A10 Cambridge to Ely Strategic Outline Business Case

Model Forecast Report

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Cambridgeshire and Peterborough Combined Authority

CPCA

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Executive Summary

Jacobs were commissioned by Cambridgeshire and Peterborough Combined Authority to produce a Strategic Outline Business Case for a scheme to improve travel conditions on the A10 between Ely and Cambridge. Seven scheme options were identified for assessment including:

- four full length dualling options (each with different alignments),
- two partial dualling options, (which included a combination of dualling limited sections of the road and capacity enhancements to selected junctions), and
- a single option comprising junction improvements only with no dualling.

As part of the evidence base for the appraisal of scheme interventions, forecasts of the A10 Ely to Cambridge (A10E2C) Transport Model (A10E2C) were produced.

The A10E2C Model was developed by consultants Atkins as an enhancement of the highway model of the Cambridge Sub-Regional Model (Version 2) (CSRM2). The development of the base year model was detailed and reported upon in a Local Model Validation Report. The anticipated opening year for a scheme on the A10 corridor is 2028, thus new forecasts of the A10E2C model were developed representing a 2028 and 2043 forecast year.

To develop forecasts of the A10E2C model a proportionate approach to appraisal was adopted which made use of existing CSRM2 forecasts which were undertaken for an earlier, pre-SOBC, assessment of transport interventions along the corridor. These forecasts were for a 2031 forecast year and made full use of the functionality of the CSRM2's Highway, Public Transport and Variable Demand Model.

Using an established relationship between the A10E2C and the CSRM2 the pre-SOBC forecasts were adapted for use in developing the forecasts for the A10E2C model. This included converting the trip matrices from the zone system of the former to that of the latter so that the demand from the 2031 CSRM2 forecasts could be utilised for the A10E2C model. Interpolation and extrapolation of that 2031 demand was used to produce a 2028 and 2043 forecast from the single 2031 forecast year of the CSRM2. Also, committed forecast highway schemes were transferred across from the 2031 CSRM2 forecast to the 2028 and 2043 A10E2C forecasts.

In addition, for the 2043 forecast, a scenario for testing the impacts of development dependent on the A10 scheme (known as the Waterbeach New Town) was also produced.

By using the CSRM2 forecasts, the A10E2C forecasts incorporated an anticipated level of development consistent with locally derived Local Plan land uses and demographic forecasts. This was necessary for assessing each option's performance against anticipated growth levels (which exceeded the growth set out in NTEM v7.2). This methodology also ensured that the effects that transport interventions in the Do Minimum and Do Something scenarios would have in varying demand patterns could be modelled.

Model outputs were analysed to assess the extent of each option's impact on trip reassignment and traffic flows, as well as congestion and delays. These demonstrated that all of the options reduced delays along the A10 corridor to a certain extent, but with clear differences in the level of reductions achieved:

- The four dualling options had the greatest impact on traffic flows and reassignment with increased capacity along the corridor effecting reassignment from local roads onto the A10. The options all showed significantly reduced delays for through trips on the A10. However, impacts on delays on side roads were variable in that some options reduced delays and some resulted in increased delays at some locations.
- The two partial dualling options demonstrated a more limited impact on reassignment and delays
- the option which included junction capacity improvements but no dualling had even less impact and was generally considered the least beneficial option.

In addition to comparing the relative merits of each option, the modelling has also helped identify aspects of each which has the potential to be improved through further refinement of the scheme, should any of the options be progressed for further assessment.

1. Introduction

Jacobs is working with Cambridgeshire and Peterborough Combined Authority (CPCA) to develop a Strategic Outline Business Case (SOBC) for improvements to the A10 between Cambridge and Ely. As part of the SOBC, an appraisal of the proposed scheme options was required and this has been undertaken using a strategic model of the A10 corridor and surrounding area.

This model is known as the A10 Ely to Cambridge (A10E2C) model and was commissioned by Cambridgeshire County Council (CCC) on behalf of CPCA and produced by CCC's consultants Atkins, specifically for the purposes of appraising transport schemes along the A10 corridor. The development of the base year model is described in the A10E2C Local Model Validation Report (LMVR)[1].

This report details the development of the forecast scenarios of the A10E2C, which will be used for the appraisal of the scheme options as part of the SOBC.

The location of the scheme is illustrated below:

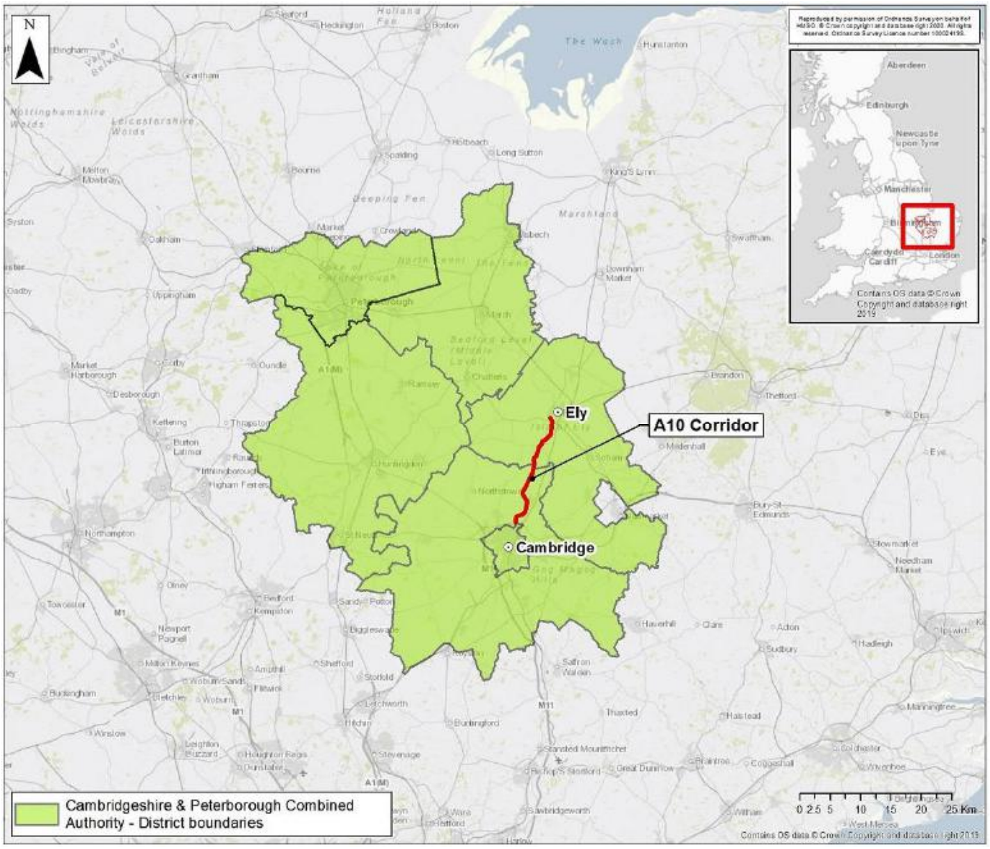


Figure 1-A: A10 Corridor

This report is comprised of the following sections:

- Section 2: Provides an overview of the forecast methodology
- Section 3: Details the forecast network and the committed transport schemes modelled
- Section 4: Presents the forecast demand including the zone systems, developments, VDM and matrix totals
- Section 5: Summarises the assignment process for the forecast model

[1] A10 Ely to Cambridge Transport Study, Local Model Validation Report, November 2018

- Section 6: Details model outputs and results
- Section 7: Summarises the report and key findings

2. Forecast Methodology

2.1 Forecasting Approach

The schemes tested in the model include a variety of improvements to the A10 corridor between Cambridge and Ely, including off-line dualling, on-line dualling, junction improvements and combinations thereof. Using a multi-criteria assessment, a long list of scheme improvement options was filtered down to a shortlist of seven. Thus, a total of seven different 'Do Something' forecast scenarios were produced, in addition to a Do Minimum scenario which excluded any improvement and served as a reference case. The Do Something scenarios are listed below, along with a brief description:

Option Ref	Previous ref (used in option assessment)	Description
Option A	Option 8F	Predominantly online full length dualling, bypassing the key pinch points east of Milton and at Stretham (western bypass) and Little Thetford
Option B	Option 8L	Predominantly online full length dualling, bypassing the key pinch points east of Milton and at Stretham (eastern bypass) and Little Thetford
Option C	Option 10B	Offline dualling of the southern section to Cambridge Research Park with selected junction improvements on the remaining single carriageway sections to the north.
Option D	Option 1	Full length, offline dualling
Option E	Option 5B	Maximum online dualling, whilst bypassing the key pinch points at Stretham (western bypass) and Little Thetford
Option F	Option 10A	Online dualling of the southern section to Cambridge Research Park with selected junction improvements on the remaining single carriageway sections to the north.
Option G	Option 12	Selected junction improvements with no dualling.

Table 2.1: Scheme options tested

Since being appointed to the project, Jacobs has participated in CCC's regular modelling forum, attended by CCC and all consultants developing schemes in the area covered by the model. Participation in that forum, and liaison with CCC helped to inform the methodology for the A10 modelling. The approach to undertaking forecasting was detailed in a methodology report which was shared with CCC, as the 'guardians' for all modelling activity in Cambridgeshire. Following their review, the proposed methodology was modified slightly, to incorporate comments raised.

The A10E2C model used to undertake the forecasting was derived from the Cambridgeshire Sub-Regional Model (version 2) (CSRM2). The CSRM2 is CCC's principal strategic modelling tool used for the assessment of all major transport schemes in the County. It was developed following Transport Analysis Guidance (TAG) on modelling and incorporates a highway, Public Transport (PT) and Variable Demand Modelling (VDM). It has served as a common basis for assessing multiple transport schemes in the county, either through direct use of the model forecasts, or through the use of the CSRM2 model to develop more detailed, 'sub-models' as the case with the A10.

To develop the A10E2C model the network and zone structure of the parent CSRM2 model was used as a basis from which enhancements in the area of the A10 study area were carried out. These enhancements ensured that the A10E2C model would have sufficient spatial detail to allow for a detailed assessment of proposed highway improvements on the A10. The wider CSRM2 highway model structure was maintained, thereby ensuring a link between the A10E2C and the parent CSRM2. This allows the A10E2C to have consistency with other schemes being tested in the CSRM2 and provides access to the demand modelling element of CSRM2. Further detail on the development of the A10E2C base model is provided in the LMVR[2]

The CSRM2 model has a variety of forecast scenarios, for different years. These are developed in iterations, reflecting regular updates to the forecasting assumptions (in terms of land use and transport schemes). The CSRM2 is a multi-modal model, with highway assignments run using SATURN software (and therefore the A10E2C model is also in SATURN), and with PT assignments and a variable demand model run in MEPLAN software.

Scheme improvements on the A10, including junction improvements, and a full dualling scenario, have previously been appraised using forecast models derived from the CSRM2 C-Series forecast. These forecasts were run through the full suite of CSRM2, including highway and PT assignments, and variable demand modelling. These were undertaken as part of the pre-SOBC for the A10 scheme and forecast reports produced describing the development of the 'do minimum' forecast[3] and the various 'do something' options[4]. It should be noted that the forecasts were undertaken for a single forecast year only (2031), for the AM and PM peak only, and using the CSRM2 'Foundation Case" forecasts (which were largely based on local plans to inform likely land uses in the future) from the C-Series.

The relationship between the base and forecast scenarios of the CSRM2 and A10E2C models is set out below.

[2] A10 Ely to Cambridge Transport Study, Local Model Validation Report, November 2018
[3] Ely to Cambridge Transport Study, Do Minimum Modelling Report, Feb 2018, Mott McDonald
[4] Ely to Cambridge Transport Study, Strand 1 – Options Modelling Report, Jan 2018, Mott McDonald

