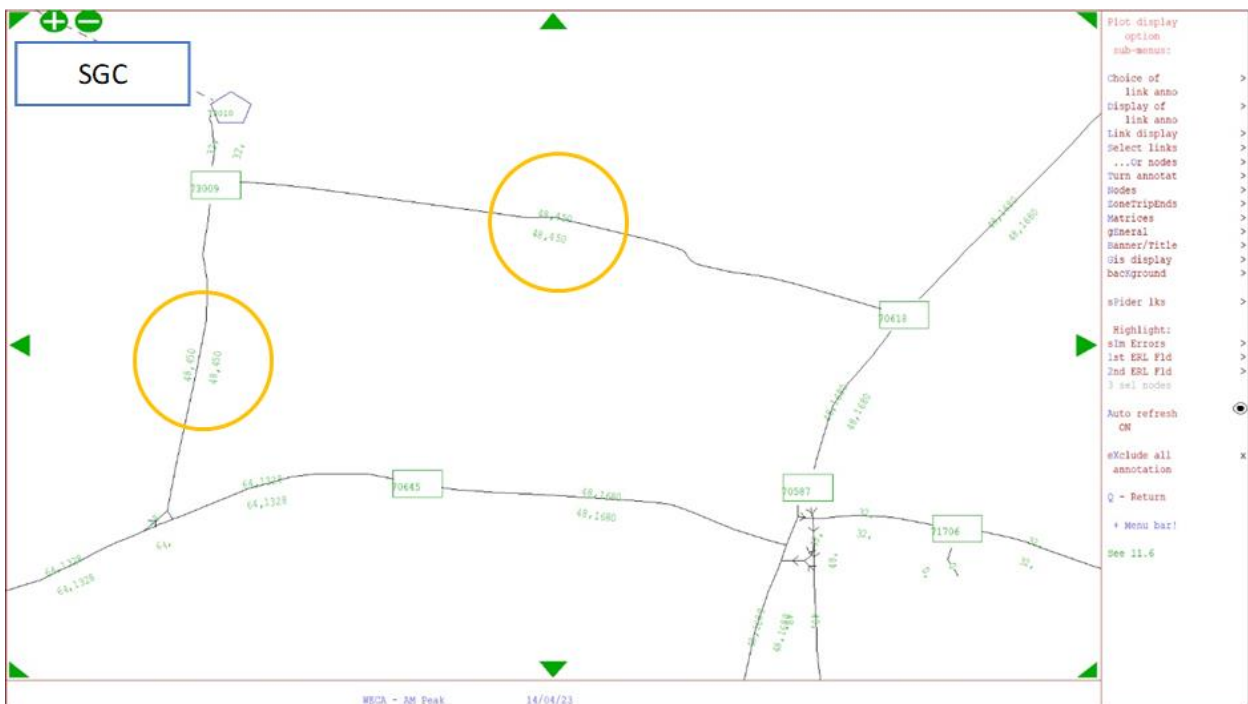
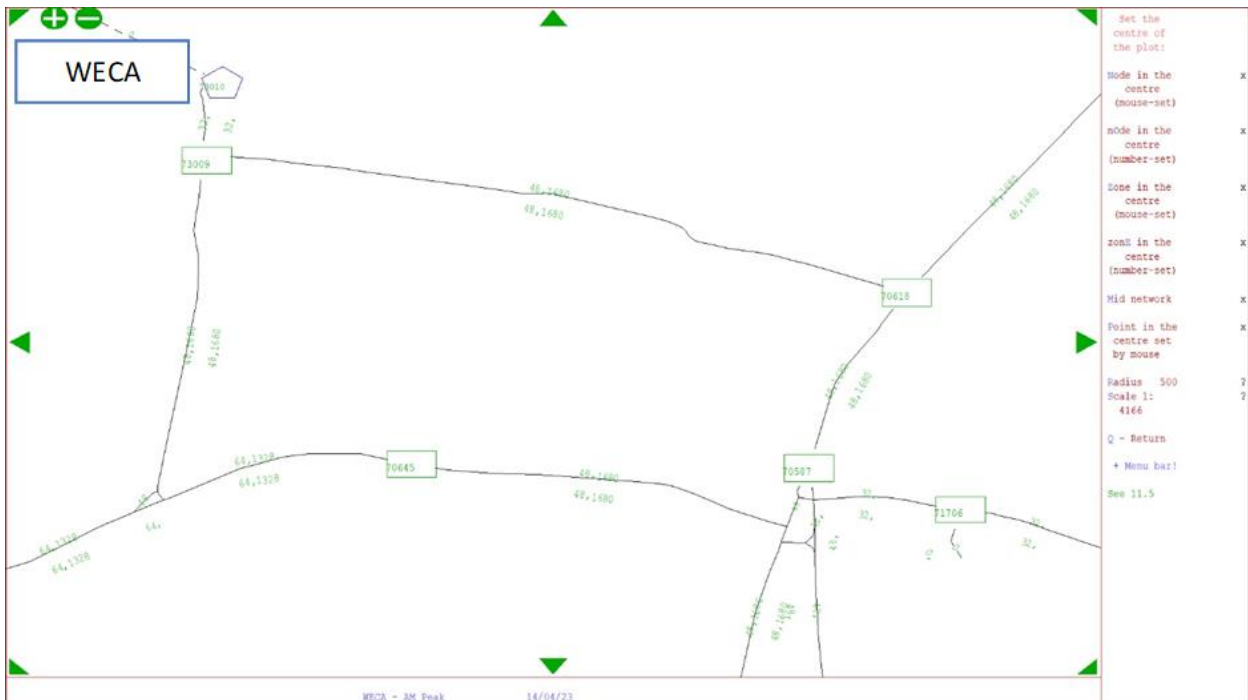
- **B4427 – Old Gloucester Road:** Updated speed from 30 mph to 40mph for both directions (70598-70848), updated capacity index from 52 to 51 for both directions (70816-72044), and capacity index from 19 to 18 (70816-70812).