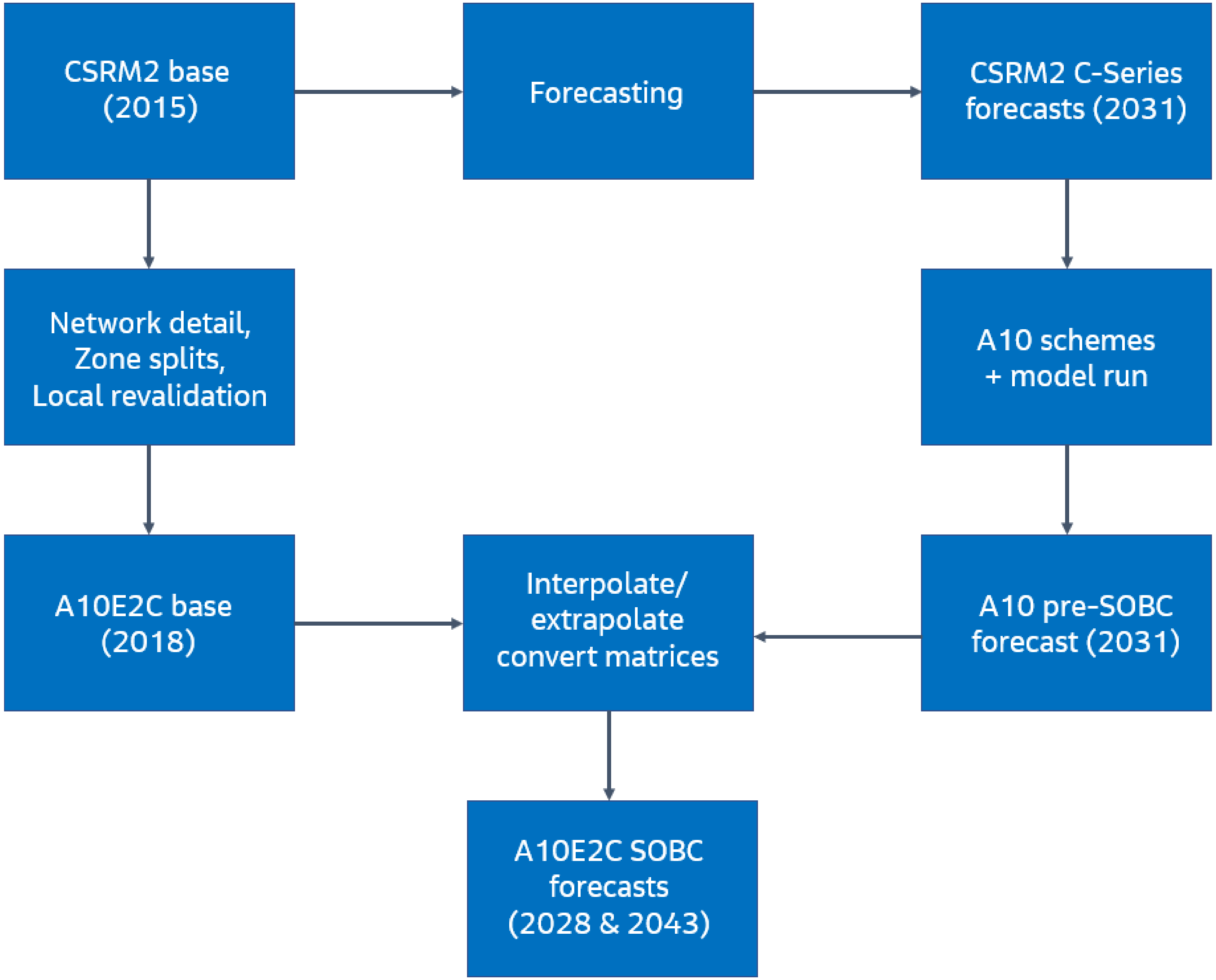


Figure 2-A: Relationship between A10E2C and CSRM2 models

Given the availability of the existing A10E2C base model and the CSRM2 forecasts, and in the absence of timely access to the CSRM2 for deriving bespoke forecasts for the SOBC, the approach to developing forecasts of the A10E2C at SOBC stage was to use the existing CSRM2 forecast scenarios developed for the A10 pre-SOBC. This made use of the functionality of the CSRM2 (including variable demand modelling), and was considered a proportionate approach (in line with Transport Analysis Guidance) to undertaking the modelling appraisal at the SOBC stage. The existing link between the A10E2C and CSRM2 also allowed forecasts from the latter to be readily converted for use for developing forecasts for the former.

The forecasting approach also considered the appraisal of dependent development at Waterbeach New Town; based on planning data it was identified that development at the New Town would be limited by capacity on the existing A10 and that development above a certain threshold could only take place once the capacity constraint could be satisfactorily addressed. Therefore, that portion of development above the limit was considered dependent on the scheme and a dependent development appraisal carried out.

There were some adjustments made to the CSRM2 forecasts in preparation for use in developing A10E2C. These included interpolation/extrapolation to the scheme opening and design years, adjustments to undertake an appraisal of dependent development, and combining the AM and PM peak forecasts to identify growth in the Interpeak period. More detail on this is provided in the sections below.

2.2 Forecast Years

The opening year for the proposed A10 scheme is anticipated to be 2028, hence that is the first forecast year selected for the modelling. The model also assessed a second forecast year,15 years post-opening, i.e. 2043

2.3 Forecast Demand

The forecast demand is derived from the demand in the CSRM2 forecasts as used for the pre-SOBC modelling. The forecasts developed for the pre-SOBC A10 appraisal provided the growth which was then applied to the A10E2C base model. The pre-SOBC demand matrices were the result of variable demand modelling (VDM) undertaken for scheme options similar to the options being assessed for the SOBC thus by using these to develop the A10E2C model forecasts, the effects of the scheme in terms of variable demand were already included and there was no need for any further VDM using the A10E2C model.

Due to the CSRM2 having a base year of 2015 and a forecast year of 2031 interpolation and extrapolation was required to derive the growth to apply to the A10E2C model (with a base year of 2018) for a forecast year of 2028 and 2043. Further adjustments were required to correctly address trip generation at new development generally, and at Waterbeach New Town specifically. The adjustments were as follows:

- New land developments included in the CSRM2 2031 forecasts as specific "development zones" were incorporated into the A10E2C forecast by interpolating/extrapolating the CSRM 2031 demand to a 2028 and 2043 forecast year according to each developments' phasing assumptions as understood from the CSRM2 forecast reports.
- In the specific case of development at Waterbeach New Town, the development trip generation for the 2043 forecast was additionally factored to represent a scenario in which only the non-dependent (deadweight) development is included, and then a scenario with the full build out (i.e. both the dependent and non-dependent development) included.
- Trip ends from the A10E2C base year matrices were factored up/down by growth rates calculated from the CRSM2 base and forecast year demand. The appropriate growth levels to go from the A10E2C base year to the two forecast years was determined by interpolation and extrapolation of the CSRM2 growth. The CSRM2 zone system has a one to many relationship with the A10E2C zone system, developed by splitting some CSRM2 zones, particularly in the vicinity of the A10 corridor; growth for each 'parent' CSRM2 zone was applied to the many 'offspring' A10E2C zones.

Further information on the development of the forecast demand is provided in section 4.

2.4 Forecast Network

The forecast networks of the A10E2C model were developed by adding all of the committed transport schemes which were included in the do minimum scenario of the pre-SOBC modelling, undertaken in the CSRM2 model. Because the A10E2C base year model was developed from the CSRM2 base year model, it was a relatively simple task of transferring the coding from the latter to the former. In addition, transport schemes detailed in the Transport Assessment for the Waterbeach New Town were also added to the network. In this way, the Do Minimum forecast networks were established.

For the Do Something scenarios, the appropriate coding for each scheme option was added to the Do Minimum network.

Further details on the forecast network development is provided in section 0.

2.5 Forecast Assignment

The forecast assignments were carried out using SATURN (version 11.4.07H, the same as used for the base model), with updated generalised costs specific to the forecast year, as calculated using values from the TAG data book. It was also consistent with the CSRM2 forecast modelling approach in that traffic signals were optimised using SATURN's SIGOPT option.

Additional reporting on the forecast assignment including the convergence levels achieved is provided in section 0.

2.6 Summary of Scenarios

The following table summarises the combination of forecast year, dependent development, and scheme options that were tested to produce the final set of scenarios:

No.	Scheme option	Forecast Year	Dependent Development
1	Do Minimum (no scheme)	2028	n/a – all development is independent in 2028
2-8	Do something (seven different options)	2028	n/a – all development is independent in 2028
9	Do Minimum (no scheme)	2043	Dependent development (at Waterbeach New Town) excluded
10-16	Do something (seven different options)	2043	Dependent development (at Waterbeach New Town) excluded
17-23	Do something (seven different options)	2043	Dependent development (at Waterbeach New Town) included

Table 2.2: List of scenarios

An AM peak, Interpeak, and PM peak time period was modelled for each of the 23 scenarios listed above.

3. Forecast Network

3.1 Committed Transport Infrastructure Schemes

Following the proposed approach, the A10 model forecast year do-minimum (DM) scenario network for year 2028 and 2043 was constructed with all committed transport infrastructure schemes.

The basis of the network for the DM scenario for the A10E2C is a forecast of the CSRM2 model developed for the pre-SOBC work, known as the “Mode-shift” package, which included committed transport schemes as they were understood at the time the models were developed. It was noted in the pre-SOBC work that whilst the Mode-Shift package did show positive impacts on mode choice for trips using the study corridor but that despite this the improvement in highway performance was limited. This confirmed the conclusion that the package would need to incorporate highway supply-side as well as demand-side measures.

These schemes in the “Mode-Shift” package included:

- New or improved walking and cycling routes between Ely, Waterbeach and Cambridge
- New high-quality segregated bus provision between the new town north of Waterbeach and Cambridge
- New bus and rail P&R sites at the new town north of Waterbeach, to remove car trips from southern section of A10
- Existing Waterbeach station relocated closer to the new town north of Waterbeach

Since the pre-SOBC models were developed, the assumption regarding non-highway schemes has evolved such that the schemes now assumed to form the DM scenario for the A10 appraisal include:

- Waterbeach station relocation and rail based park and ride (200 spaces)
- Mere Way cycleway
- Bridge across the A10 for NMU from Waterbeach towards Landbeach
- Milton cycleway improvements
- Denny End Rd junction localised widening
- Stretham RB (northern approach widening)
- Local bus services from Waterbeach new town to Biomedical Campus (route 19)

As none of these were highway schemes, they were not carried across to the forecast network of the A10E2C, although the impact of these measures on the highway demand, in terms of mode-shift, was reflected in the development of the demand for the A10E2C forecast, as described in section 4.

Whilst the exact nature of the scheme continues to evolve, the impacts that these would have on highway trips, in terms of effecting mode shift is considered to be broadly the same as what the pre-SOBC “Mode-shift” package modelled, hence the reason for using that scenario as the basis for the DM for the A10E2C model.

This includes the following major highway infrastructure schemes, which were added to the A10E2C base model to form the forecast year DM network:

- A428 Black Cat to Caxton Gibbet dualling scheme;
- A14 Improvement Scheme as of Design Freeze 3;
- Ely Southern Bypass; and
- Northstowe Phase 2 – link road to Bar Hill known as Southern Access Road (West).

The CSRM2 DM scenario network also includes more localised planned and projected improvements to the extent that information was available at the time of producing the network coding. These schemes are associated with land development projects listed below:

- Cambridge East
- Cambridge West;
- Clay Farm;
- Darwin Green;
- Cambridge North West;
- Ely North;
- Alconbury Weald;
- Bearscroft Farm, Godmanchester;
- St Neots East;
- Bourn Airfield;
- Cambourne West;
- Hauxton;
- Northstowe Phase 1
- Waterbeach

The figure below illustrates the location of the schemes within the updated modelled network (to the extent that they include new links):

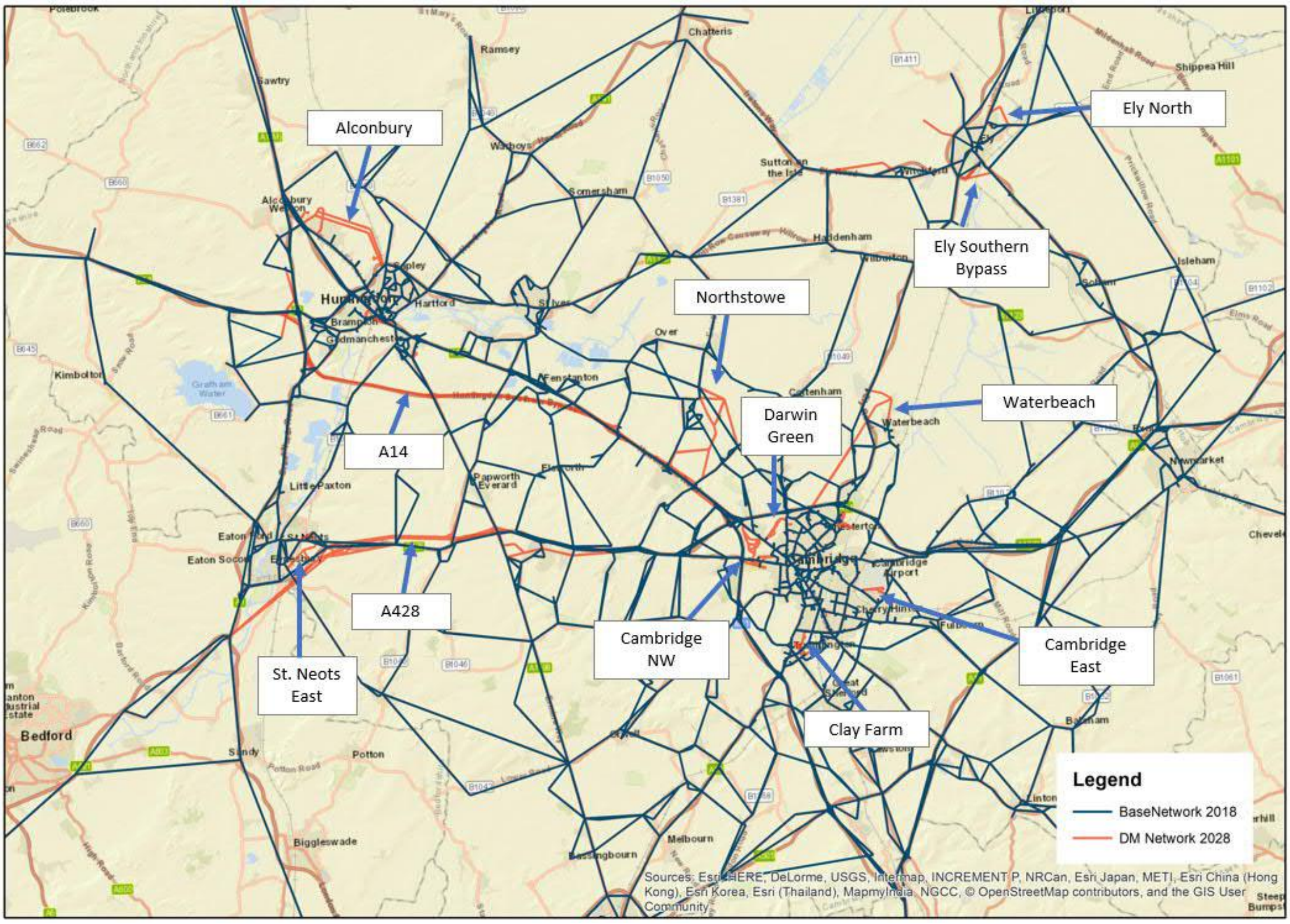


Figure 3-A: Overview of committed schemes from CSRM2 pre-SOBC DM scenario carried over to A10E2C model forecast