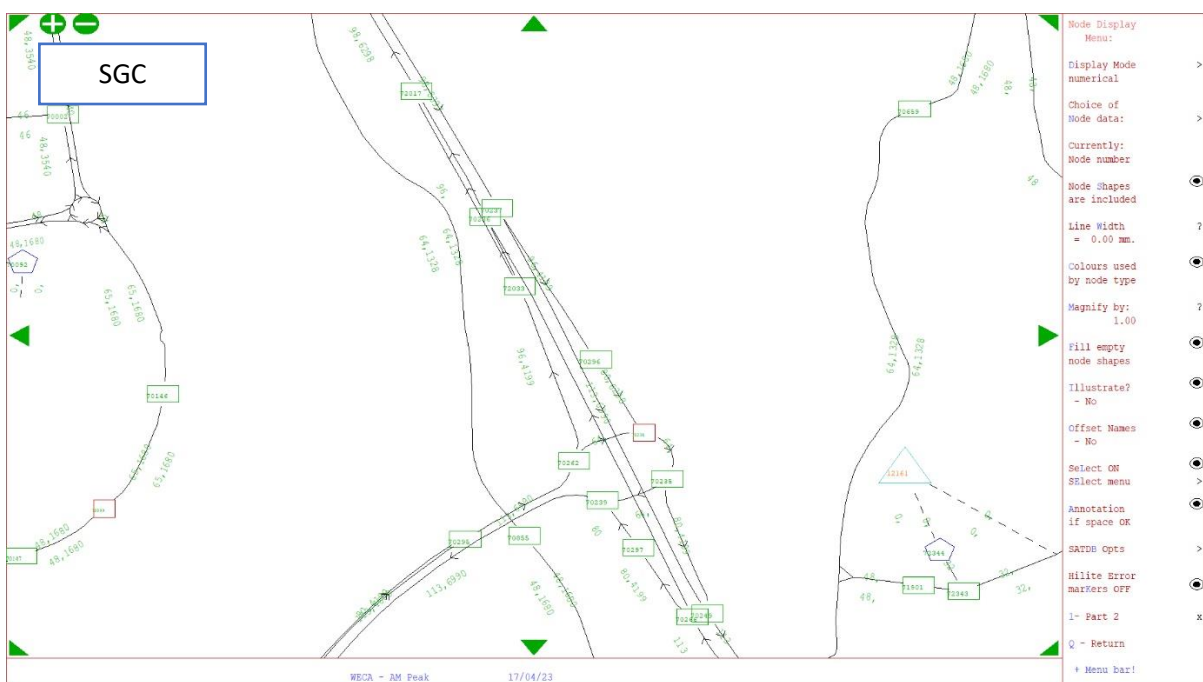
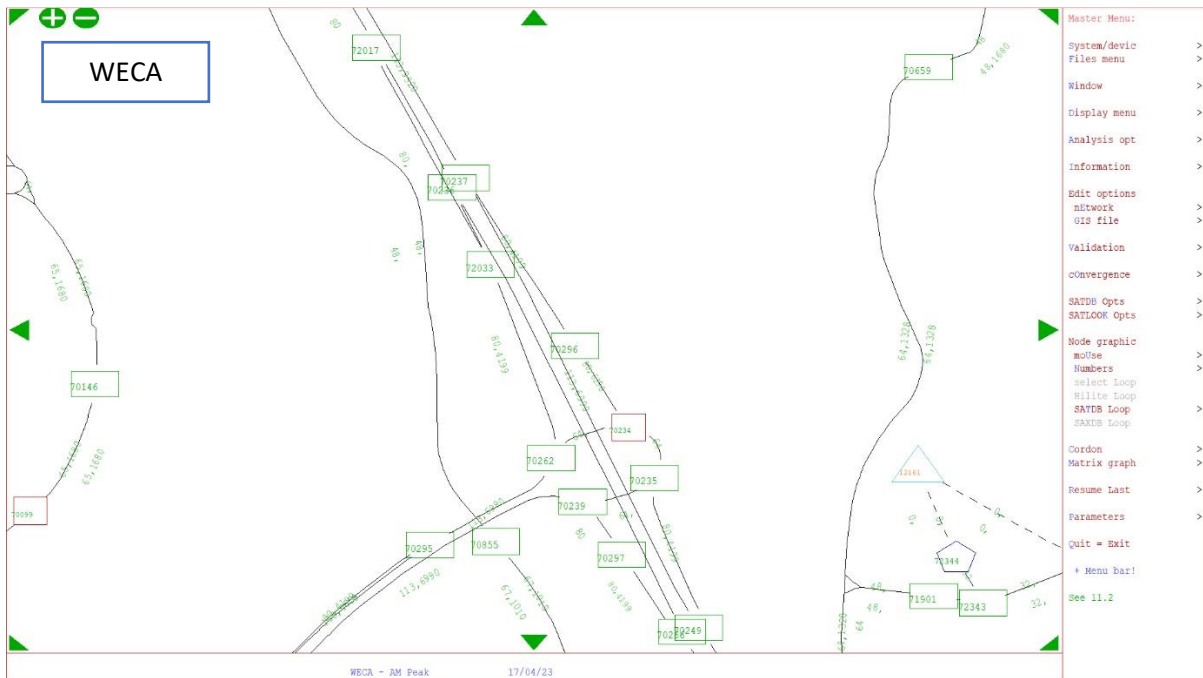
- **B4427 – Old Gloucester Road:** Updated speed from 30 mph to 40mph for both directions (70850-70855) and added capacity index of 17 for both directions (70850-70855).



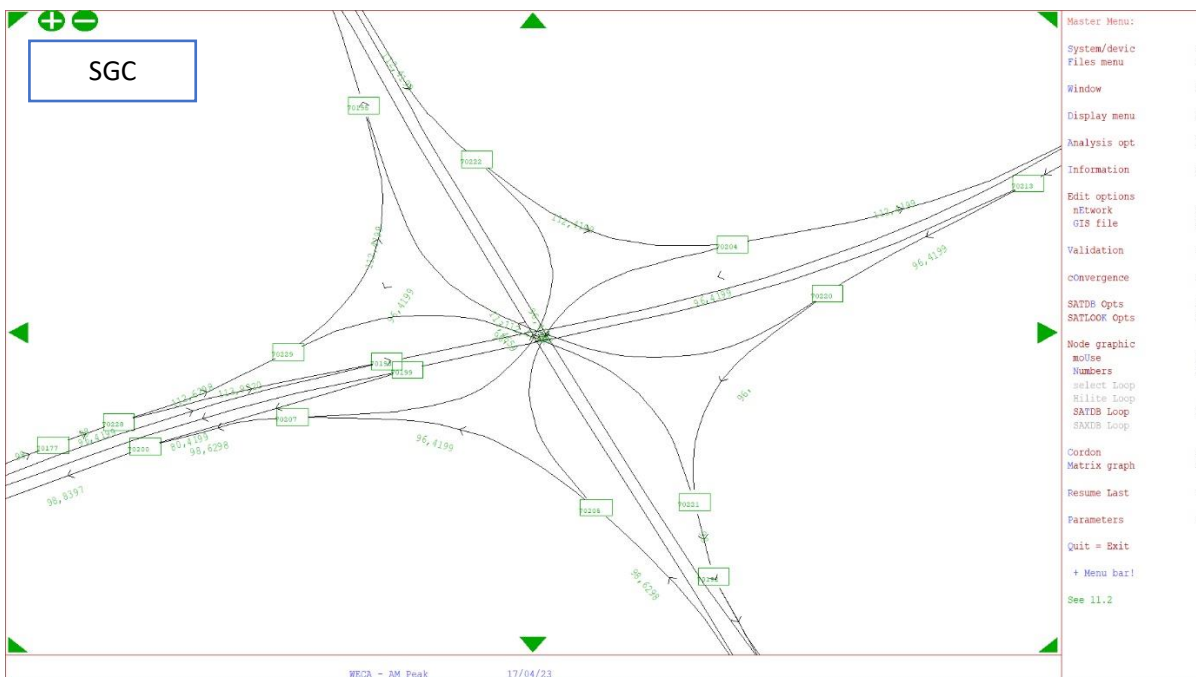
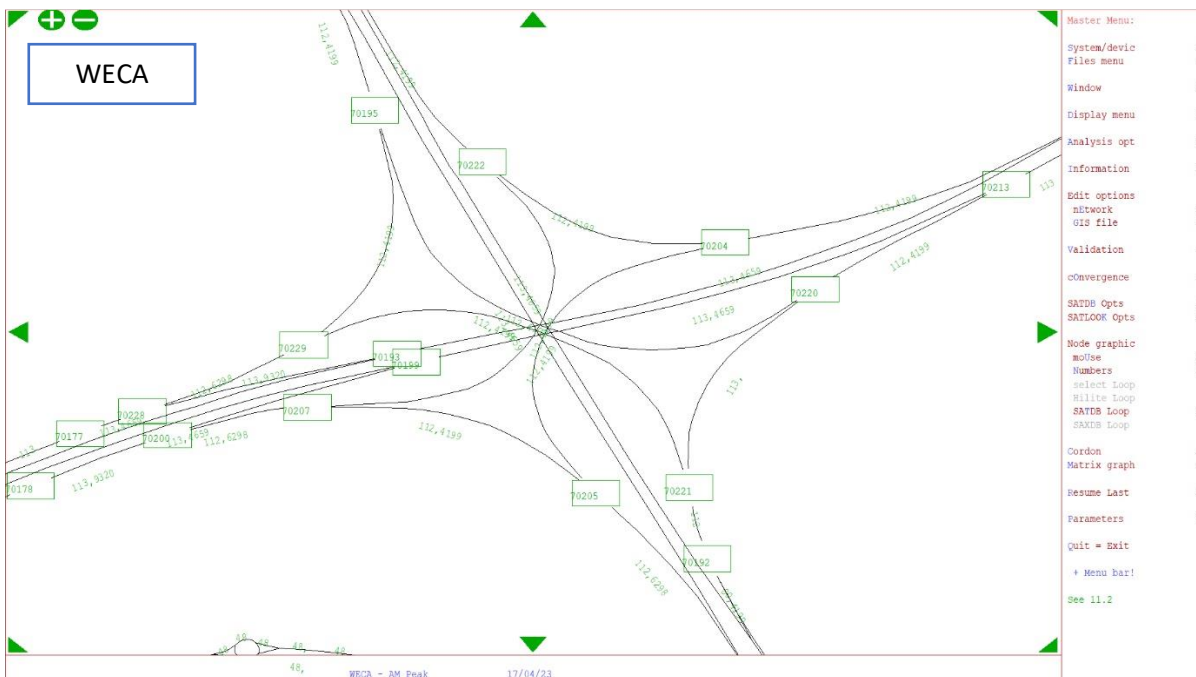
- **Church Lane:** Updated capacity index from 34 to 51 for both directions (71837-73009-70618)