In addition, a few confirmed local improvements along the A10 were also added. These schemes were detailed in the Transport Assessment for the first phase of Waterbeach New Town, which is well progressed in the planning system and has a high likelihood of coming forwards. These include:

- Milton Interchange;

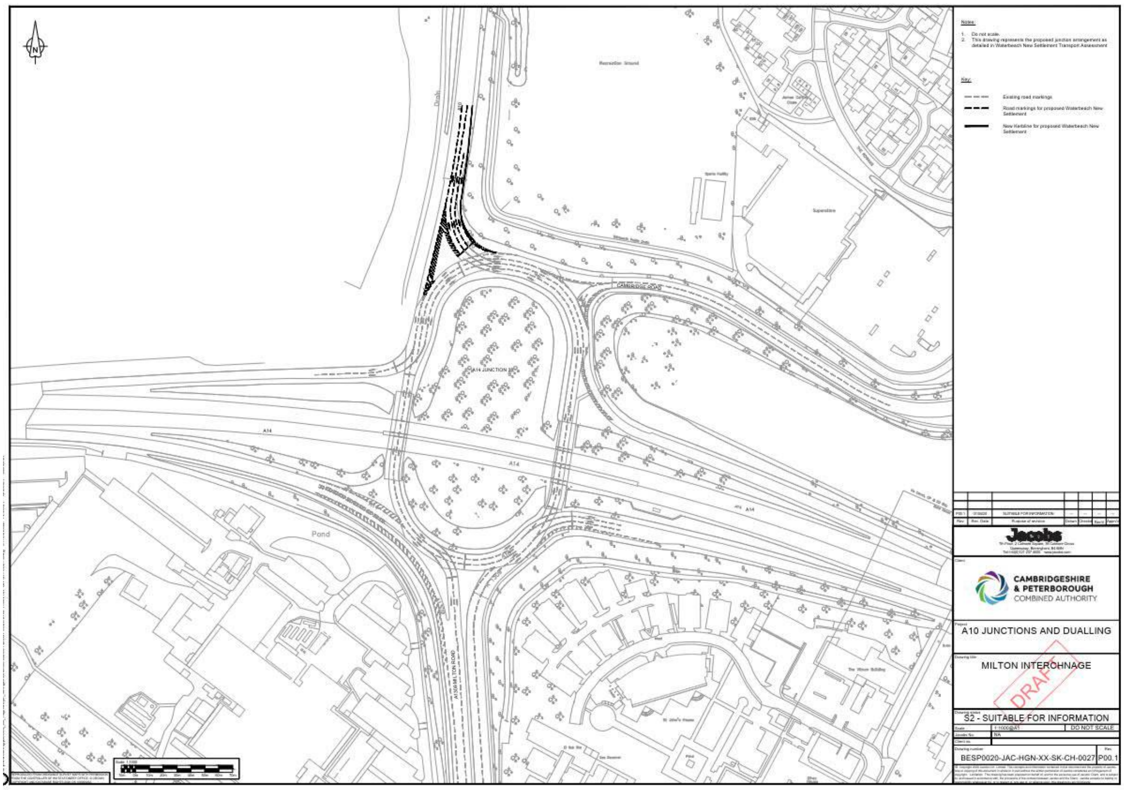


Figure 3-B Milton Interchange Scheme Drawing

- Butt Lane Park and ride;

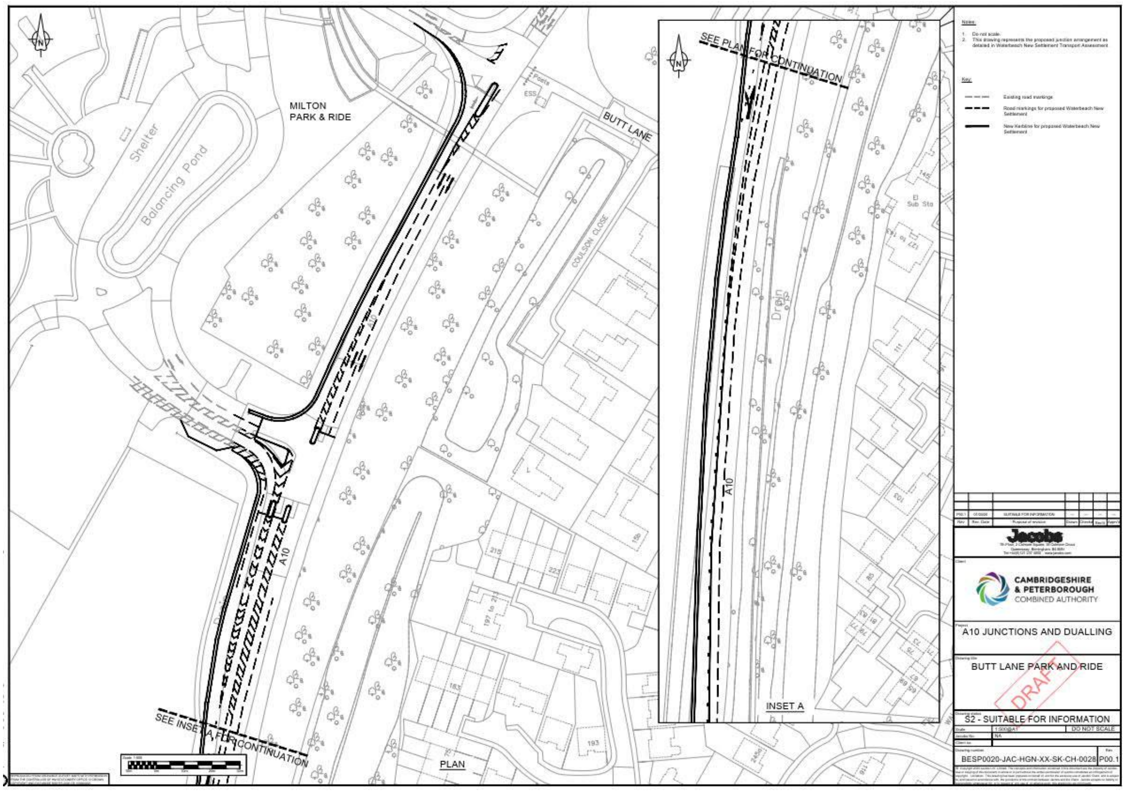


Figure 3-C Butt Lane Park and Ride Scheme Drawing

- Denny End Road;

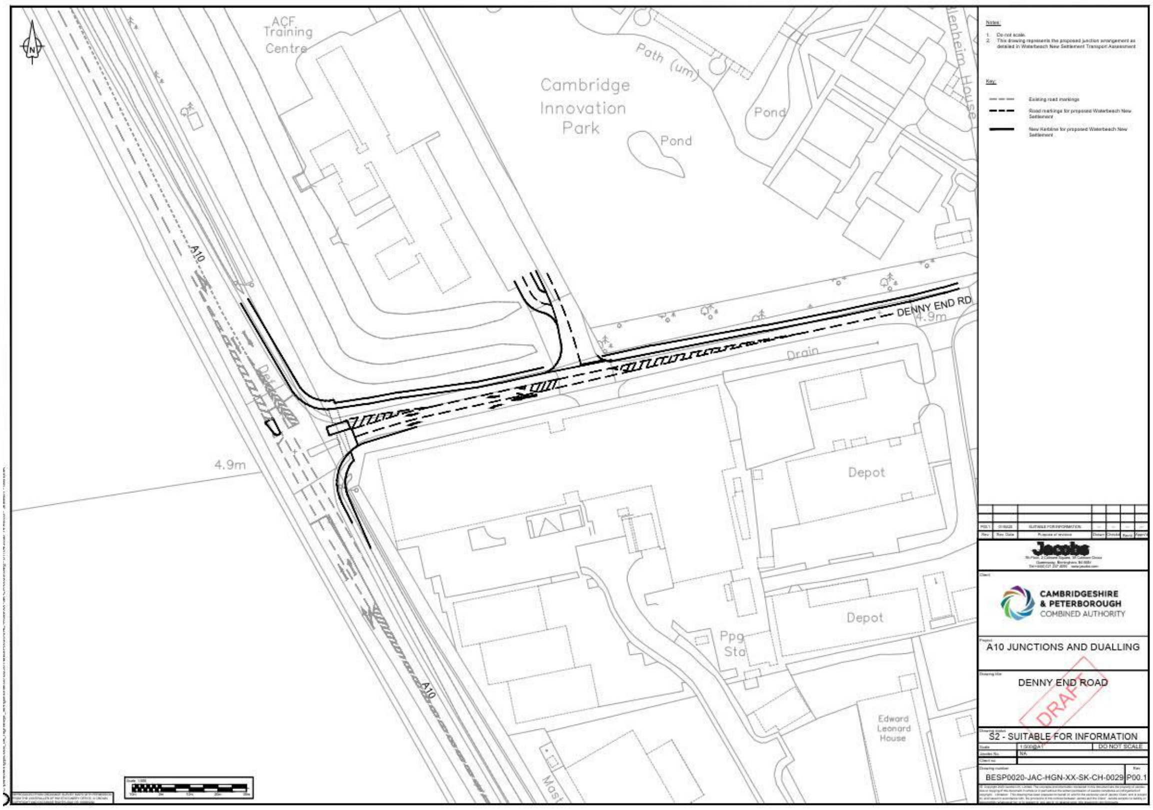


Figure 3-D Denny End Road Scheme Drawing

- Cambridge Research Park; and

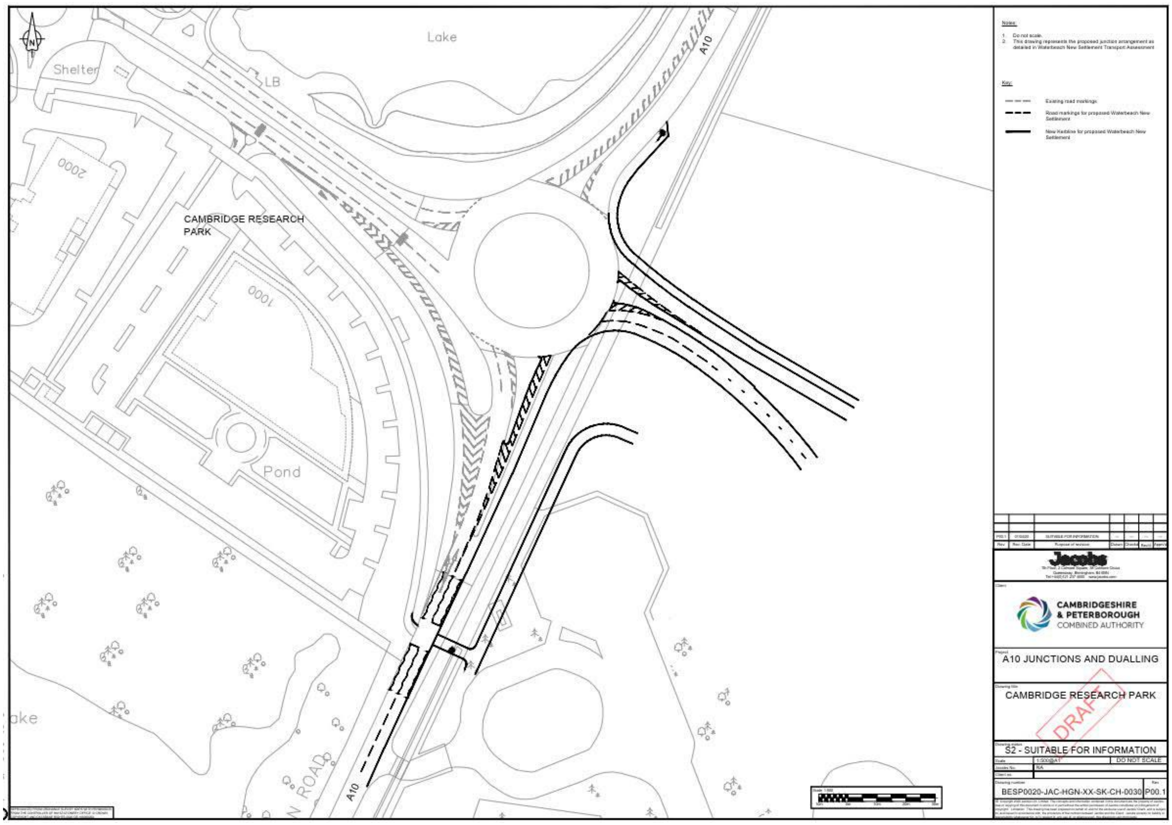


Figure 3-E Cambridge Research Park Scheme Drawing

- Stretham Roundabout.