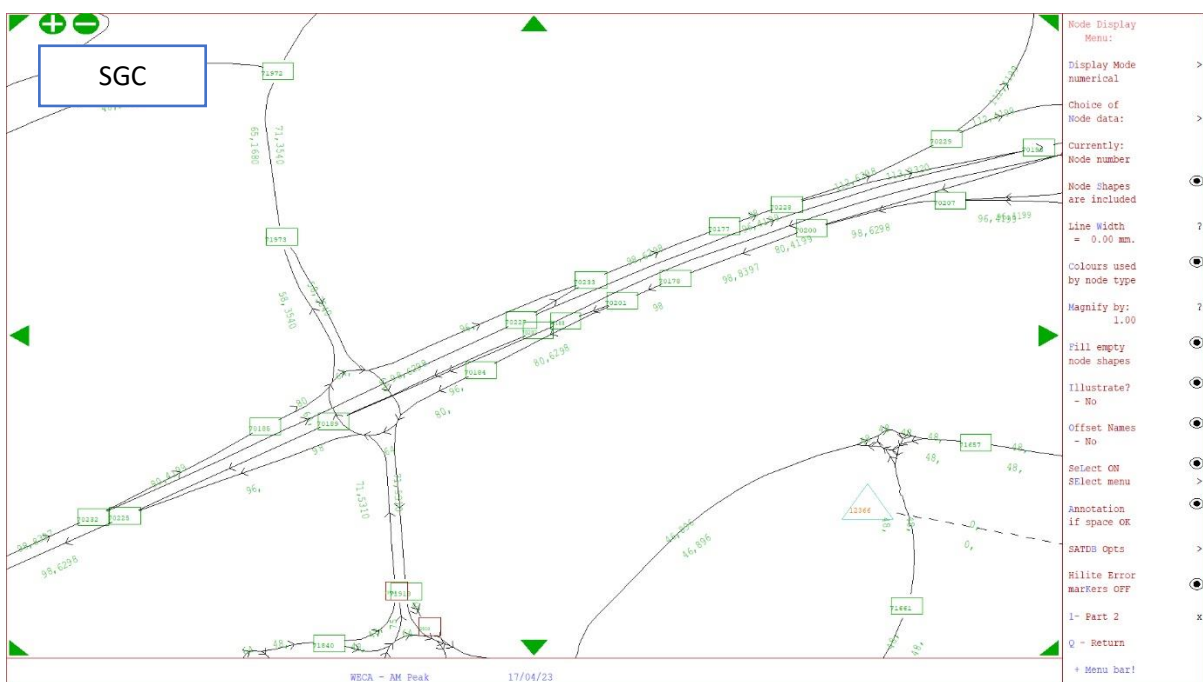
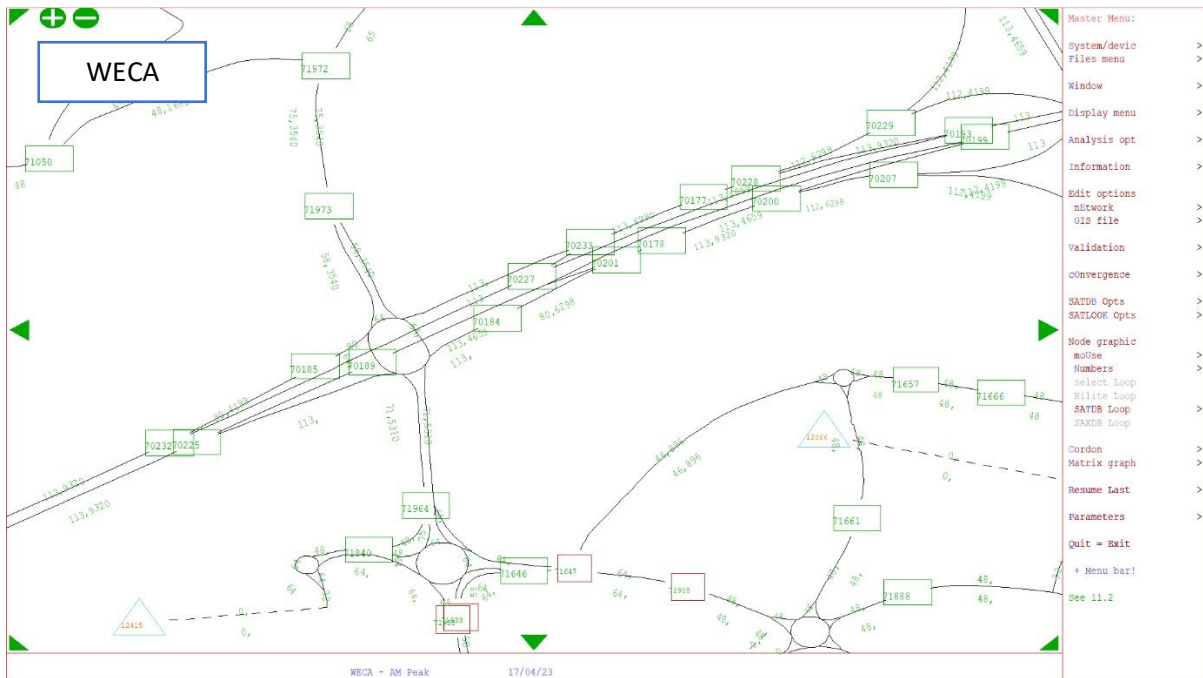
- **M4 J19: Variable Speed limit changes & updated capacity index/ speed flow curve accordingly.**



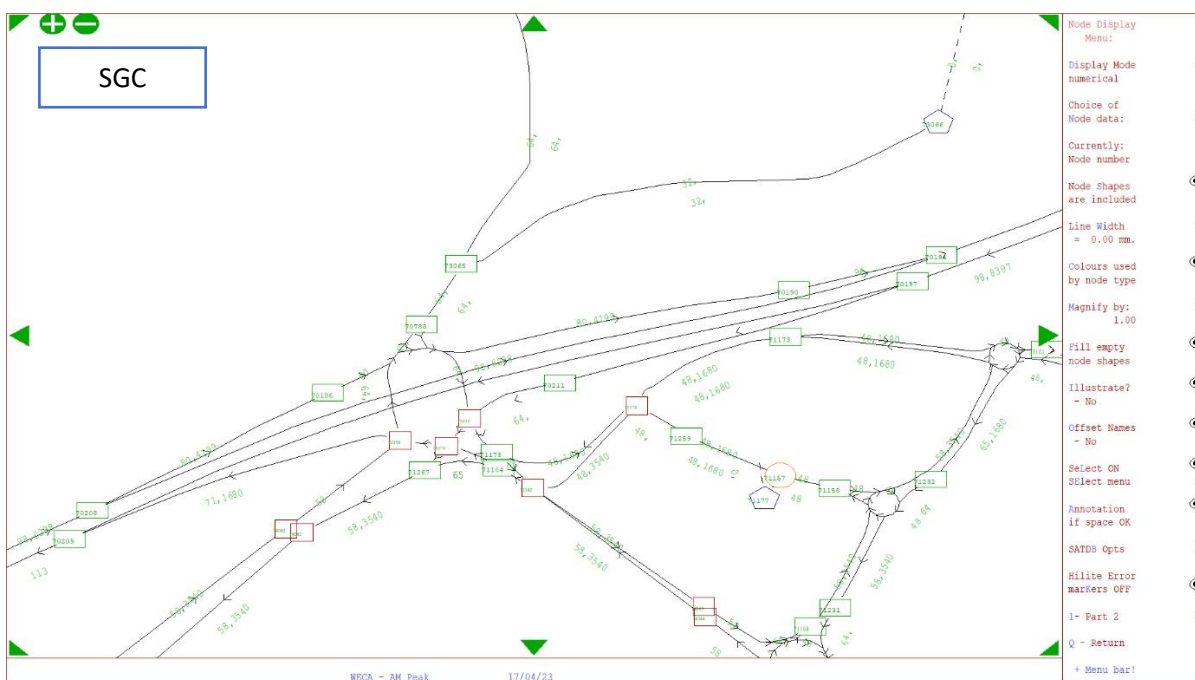
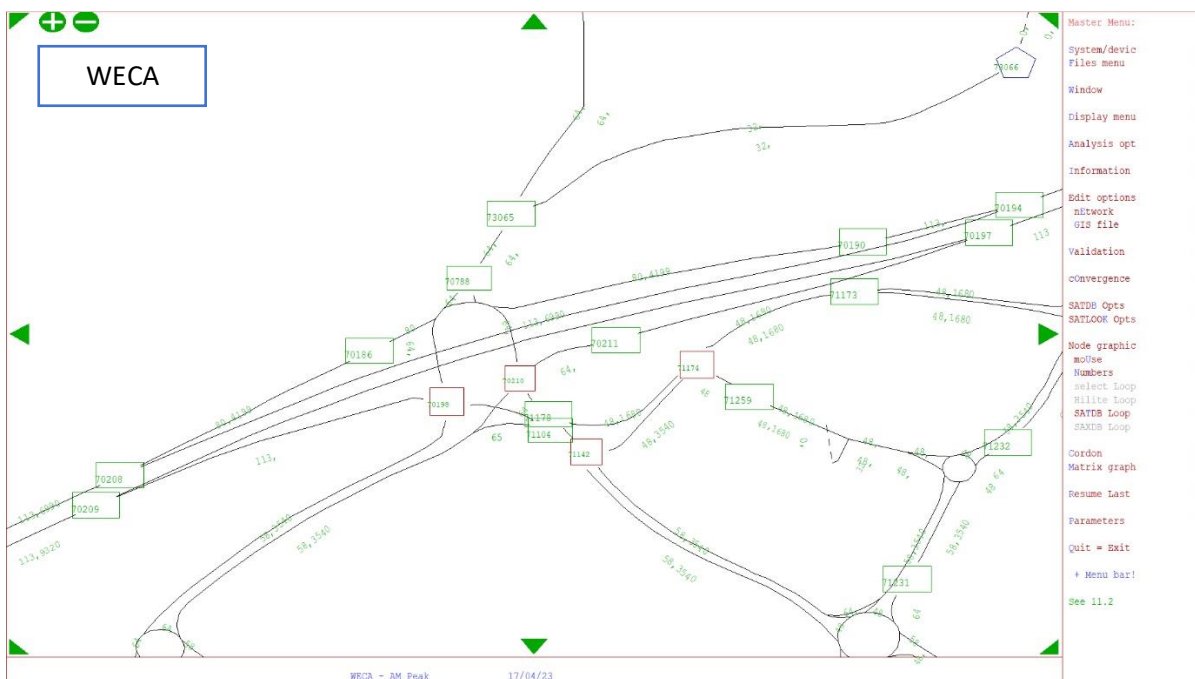
- M4 J20: Variable Speed limit changes & updated capacity index/ speed flow curve accordingly.