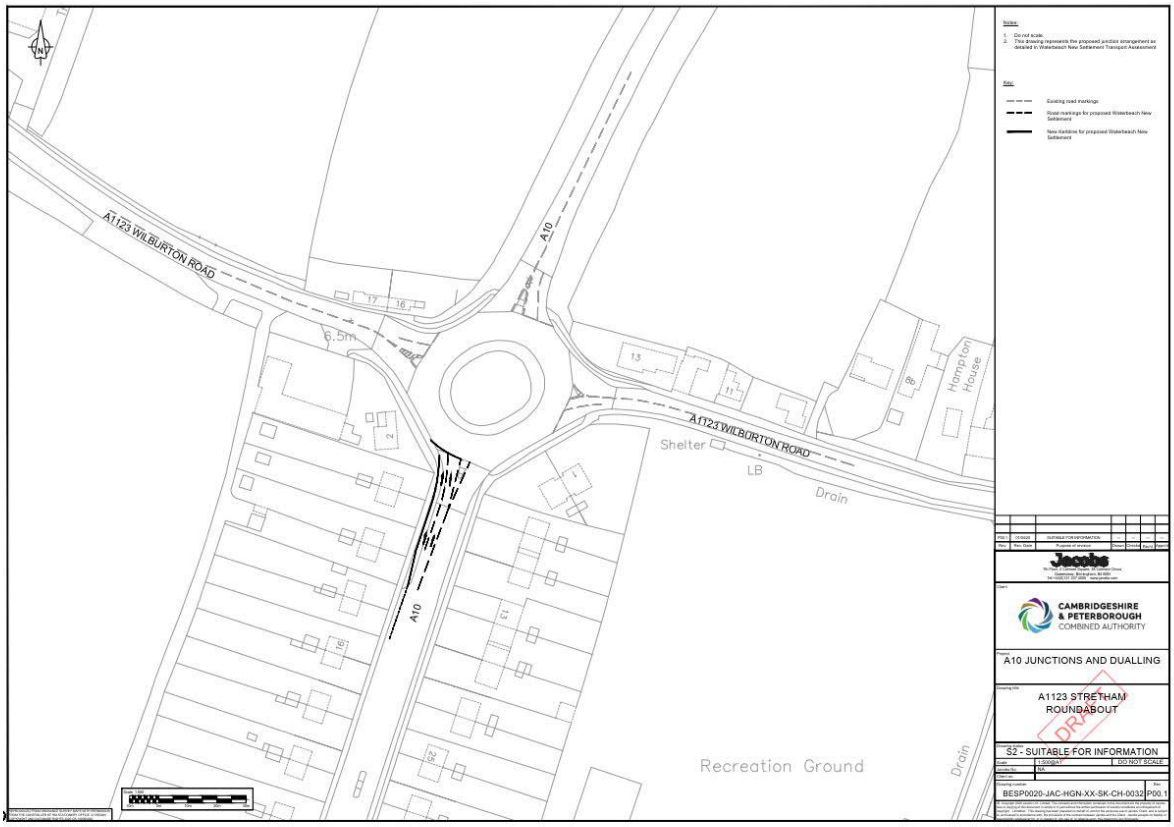


Figure 3-F Stretham Roundabout Scheme Drawing

3.2 Tested Transport Infrastructure

On top of A10 forecast year DM network, seven scheme options were tested in different Do Something scenarios. The options are listed in Table 2.1, and are further detailed below.

3.2.1 Option A

Option A comprises of predominantly online full length dualling, bypassing the key pinch points east of Milton and at Stretham (via a bypass to the west) and Little Thetford. A schematic illustrating this option is below:

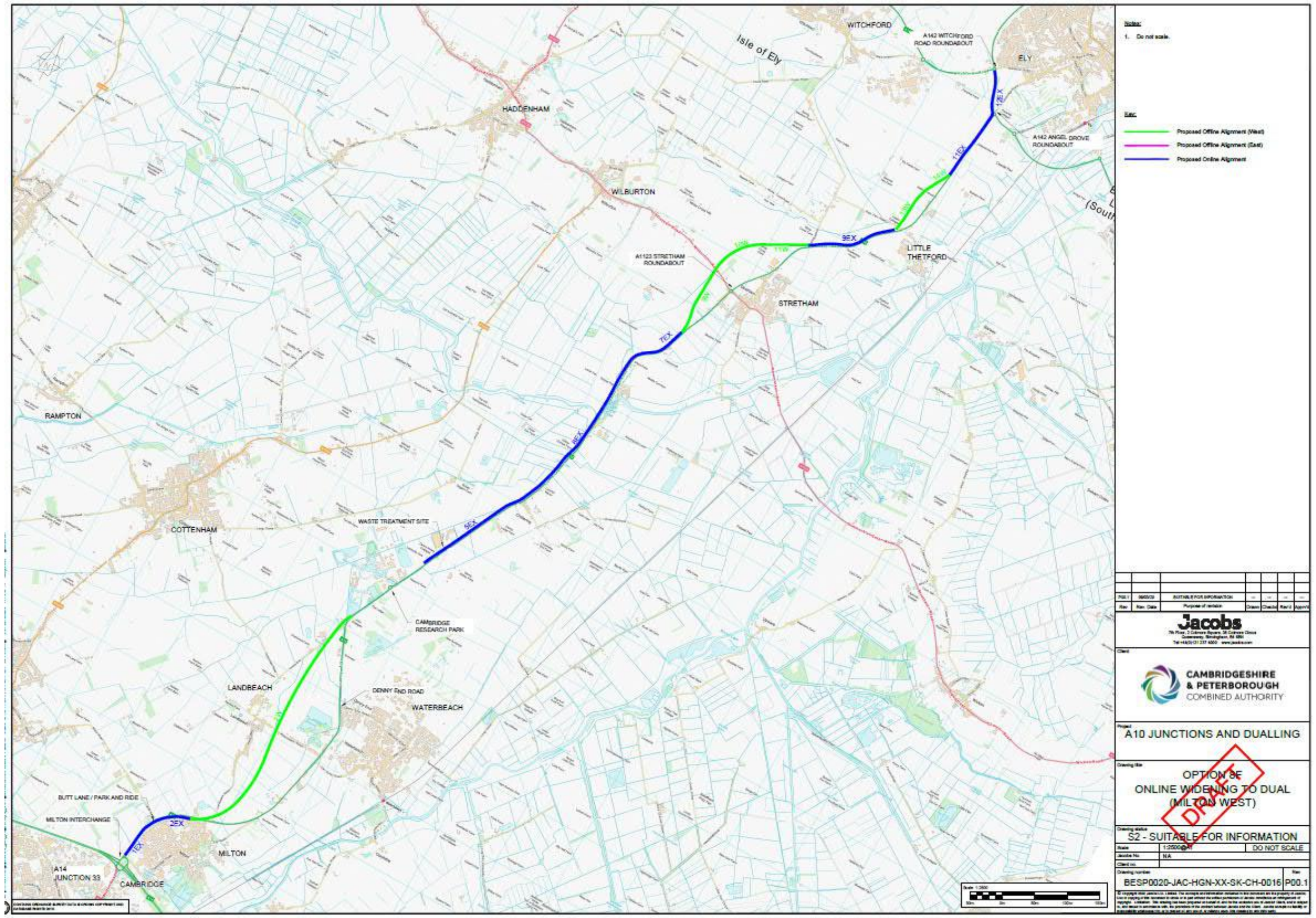


Figure 3-G Option A schematic drawing

Within the image, off line sections of the new scheme (i.e. where the alignment deviates from the existing A10) are shown in green. At the point at which these sections meet the existing A10 alignment, a roundabout junction has been assumed, with no other junctions to existing connections, with the exception of the road north from Landbeach (Green End) which forms a left-in/left-out priority junction with the dualled road.

3.2.2 Option B

Option B comprises of predominantly online full length dualling, bypassing the key pinch points east of Milton and at Stretham (via a bypass to the East) and Little Thetford. A schematic illustrating this option is below:

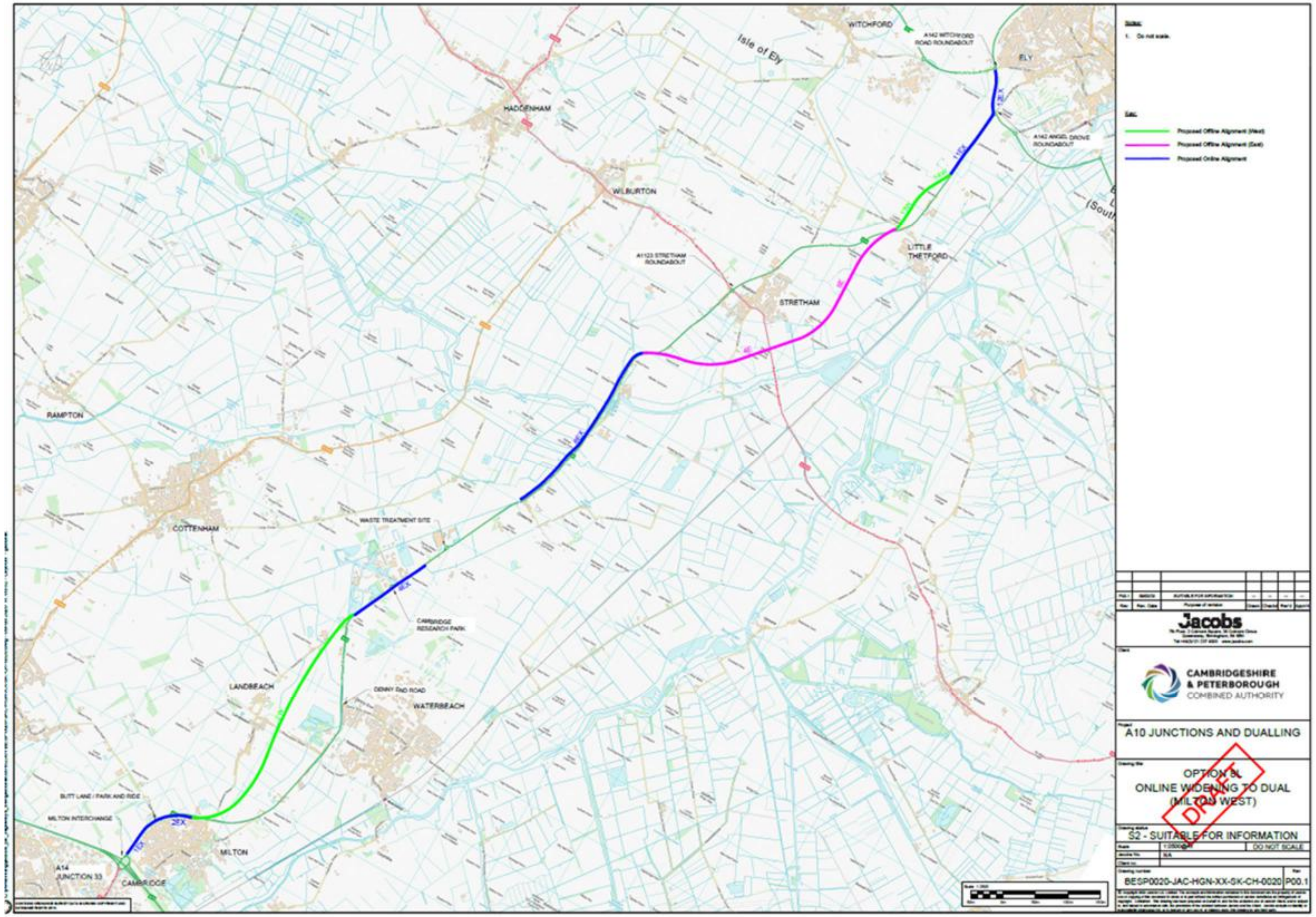


Figure 3-H Option B schematic drawing

The offline sections of the scheme (shown in green and pink in the above image) share the same principles of connections to the existing network as does option A, i.e. there is a roundabout at all points where the offline section deviates from the main line, and with no other connections with existing roads apart from a left-in/left-out junction with Green End.

3.2.3 Option C

Option C comprises offline dualling of the southern section to Cambridge Research Park with selected junction improvements to the north, where the road is maintained as a single carriageway. A schematic illustrating this option is below:

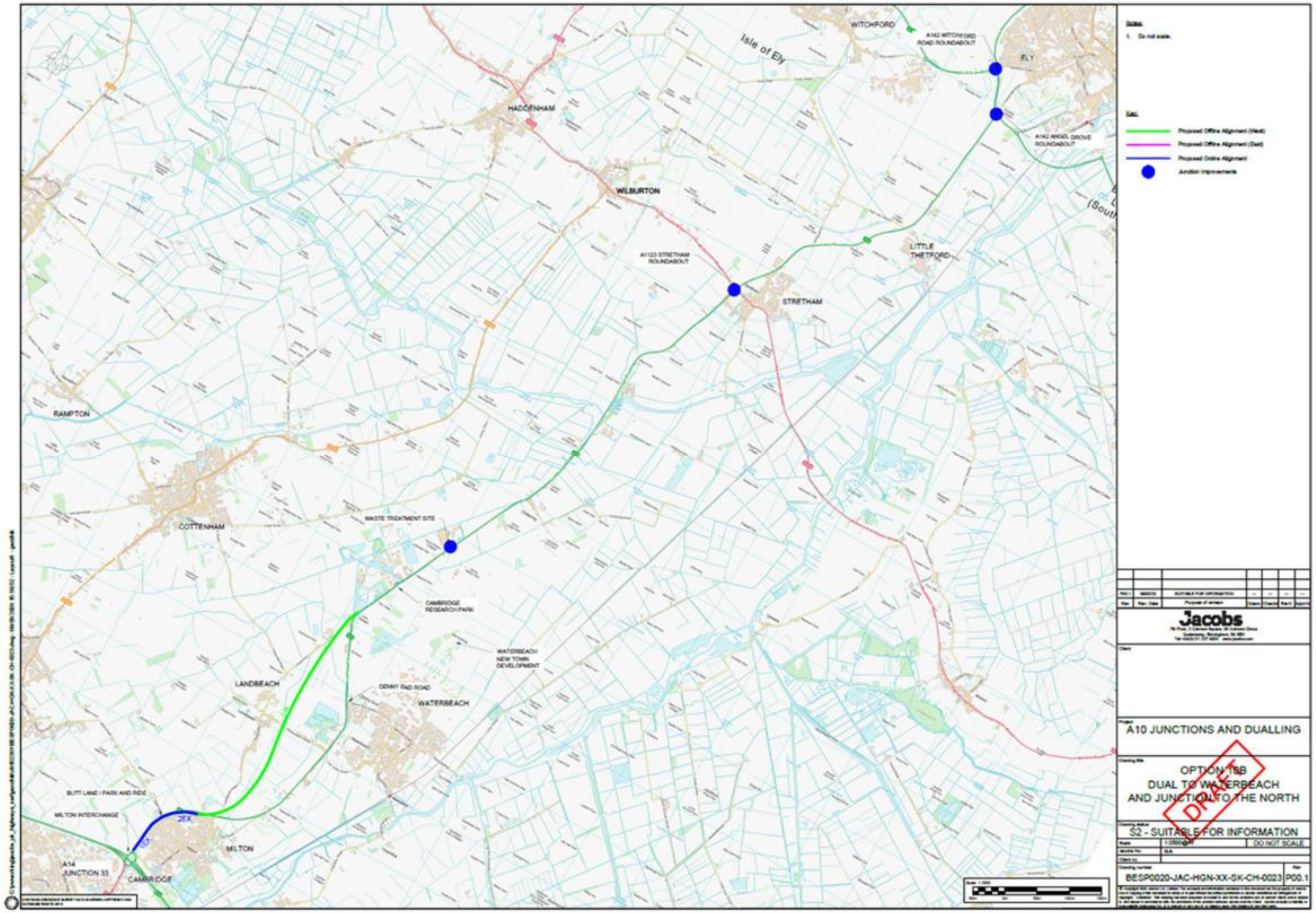


Figure 3-I Option C schematic drawing

Within this option, the offline section indicated in green has the same connection with existing links as does Option A, i.e. a roundabout with the existing A10 at the start and end of the offline section, a left-in/left-out priority junction with Green End, and no other connections. The locations of junction improvements are indicated as blue dots.