- **M5 J16:** Variable Speed limit changes & updated capacity index/ speed flow curve accordingly.



- **M5 J17:** Variable Speed limit changes & updated capacity index/ speed flow curve accordingly.





## 1.2.4. Other Network Updates

Table 1-1 below presents the list of network updates in terms of lanes, lane allocations, junction type, saturation flow etc.

**Table 1-1 - Updates to lane and turn properties**

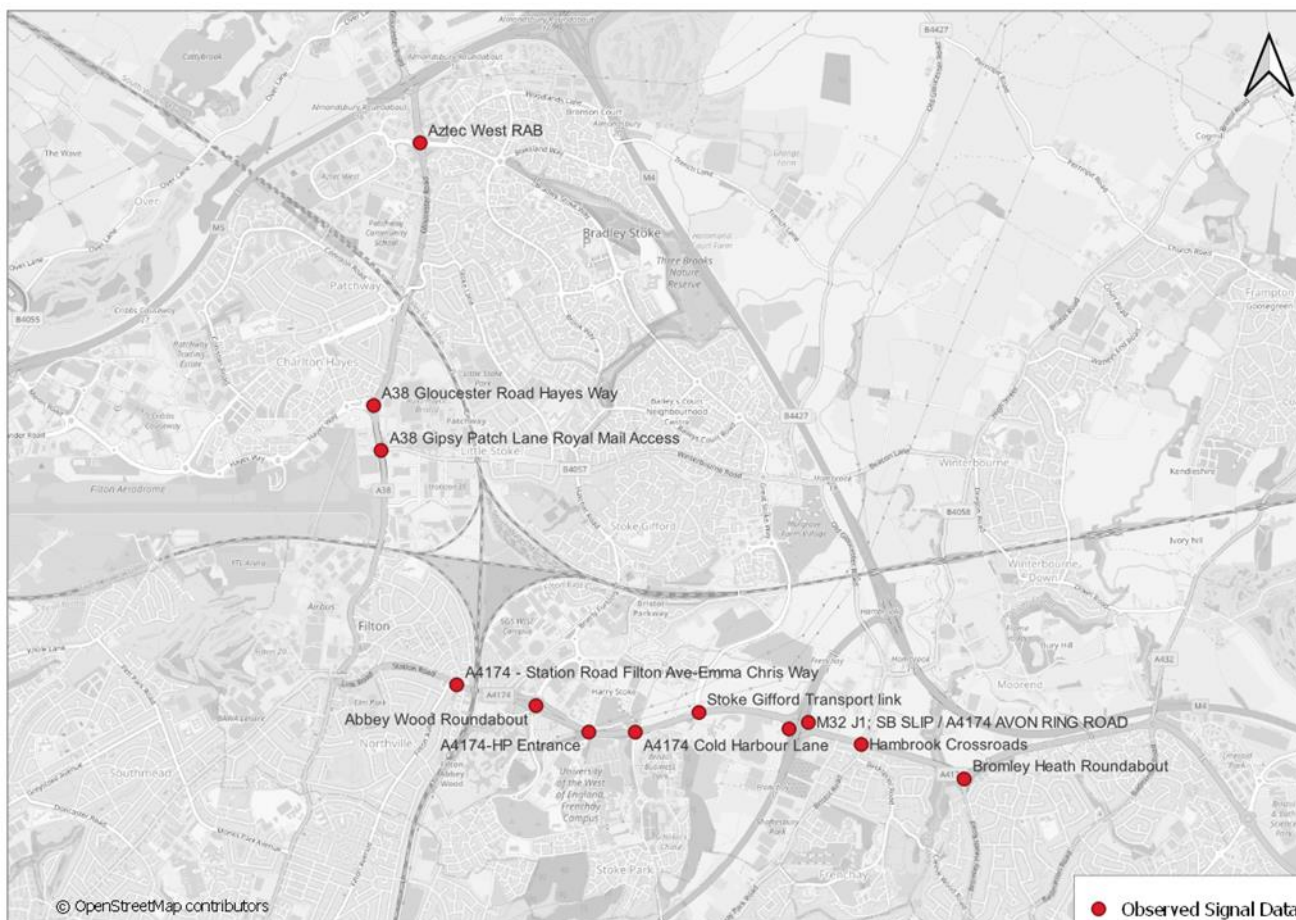
Location	Node/ Links	Changes
B4058 – High Street/ Beacon Lane	70589	Only left turn is allowed from approach arm 70645. Right turn is removed
B4057 – Bradley Stoke Roundabout	70609	Updated approach arm (70610) from 1 lane with flare to 2 lanes and updated saturation flow accordingly.
Savages Wood Roundabout	71822	Updated southbound approach arm (71913) to be as give-way.
Great Stoke Roundabout	70602	Updated circulatory arm (70599-70602) from 3 lanes to 2 lanes.
Bradley Stoke Way	71855	Converted priority node to a signalised node.
B4055 Cribbs Causeway/ Blackhorse Hill	73065	Removed flare from southbound arm (70787).
B4055 Cribbs Causeway	70788	Updated from 2 lanes to 1 lane for northbound direction (71278).
M5 - B4055 Cribbs Causeway	70212	Updated lane 2 for exit arm movement to be shared by both circulatory and exit arm with updated saturation flow.