3.2.4 Option D

Option D comprises full length, offline dualling. A schematic illustrating this option is below:

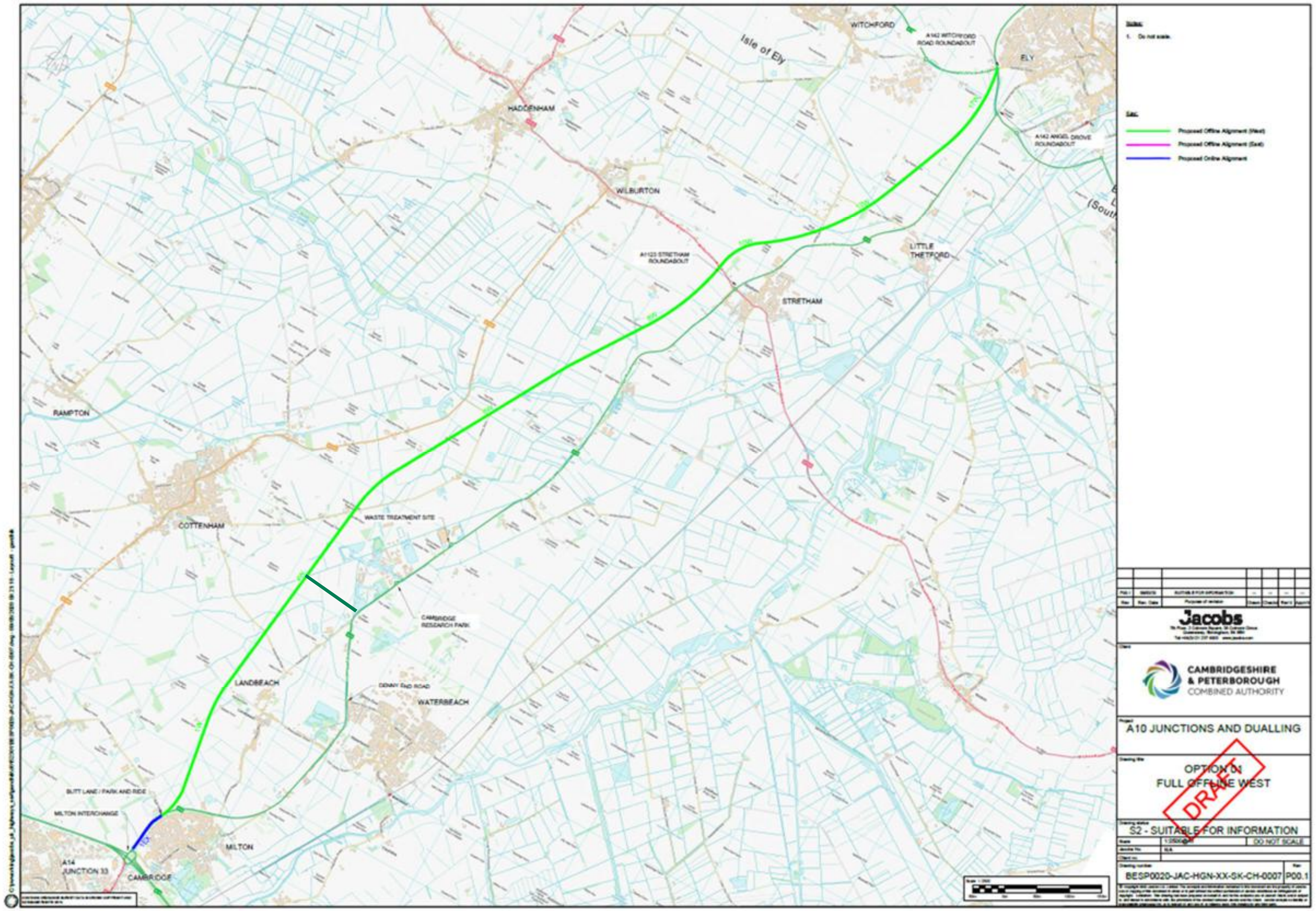


Figure 3-J Option D schematic drawing

The off-line section for this option is identified in green. At the southern end of the offline section, there is a roundabout junction with the existing A10. There is also a connecting link between the new alignment and the existing A10, shown in dark green in the image above. This has a left-in/left-out priority junction at either end. There is a four-arm roundabout connecting the new off-line section with the A1123 Wilburton Road west of Stretham, and finally, at the northern end, the new off-line section forms a new arm of the existing A10/A142 Witchford Road junction. Aside from these junctions there are no other connections with existing roads.

3.2.5 Option E

Option E plans to maximise the extent of online dualling, whilst bypassing the key pinch points at Stretham (via a bypass to the west) and Little Thetford. A schematic illustrating this option is below:

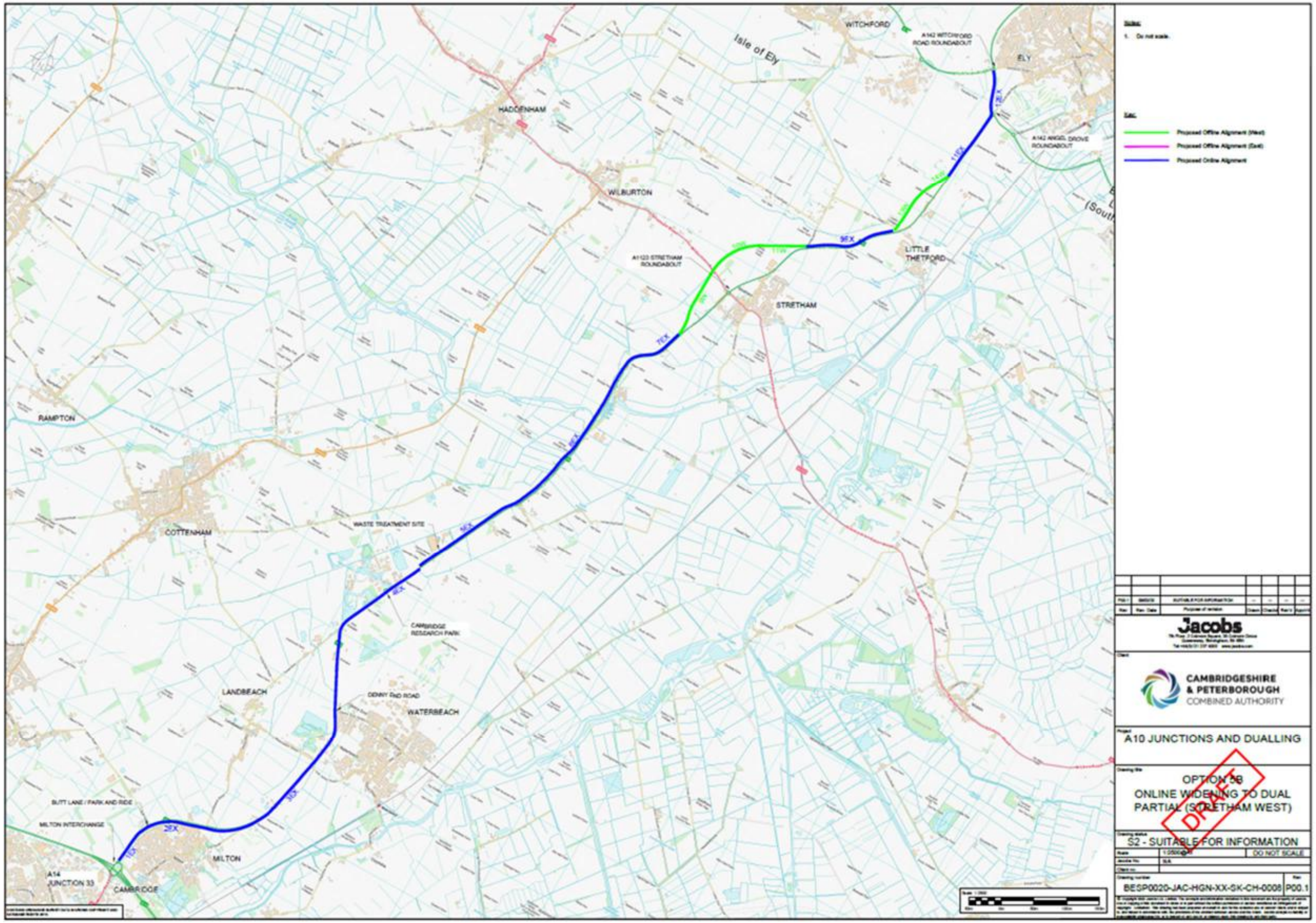


Figure 3-K Option E schematic drawing

In this option, the offline sections shown in green share the same connections with the existing network as in option A.

3.2.6 Option F

Option F comprises of online dualling of the southern section (as far as Cambridge Research Park) with, to the north of this point only capacity improvements to selected junctions, and no dualling. A schematic illustrating this option is below:

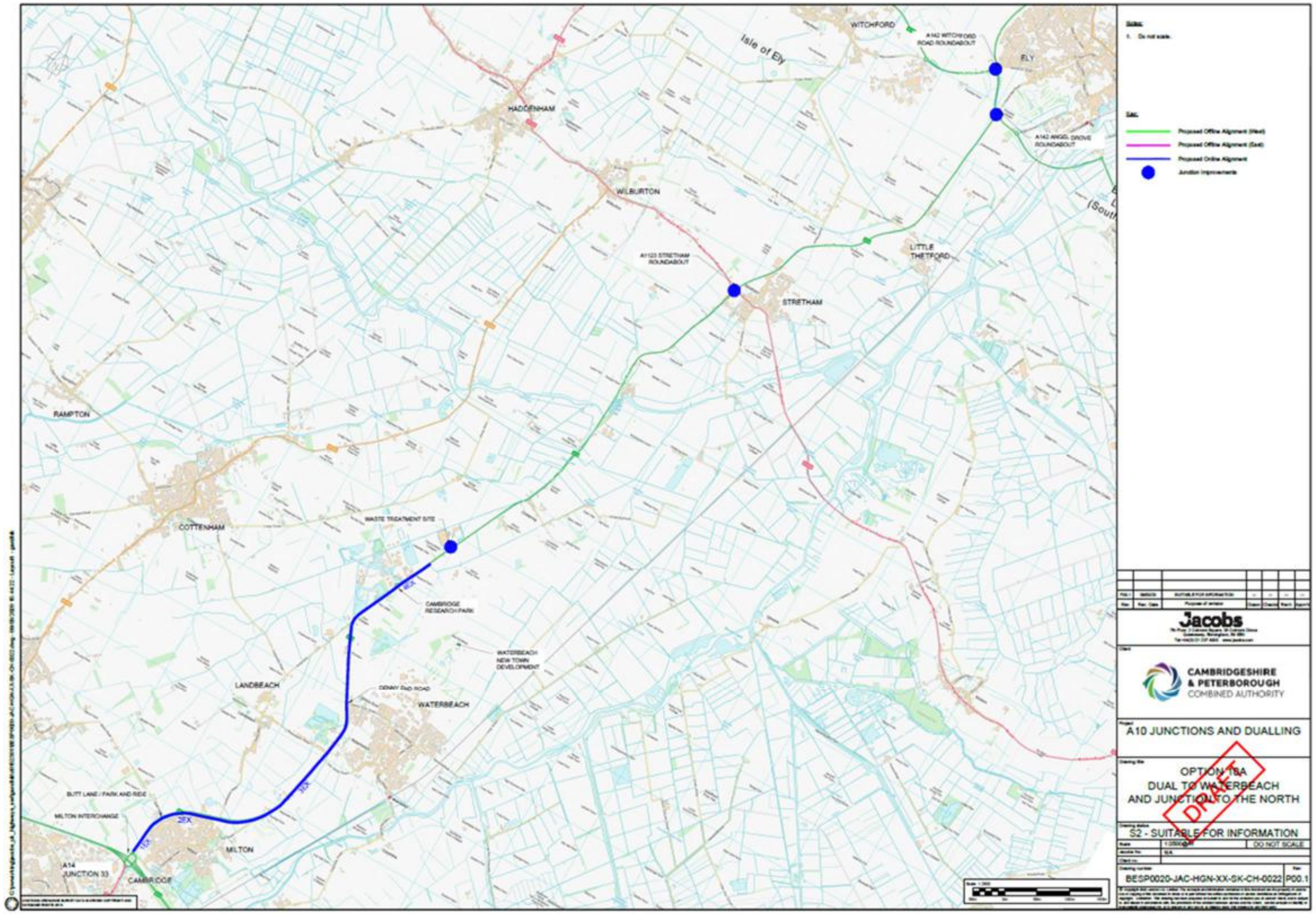


Figure 3-L Option F schematic drawing

The blue dots indicate junctions which have improvements.