M4/M5 – Almondsbury Roundabout	70229	Updated number of lanes from 4 to 3 lanes with middle lane shared for both turns.
A4174 - Hicks Gate Roundabout	50633, 50384	Updated middle lane shared for both circulatory & exit from only allowed to exit and updated saturation flow.
A4174 - Dramway Roundabout	71373	Updated northbound entry arm as give-way movement.
A4174 - Hambrook Cross Road	71435	Added bus lane on eastbound direction (71445-71435).
A431 High Street/ B4046 Chapel Road	70393	Added flare for southbound movement (70782-70393).
A431 – Bath Road Roundabout	70402	Updated 2 lanes to 1 lane with flare for northbound entry arm.
Merlin Road/ Lysander Road Roundabout	71138	Updated entry arm saturation flow
A431 High Street/ Whittucks Road	70487	Added right flare for eastbound entry arm and optimised signal timings to reduce delays.
A431 - Cherry Gardens	70312	Movement 70401-70312-70311 is not allowed on ground and hence the turn is removed.
M4 J20 – Almondsbury Roundabout	70240	Lane 3 shared for both the movements – updated it to only M5 northbound direction i.e., Lane 1-3 towards M5 and Lane 4-5 towards M4.
A431 – Cherry Gardens	70311	Change in Circulating time & capacity, and GAP value.
A431 – Memorial Road	70413	Change in Circulating time & capacity, and GAP value.

Location	Node/ Links	Changes
B4061 – Midland Way	71089	Change in Circulating time & capacity, and GAP value.
B4509 – Wotton Road	70845	Change in Circulating time and added GAP value.
Rodford Way/ Scott Way/ Heron Way	70909	Change in Circulating time & capacity, and GAP value.
Lysander Road Roundabout	71157	Change in Circulating time & capacity, and GAP value.
Downend Road/ Kimberley Road	71332	Change in Junction type coding. Changed from type 5 to 2.
Trench Lane/ Bowsland Way	71857	Change in Circulating time & capacity, and GAP value
Long Down Avenue	70168	Saturation flow for the centroid connector/stub link is increased to reduce excessive delays
Gloucester Rd/Over Ln	73055	Saturation flow for the centroid connector/stub link is increased to reduce excessive delays
Aldermoor Way	71616	Saturation flow for the centroid connector/stub link is increased to reduce excessive delays
Bristol Parkway	73019	Saturation flow for the centroid connector/stub link is increased to reduce excessive delays
Bowsland Way	71660	Saturation flow for the centroid connector/stub link is increased to reduce excessive delays
Beckspool Road	72153	Saturation flow for the centroid connector/stub link is increased to reduce excessive delays

### 1.2.5. Signal Updates

Observed data for signals with information on traffic signal timing, staging and phases data has been provided by SGC for junctions presented in the below figure which also includes exploded roundabouts. All other signalised junctions were retained with the signal times from WERTM model.

**Figure 1-2 - Junctions with observed signal data**



The signal data was provided in the form of pdf or html for each junction from which the following data was extracted:

- Number of stages;
- Phases and descriptions i.e., vehicular movements, pedestrian movements, all red etc.
- Phases in stages i.e., what phases are allowed in each stage;
- Phase timing sets;
- Intergreen times between phases; and
- Time table sets showing which phase timing set is to be taken based on time period.

Pedestrian movements are not explicitly modelled and hence the timings (green and intergreen combined) for these are added to intergreen times of a vehicular movement phase.

All the signal data was finally converted to a suitable format to input to SATURN network .dat files.

In addition to the above signal updates, signal (node 70234) at M4J19 Southbound exit slip road is optimised from template (unobserved) coding to reduce excessive delays. Note that only AM peak is presented below whereas the signal optimisation was carried out in all peaks.