3.2.7 Option G

Option G comprises junctions capacity improvements at selected locations, with the A10 retained as a single carriageway road. A schematic illustrating this option is below:

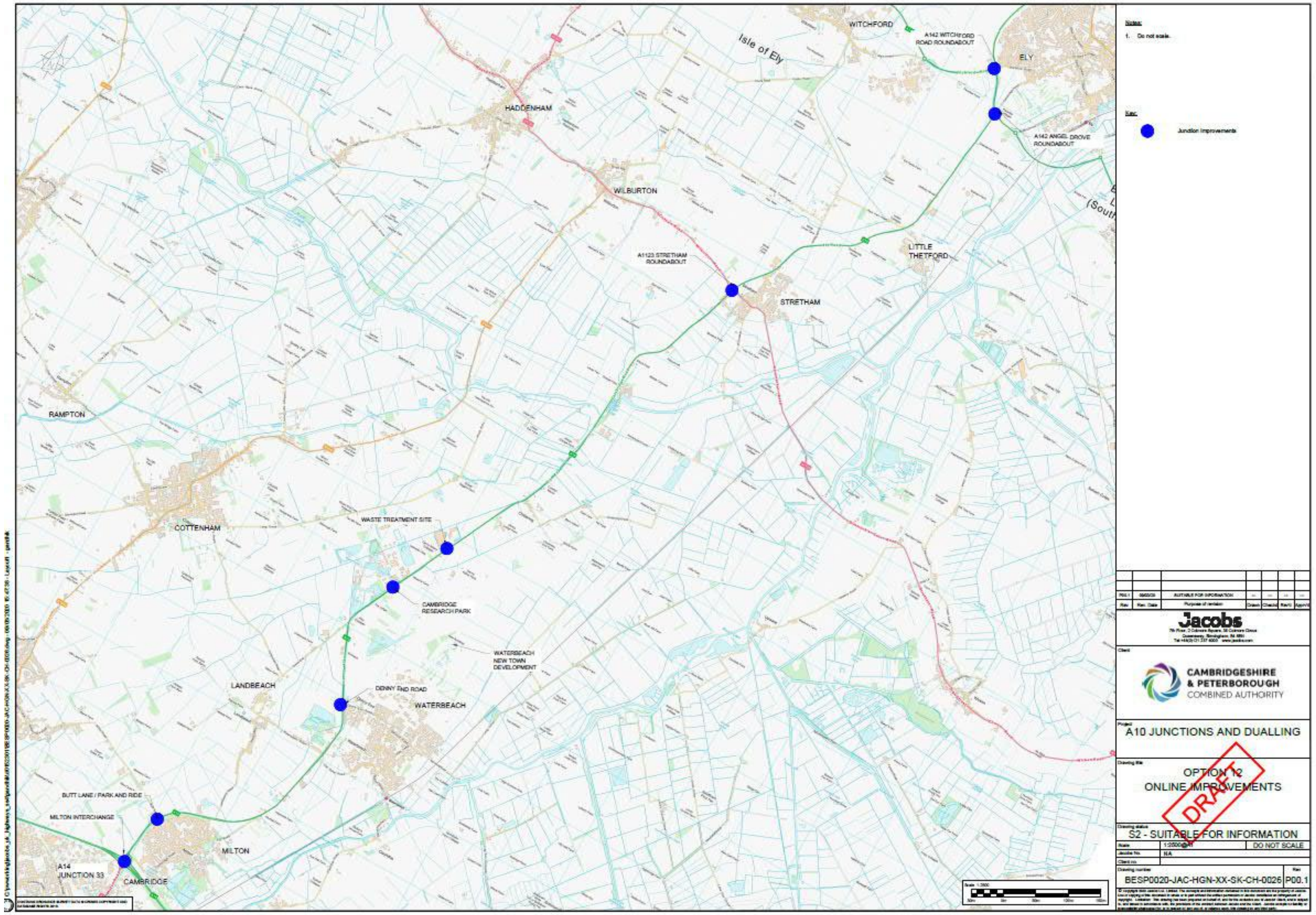


Figure 3-M Option G schematic drawing

For this option, all upgraded junctions are modelled on the assumption that they will operate within capacity, thus have sufficient saturation flow etc. to accommodate the traffic demand.

3.3 Signalised Junctions

In the forecast year highway networks, traffic signals were optimised using SATURN's SIGOPT option. This reflected the assumption that signal settings for existing junctions would be continually refreshed as traffic patterns change, and also gives the opportunity for the timings for any proposed new junction to be optimised once the new traffic exists in the model. This is a global parameter, so all traffic signals (both existing and new junctions) were optimised in all scenarios.

3.1 User Classes, Vehicle Operating Cost, and Value of Time

Value of time and the parameters for vehicle operation cost were updated for 2028 and 2043 model networks. Table 3.1 and Table 3.2 gives the values of time by vehicle type and travel purposes and vehicle operation cost parameters by distance in terms of pence per minute (PPM) and pence per kilometre (PPK).

A10E2C model has 12 user classes defined. They are:

- User class 1 - Car home base work with low income
- User class 2 - Car home base work with medium income
- User class 3 - Car home base work with high income
- User class 4 – Car Education
- User class 5 - Car employ business
- User class 6 - Car Other with low income
- User class 7 – Car other with medium income
- User class 8 - Car other with high income
- User class 9 – HGV
- User class 10 – HGV (Huntington)
- User class 11 – LGV
- User class 12 – LGV Business

The TAG data book (May 2019) was used to define PPM and PPK.

Year 2028		AM		IP		PM	
Purpose	UC	ppm	ppk	ppm	ppk	ppm	ppk
HBW- Low	1	9.77	5.13	9.46	5.13	9.78	5.13
HBW-Medium	2	16.48	5.13	15.95	5.13	16.51	5.13
HBW-high	3	30.00	5.13	29.05	5.13	30.07	5.13
Education	4	16.94	5.13	18.96	5.13	18.95	5.13
Empl Business	5	34.86	11.05	35.72	11.05	35.36	11.05
Other- Low	6	9.25	5.13	9.38	5.13	9.37	5.13
Other-Medium	7	15.64	5.13	15.86	5.13	15.86	5.13
Other- high	8	25.94	5.13	26.31	5.13	26.29	5.13

Year 2028		AM		IP		PM	
Purpose	UC	ppm	ppk	ppm	ppk	ppm	ppk
HGV	9	50.03	42.00	50.03	42.00	50.03	42.00
HGV (Huntington)	10	50.03	42.00	50.03	42.00	50.03	42.00
LGV	11	24.64	13.48	24.64	13.48	24.64	13.48
LGV-Business	12	24.64	13.48	24.64	13.48	24.64	13.48

Table 3.1: Parameters for 2028 vehicle operating cost and value of time

Year 2043		AM		IP		PM	
Purpose	UC	ppm	ppk	ppm	ppk	ppm	ppk
HBW- Low	1	12.99	4.36	12.58	4.36	13.02	4.36
HBW-Medium	2	21.93	4.36	21.23	4.36	21.97	4.36
HBW-high	3	39.92	4.36	38.65	4.36	40.01	4.36
Education	4	22.54	4.36	25.23	4.36	25.22	4.36
Empl Business	5	46.38	9.21	47.53	9.21	47.05	9.21
Other- Low	6	12.31	4.36	12.48	4.36	12.47	4.36
Other-Medium	7	20.81	4.36	21.11	4.36	21.10	4.36
Other- high	8	34.52	4.36	35.00	4.36	34.98	4.36
HGV	9	66.56	44.08	66.56	44.08	66.56	44.08
HGV (Huntington)	10	66.56	44.08	66.56	44.08	66.56	44.08
LGV	11	32.78	12.84	32.78	12.84	32.78	12.84
LGV-Business	12	32.78	12.84	32.78	12.84	32.78	12.84

Table 3.2: Parameters for 2043 vehicle operating cost and value of time

4. Forecast Demand

4.1 Overview

The forecast year demand, for 2028 and 2043, was generated by adding growth to the trip ends of the base year matrices, and then factoring the base matrices up to meet those target trip ends, in a process known as "furnessing". The trip end targets were calculated slightly differently depending on whether the demand was being calculated for a modelled zone already contained with the base model, or for a new zone added to the forecast to represent new land development:

- For the base year zones, trip end growth rates were calculated based on the growth in the CSRM2 model from the pre-SOBC forecasts i.e. trip end growth from the CSRM2 2015 base year to the appropriate 2031 forecast scenario was calculated and then adjusted to represent growth between the A10E2C 2018 base year and the 2028/2043 forecast year, and then applied to the A10E2C base year trip ends.

- For new zones representing forecast developments in the CSRM2 the new zone was added to the A10E2C forecast and the trip generation was factored appropriately to reflect the assumed development phasing in 2028 or 2043 (the A10E2C forecast years) compared to 2031 (the CSRM2 forecast year).

These two parts' demand then combined together to form the A10 model trip ends, which were then used to factor up the demand from the base year to the forecast year. Figure 4-A describes the process in more detail.

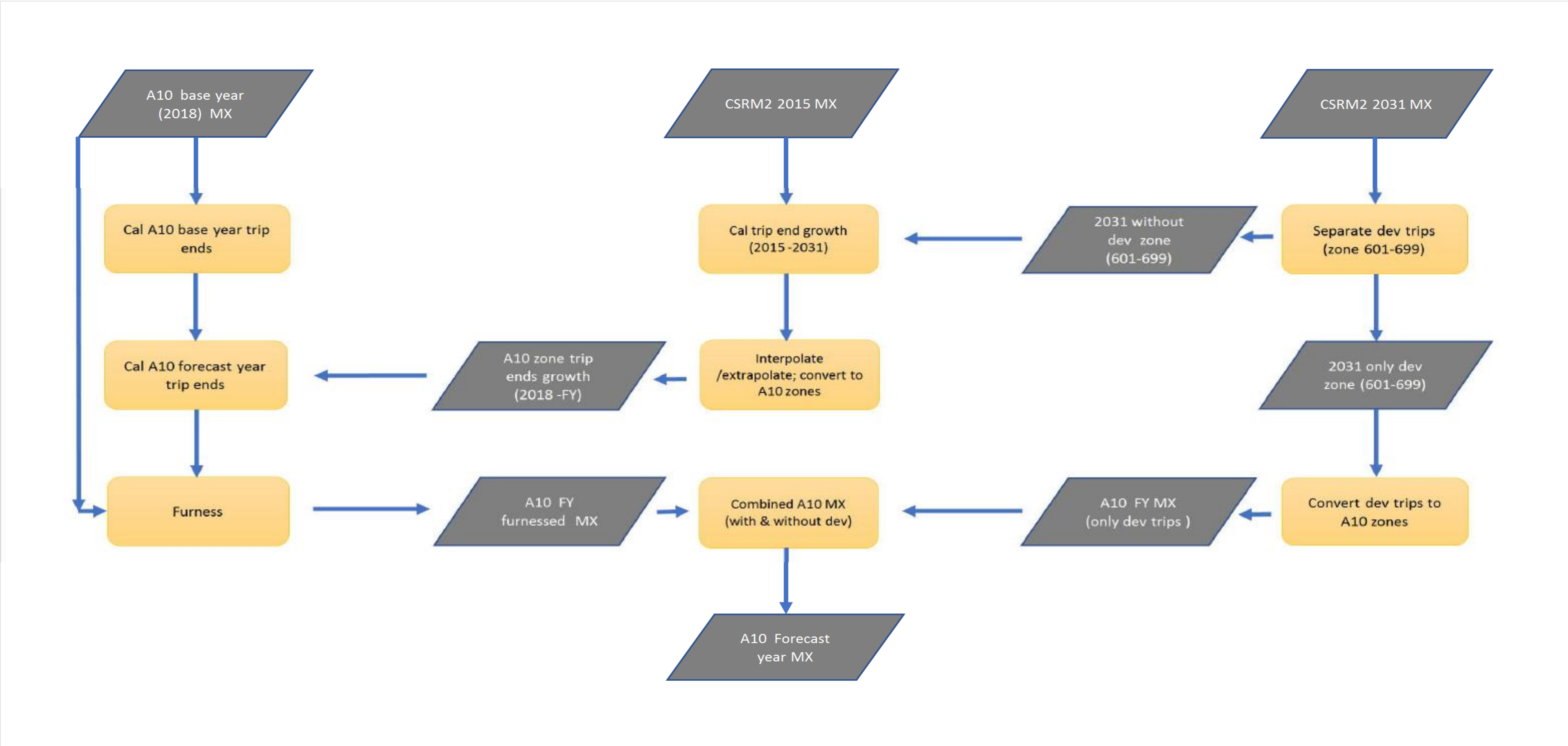


Figure 4-A: Forecast demand development summary

The process was undertaken using the forecast matrices from the pre-SOBC forecast scenarios which most closely matched to the A10E2C scenarios:

- The pre-SOBC 'Mode-shift' package matrices were used to develop the A10E2C DM. This ensured that the effects on the demand of the PT schemes which are assumed to form part of the do minimum for the A10 scheme appraisal were included as a result of the pre-SOBC modelling having utilised the Variable Demand Modelling functionality of CSRM2.
- The pre-SOBC 'Junctions+' package matrices were used for Option G matrices. The Junctions+ package included junction improvements to the same set of junctions are included in Option G. It also included the PT schemes included in the 'Mode-Shift' package. Thus, the effects of VDM modelling on Option G are included within the matrices.
- The pre-SOBC 'Full-dual' package matrices were used for the matrices for Options A to F. The 'Full dual' package included the variable demand effects due to dualling of the full length of the A10 between Cambridge and Ely, thus these effects were thereby carried over into A10E2C forecasts.

4.2 CSRM2 and A10E2C model zone systems

As the A10E2C model is derived from the parent CSRM2, the zone structure is identical, except for some CSRM2 zones split into a finer level of detail in the A10E2C model. The detail of the zones and the zone splits is provided in the LMVR for the A10E2C model. This also provides the method used for splitting the trips from the parent CSRM2 zones to the offspring A10E2C model; the methodology utilises demographic data from Census statistics available at Output Area level. The relationship between the parent zone CSRM2 zone and the split A10E2C zone was important to understand to ensure that growth from the CSRM2 model is correctly transferred to the zones of the A10E2C model.

In addition, both models have spare zones in the base year model intended be used for "Future Development" trip generation.

4.3 CSRM2 Forecast Year New Developments

Future year development information came from the CSRM2 C-series Forecast[5] and the inclusion of development in the A10E2C forecasts is consistent with that. Section 3 of that report detailed the major development sites and Appendix B the additional dwellings and jobs for all development allocated to CSRM2 zones. Figure 4-B is a duplication of the table containing the major development sites.

[5] Cambridge Sub-Regional Model 2, C-Series Model Forecasting Report, January 2018, Atkins.

Table 3-2 Major development sites with absolute growth in dwellings and jobs

District	Site name	CSRM2 Zone	Number of additional dwellings			Number of additional jobs		
			2011-2015	2015-2031	2011-2031	2011-2015	2015-2031	2011-2031
Cambridge City Council (CCiC)	Addenbrooke's	147	-2	552	550	890	4,113	5,002
	ARM / Capita Park (City)	116	-1	40	39	208	1,178	1,386
	Cambridge East	614	-	1,280	1,280	-	-	-
	Cambridge West	140	9	1	10	24	1,330	1,354
	Clay Farm	155, 613	852	1,533	2,385	42	4	46
	Darwin Green	611	-	1,627	1,627	-	-	-
	Northern Fringe (City)	120	1	-1	-	1,885	1,653	3,538
	NW Cambridge - Cambridge University	615	-	1,850	1,850	-	742	742
South Cambridgeshire District Council (SCDC)	Bourn Airfield	297	-	1,360	1,360	19	1,306	1,325
	Cambourne West	608	-	1,200	1,200	-	1,550	1,550
	Cambridge East	620	-	480	480	-	-	-
	Darwin Green	610	-	1,000	1,000	-	-	-
	Hinxton	269	2	-	2	700	476	1,176
	Northern Fringe (SCDC)	204	-	-	-	-	1,336	1,336
	Northstowe Phase 1	602	-	1,500	1,500	-	842	842
	Northstowe Phase 2	603	-	3,500	3,500	-	3,370	3,370
	NW Cambridge- University Site	609	-	1,155	1,155	-	1,608	1,608
	Waterbeach	606	-	2,050	2,050	-	996	996
Huntingdonshire District Council (HDC)	Alconbury Weald Centre	616	-	2,500	2,500	-	3,620	3,620
	Alconbury Weald South	601	-	2,500	2,500	-	1,207	1,207
	Bearscroft Farm, Godmanchester	612	-	753	753	-	578	578
	Ermine Street	502	1	1,440	1,441	39	3	42
	St Neots East	604	-	3,820	3,820	-	1,546	1,546
East Cambridgeshire District Council (ECDC)	Lancaster Way and Business Park	402	23	-	23	465	1,757	2,222
	Littleport	413	177	1,787	1,964	773	459	1,232
	North Ely	605	-	3,000	3,000	-	398	398

Figure 4-B: Major Development sites in CSRM2 forecast

Figure 4-C below is an extract from the dwelling projection table contained in Appendix B in the CSRM2 C-series Forecast[6] report and illustrates the detail of the data available. The Housing Inventory can be found in section B.1 (pages 111-183) and the Employment Inventory can be found in section B.2 (pages 183-190).

Cambridge Sub-Regional Model 2
C-Series Model Forecasting Report

B.1. Housing inventory

Table B-1 Dwelling projection in 5 year periods for all four districts

District	Classification	Site Name and Address	2012-2016	2017-2021	2022-2026	2027-2031	2032-2036	2037-2041	2011-2041	CSRM2 zone
Cambridge	Windfall	Unidentified windfall	121	495	615	619			1,850	N/A
Cambridge		Total - NIAB	-	400	414	-			814	611
Cambridge		Total - NIAB	-	400	414	-			814	611
Cambridge		Total - Clay Farm	73	661	-	-			734	613
Cambridge		Total - Clay Farm	-	661	-	-			661	613
Cambridge		Total - Clay Farm	90						90	155
Cambridge		Cambridge East Land North of Cherry Hinton	-	270	250	121			640	614
Cambridge		Cambridge East Land North of Cherry Hinton	-	270	250	121			640	614

Figure 4-C: Extract of development and zone allocations in CSRM2 model

[6] Cambridge Sub-Regional Model 2, C-Series Model Forecasting Report, January 2018, Atkins.

4.4 A10E2C Model Forecast Year Demand

The process of generating the A10E2C model forecast year demand matrices is explained in detail here.

4.4.1 Stage 1 – Development trip demand

- A mask matrix (0/1 matrix) was created to separate trips from “development zones” (zone 601-699) from all other trips in the CSRM2 forecast year (FY) matrix. This matrix has cell value equal to 1 for all movements to or from each zone representing new development.

- Apply (by multiplication) the mask matrix to the CSRM2 FY matrices by time period and user classes to obtain the “development” matrices.

- The CSRM2 “development” matrices were then converted to the A10E2C model zone structure by splitting out the trips for those CSRM2 zones which are disaggregated into multiple A10E2C zones. The splitting is undertaken by applying the same proportions used when the base CSRM2 matrices were converted for use in the base A10E2C model when first developed, as detailed in the LMVR.

- The CSRM2 FY matrices were based on development phasing and build out assumptions to 2031. The A10E2C model forecast years are 2028 and 2043. Therefore, an adjustment to the 2031 development trips for use in the A10E2C forecast models was needed. The model forecasting report for CSRM2 detailed the planned build out of development between 2012 and 2036 in 5-year increments. This information was used to interpolate the build outs in 2028. For the 2043 forecasts it was assumed that the level of build out for each development would remain the same as for 2036, i.e. that all developments would be fully built out by that year. A factor for each development zone is thereby calculated for factoring the 2031 development trips.

- Where the development is entirely residential, the factor is derived according to the build out of houses, and where it’s entirely employment the factor is derived according to the interpolated number of jobs. For mixed developments, a housing based factor is used for home based work, education and other trip purposes whilst the jobs based factor is used for employer’s business, LGV and HGV trips.

4.4.2 Stage 2 – Apply CSRM2 growth rates (2018 – FY) to A10E2C base year demand

- The average annual growth rate in trip ends in the CSRM2 model was calculated based on the base year (2015) matrix and 2031 FY matrix. Then the equivalent growth rate from 2018 to 2028 or 2043 was calculated based on the average annual growth from the CSRM2 model.
- CSRM2 trip end growth rates were applied to the A10E2C base year (2018) trip ends to derive forecast year A10E2C trip ends for 2028 and 2043. Both the calculation of growth from CSRM2 and the application of this to the A10E2C was done specifically for each trip end, for each matrix. For those A10E2C model zones, which were split from their parent CSRM2 zone, the same growth rates from the parent zone were applied to all split zones.

- Use a matrix balancing to growth the A10E2C base year matrices to match the forecast year trip ends total (a process also known as 'Furnessing')

4.4.3 Stage 3 – Assembling A10E2C FY matrices

- Matrices from stage 1 & 2, i.e. the “development trip only” matrix (in the A10E2C zone structure) and the post-Furnessing matrix (growth from A10E2C base year) were combined to form the full A10E2C forecast year matrix

- The process is carried out by for each user class separately and then the separate matrices stacked together for use in assignment.

4.5 Dependent Development at Waterbeach New Town

Development at Waterbeach New Town is considered partially dependent on the schemes being assessed for the business case, and therefore an assessment of the negative externalities of the dependent part of the development was carried out as part of an overall assessment on the induced investment benefits of the scheme (in this case, “induced investment” refers to the dependent part of the development which is enabled by having the scheme in place). Trip generation at this development was therefore treated as a special case with matrices representing just the non-dependent (or ‘deadweight’) and the dependent parts of the development separately produced. In the A10E2C model forecast, the deadweight scenario assumed that build out at the development would be capped at 1,600 new houses , which was assumed to be achieved by 2028. This level of build out was maintained for the 2043 deadweight scenario. The factoring process described in stage 1 of the trip matrix development was undertaken inclusive of this assumption.

The scheme being assessed has the potential to enable up to 11,000 homes to be built on the site, and there the dependent development scenario assumed 1,600 new houses by 2028 and 11,000 new houses by 2043. Therefore, to develop trip matrices for this scenario, when stage 1 of the trip matrix development was undertaken, the modelled trip generation for the development was derived by applying appropriate factors to the trips ends for that zone to provide the incremental trip generation from the incremental increase in housing. The trip generation increments were calculated based on the trip generation detailed in the Transport Assessment for Waterbeach New Town, available through South Cambridgeshire’s planning portal.

4.6 Matrix Scenario Summary

The processes set out in section 4.4 and section 4.4 were undertaken for the following scenario dimensions:

- Three forecast years:
  - 2028
  - 2043 (with only non-dependent development at Waterbeach New Town)
  - 2043 (with dependent development at Waterbeach New Town)
- Three model scenarios tests (each derived from the pre-SOBC forecasts):
  - ‘Do Minimum’ (with no improvement scheme). For this scenario, the 2043 ‘dependent development’ forecast year was not required (since it excludes the scheme upon which the development is dependent).
  - ‘Do Something’, junction improvement option
  - ‘Do Something’, dualling option
- Three time periods:
  - AM peak hour
  - Average Interpeak hour
  - PM peak hour

There was therefore a total of 24 sets of trip matrices developed as listed in Table 4.1:

Forecast Year	CSRM2 Scenario	Waterbeach Demand	Time period	Used for SOBC scenario
2028	Mode-shift	Deadweight only	AM	2028 AM Peak DM
2028	Mode-shift	Deadweight only	IP	2028 IP Peak DM
2028	Mode-shift	Deadweight only	PM	2028 PM Peak DM
2028	Full-Dual	Deadweight only	AM	2028 AM Peak Options A to F
2028	Full-Dual	Deadweight only	IP	2028 IP Peak Options A to F

Forecast Year	CSRM2 Scenario	Waterbeach Demand	Time period	Used for SOBC scenario
2028	Full-Dual	Deadweight only	PM	2028 PM Peak Options A to F
2028	Junctions+	Deadweight only	AM	2028 AM Peak Option G
2028	Junctions+	Deadweight only	IP	2028 IP Peak Option G
2028	Junctions+	Deadweight only	PM	2028 PM Peak Option G
2043	Mode-shift	Deadweight only	AM	2043 AM Peak DM
2043	Mode-shift	Deadweight only	IP	2043 IP Peak DM
2043	Mode-shift	Deadweight only	PM	2043 PM Peak DM
2043	Full-Dual	Deadweight only	AM	2043 AM Peak Options A to F
2043	Full-Dual	Deadweight only	IP	2043 IP Peak Options A to F
2043	Full-Dual	Deadweight only	PM	2043 PM Peak Options A to F
2043	Junctions+	Deadweight only	AM	2043 AM Peak Option G
2043	Junctions+	Deadweight only	IP	2043 IP Peak Option G
2043	Junctions+	Deadweight only	PM	2043 PM Peak Option G
2043	Full-Dual	Dependent	AM	2043 AM Peak Options A to F with dependent development
2043	Full-Dual	Dependent	IP	2043 IP Peak Options A to F with dependent development
2043	Full-Dual	Dependent	PM	2043 PM Peak Options A to F with dependent development
2043	Junctions+	Dependent	AM	2043 AM Peak Option G with dependent development
2043	Junctions+	Dependent	IP	2043 IP Peak Option G with dependent development
2043	Junctions+	Dependent	PM	2043 PM Peak Option G with dependent development

Table 4.1: List of trip matrices developed

4.7 Variable Demand Modelling

The forecast model scenarios developed for the pre-SOBC work, which used the CSRM2 forecasts, were subject to a full run of that model's Variable Demand functionality and is reported on in appropriate reports, referenced in previous sections of this report. The CSRM2 runs included the mode-shift package, junction improvements, and a full dualling scheme similar to the options described in this report. They therefore approximated the interventions assumed for the Do Minimum and Do Something scenarios of the A10E2C forecast. Whilst it is noted that the specific details of each scheme may vary between the CSRM2 and A10E2C, and that there has been interpolation/extrapolation to convert growth to different forecast years, the approach adopted will broadly reflect the likely Variable Demand impacts. Whilst more detailed assessment at Outline Business Case would need to make use of bespoke model runs to ensure the CSRM2 VDM is run using the exact same assumptions of scheme details, the approach adopted at this stage is proportionate for a Strategic Outline Business Case, making best use of available models in order to identify the best performing of a number of options.

4.8 Forecast Year Trip Matrix Totals

A summary of the trip matrix totals, by user class for the AM, IP and PM peak base year (2018) and forecast year (2028) is in Table 4.2.

Trip Purpose	User class	2018-AM	2028- AM			Growth-AM	2018-IP	2028- IP			Growth-IP	2018-PM	2028- PM			Growth-PM
		Base year	DM	DS-Junct	DS-Dualling	2018 to 2028 DM (%)	Base year	DM	DS-Junct	DS-Dualling	2018 to 2028 DM (%)	Base year	DM	DS-Junct	DS-Dualling	2018 to 2028 DM
HBW- Low	1	4932	6082	6094	6106	23.3	992	1323	1324	1327	33.3	5971	7256	7267	7277	21.5
HBW-Medium	2	12560	15939	15424	15455	22.6	2581	3441	3445	3450	33.3	15239	18474	18506	18533	21.2
HBW-high	3	23180	28534	28418	28475	22.3	4888	6565	6572	6582	34.3	28338	34472	34538	34587	21.6
Education	4	21278	25804	25805	25868	21.3	4301	6159	6159	6171	43.2	4084	5597	5599	5602	37.0
Empl Business	5	4503	6168	6171	6176	37.0	4212	5808	5813	5814	37.9	6147	7560	7564	7566	23.0
Other- Low	6	8479	9782	9779	9794	15.4	15078	18254	18245	18297	21.1	14819	17445	17488	17537	17.7
Other-Medium	7	6009	7081	7078	7088	17.8	13717	17283	17272	17328	26.0	13247	16283	16317	16372	22.9
Other- high	8	4477	5272	5269	5273	17.8	14016	17460	17449	17496	24.6	12409	14974	14996	15045	20.7
HGV	9	9225	10528	10528	10528	14.1	9570	10956	10956	10956	14.	7318	8404	8404	8404	14.8
HGV (Hunt'don)	10	761	863	863	863	13.3	427	486	486	486	13.8	216	243	243	243	12.5
LGV	11	8370	9964	9964	9964	19.0	7969	9550	9550	9550	19.8	5560	6636	6636	6636	19.4
LGV-Business	12	465	549	549	549	18.1	610	722	722	722	18.4	367	435	435	435	18.5
Total- Car	All	85418	103936	104038	104236	21.7	59784	76293	76279	76463	27.6	100255	122060	122275	122520	21.7
Total- LGV	All	8835	10513	10513	10513	19.0	8579	10272	10272	10272	19.7	5927	7071	7071	7071	19.3
Total- HGV	All	9987	11391	11391	11391	14.1	9997	11442	11442	11442	14.5	7534	8647	8647	8647	14.8

Table 4.2: A10E2C 2028 Forecast matrix totals

From the table it is noted that the trip matrix totals between the three 2028 scenarios are relatively similar, but that the DS scenarios have slightly more trips than the DM, and that the dualling option has more trips than the junctions option. This is to be expected given that the additional highway capacity in the DS schemes would induce more highway trips through VDM. It is further notable that the changes, although small in all cases, are slightly larger in the PM peak than in the AM peak.

As a comparison to the A10E2C growth, Table 4.3 details the growth rates in the CSRM2.

Trip Purpose	User class	2015-AM	2031- AM			Growth AM	2015-IP	2031- IP			Growth IP	2015-PM	2031- PM			Growth PM
		Base year	DM	DS-Junct	DS-Dualling	2015 to 2031 DM (%)	Base year	DM	DS-Junct	DS-Dualling	2015 to 2031 DM	Base year	DM	DS-Junct	DS-Dualling	2015 to 2031 DM
HBW- Low	1	5529	6968	6985	7001	26.6	1684	2198	2201	2205	30.5	6482	8096	8113	8127.4	24.9
HBW- Medium	2	13134	16542	16588	16627	26.0	3943	5208	5214	5225	32.1	15304	19193	19239	19274.28	25.4
HBW-high	3	23405	29403	29497	29566	25.6	6854	9194	9205	9224	34.1	26962	34004	34096	34160.14	26.1
Education	4	12651	16634	16633	16627	31.5	4557	6744	6745	6756	48.0	4442	6116	6119	6122.84	37.7
Empl Business	5	8500	10601	10611	10616	24.7	8014	10734	10740	10740	33.9	6445	8041	8044	8046.96	24.8
Other- Low	6	7404	8585	8581	8603	16.0	11833	15511	15501	15556	31.1	13163	15823	15885	15961.18	20.2
Other-Medium	7	5941	6900	6897	6909	16.1	12964	17288	17273	17325	33.4	13972	17163	17218	17288.37	22.8
Other- high	8	2759	3376	3374	3377	22.4	9572	13192	13180	13217	37.8	8804	11263	11291	11334.68	27.9
HGV	9	10564	12982	12982	12982	22.9	10735	13275	13275	13275	23.7	7900	9856	9856	9855.96	24.8
HGV (Huntington)	10	841	1037	1037	1037	23.3	544	681	681	681	25.1	513	631	631	630.88	23.1
LGV	11	7319	9752	9752	9752	33.2	7460	10031	10031	10031	34.5	5318	7126	7126	7125.52	34.0
LGV- Business	12	878	1145	1145	1145	30.3	1163	1531	1531	1531	31.7	385	508	508	507.95	32.1
Total- Car	All	79323	99008	99166	99326	24.8	59420	80069	80059	80248	34.8	95576	119699	120004	120316	25.2
Total- LGV	All	8197	10897	10897	10897	32.9	8623	11562	11562	11562	34.1	5703	7633	7633	7633	33.9
Total- HGV	All	11405	14019	14019	14019	22.9	11279	13956	13956	13956	23.7	8413	10487	10487	10487	24.7

Table 4.3: 2031 CSRM2 Model matrix totals

Comparing the growth in the two tables, the CSRM2 growth, which covers a 16 year period has higher growth levels that the 10 year period of the A10E2C 2028 forecast, as expected. However, there are a few exceptions to this general rule (marked in the table in red) and these occur for the user classes “Employers Business” and “Other – Medium income” in the AM peak, ‘Homebased Work-Low income’, ‘Homebased Work-Medium income’, ‘Homebased Work-high income’ and ‘Employers Business’ in the Interpeak and only ‘Other-Medium income’ in the PM peak.

The reason for these counter intuitive decreases is that growth rates in the CSRM2 vary by zone, and in some cases, negative growth occurs. In addition, trip ends in the base matrices differ between the CSRM2 and A10E2C model, in some cases with more trips and in other cases less. Growth is applied on a zone by zone basis, and in some cases, there are particular combinations of relatively high growth from CSRM2 applied to a high number of trip ends in the A10E2C base matrix (relative to the trip ends in the CSRM2 base matrices), and similarly relatively low growth from CSRM2 applied to a low number of trips in the A10E2C base matrix. For the trip matrices noted above, this occurs frequently enough such that the net effect is to increase the trip totals in the A10 to such an extent that growth exceeds that of the CSRM2. The opposite effect occurs for some other trip purposes for which growth to 2028 is much lower than what might be expected given the growth to 2031, for example, education trips in the AM peak (31.5% in CSRM2, 21.3% in A10E2C)

A similar table showing the A10E2C growth from 2018 to 2043 is below. It is notable from these tables that occurrences of particularly high or low levels of growth for some trip purposes in the 2028 matrices are carried through to the 2043 matrices.

Trip Purpose	User class	2018-AM	2043- AM			Growth-AM	2018-IP	2043- IP			Growth-IP	2018-PM	2043- PM			Growth-PM
		Base year	DM	DS-Junct	DS-Dualling	2018 to 2043 DM (%)	Base year	DM	DS-Junct	DS-Dualling	2018 to 2043 DM (%)	Base year	DM	DS-Junct	DS-Dualling	2018 to 2043 DM (%)
HBW- Low	1	4932	7466	7491	7511	51.4	992	1689	1692	1696	70.2	5971	8747	8773	8789	46.5
HBW- Medium	2	12560	18771	18839	18893	49.5	2581	4487	4496	4504	73.9	15239	22293	22366	22409	46.3
HBW-high	3	23180	34266	34407	34502	47.8	4888	8723	8738	8753	78.4	28338	41767	41919	41999	47.4
Education	4	21278	31082	31011	30812	46.1	4301	8977	8978	8988	108.7	4084	9302	9461	9578	127.7
Empl Business	5	4503	8470	8474	8469	88.1	4212	8217	8225	8212	95.1	6147	9797	9799	9789	59.4
Other- Low	6	8479	11711	11701	11721	38.1	15078	23637	23617	23739	56.8	14819	20357	20438	20545	37.4
Other-Medium	7	6009	8422	8413	8422	40.2	13717	22514	22491	22670	64.1	13247	19264	19326	19489	45.4
Other- high	8	4477	6788	6777	6773	51.6	14016	23814	23788	24075	69.9	12409	18706	18752	19028	50.7
HGV	9	9225	12874	12874	12874	39.6	9570	13452	13452	13452	40.6	7318	10366	10366	10366	41.7
HGV (Huntington)	10	761	1046	1046	1046	37.4	427	595	595	595	39.4	216	292	292	292	35.4
LGV	11	8370	13052	13052	13052	55.9	7969	12625	12625	12625	58.4	5560	8728	8728	8728	57.0
LGV- Business	12	465	711	711	711	53.0	610	939	939	939	54.1	367	567	567	567	54.4
Total- Car	All	85418	126977	127113	127103	22.2	59784	102057	102027	102638	33.8	100255	150233	150835	151626	23.1
Total- LGV	All	8835	13763	13763	13763	30.9	8579	13564	13564	13564	32.1	5927	9294	9294	9294	31.4
Total- HGV	All	9987	13920	13920	13920	22.2	9997	14047	14047	14047	22.8	7534	10658	10658	10658	23.3

Table 4.4: A10E2C 2043 Forecast matrix totals

Across all forecast years, the difference in trips between the different scenarios should be noted. These are summarised below:

Scenario	AM car trips			IP car trips			PM car trips		
	DM	DS Dual	Difference	DM	DS Dual	Difference	DM	DS Dual	Difference
2028 (A10E2C interpolated)	103936	104236	300	76293	76463	170	122060	122520	460
2031 (CSRM2)	99008	99326	318	80069	80248	179	119699	120316	617
2043 (A10E2C extrapolated)	126977	127103	126	102057	102638	581	150223	151626	1403

Table 4.5: Comparison of trip totals

The effects of extrapolating the trips to 2043 should be noted; the increase in trips in the dualled scenario is larger for 2043 than on 2031 for the IP and PM time period but less in the AM peak. This is due to the nuance of calculating growth on a trip end basis. The scale of the increased induced trips is considered reasonable. The pre-SOBC modelling from 2031 shows 318 trips induced in the AM peak and 617 in the PM peak. The time saving on the route between Ely and Cambridge under this scenario was around ten minutes in each direction in the AM peak, and around 25 minutes northbound and ten minutes southbound in the PM peak. In the 2043 scenario the equivalent time savings are around eight minutes in each direction in the AM peak, and around 30 minutes northbound and one minute southbound in the PM peak. On this basis, the change in trip totals is consistent with the changes seen in the pre-SOBC forecasting.

4.9 A10E2C Demand Growth Compared to TEMPro

Table 4.6 to Table 4.13 compares the growth in A10E2C model forecast year matrix trip ends growth and TEMPro (using NTEM v7.2) trip end growth for different car trip purposes. The comparison is given for the AM peak period for origin/destination trips.

4.9.1 2028

Area	Purpose	2018		2028		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	Commute	8473	8579	10808	10688	1.28	1.25	1.04	1.07
Cambridge	Commute	4363	6822	5308	7210	1.22	1.06	1.08	1.07
South Cambridge	Commute	9119	9727	11152	12739	1.22	1.31	1.08	1.07
East Cambridgeshire	Commute	4738	4170	5824	5788	1.23	1.39	1.07	1.07
Total	Commute	26693	29298	33093	36425	1.24	1.24	1.07	1.07

Table 4.6: AM Car Commute growth

Area	Purpose	2018		2028		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	Business	863	1138	1290	1655	1.49	1.45	1.06	1.08
Cambridge	Business	599	799	834	684	1.39	0.86	1.08	1.07

Area	Purpose	2018		2028		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
South Cambridge	Business	924	1185	1391	1918	1.51	1.62	1.09	1.08
East Cambridgeshire	Business	461	546	618	943	1.34	1.73	1.08	1.08
Total	Business	2847	3668	4134	5201	1.45	1.42	1.07	1.08

Table 4.7 AM Car Business growth

Area	Purpose	2018		2028		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	Other	9761	9291	12688	11483	1.30	1.24	1.16	1.18
Cambridge	Other	5982	7482	5182	5844	0.87	0.78	1.17	1.16
South Cambridge	Other	11181	10400	13489	14613	1.21	1.41	1.17	1.18
East Cambridgeshire	Other	5155	4589	6996	6518	1.36	1.42	1.19	1.18
Total	Other	32079	31761	38355	38458	1.20	1.21	1.17	1.17

Table 4.8 AM Car Other Growth

Area	Purpose	2018		2028		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	All car trips	19097	19008	24787	23826	1.30	1.25	1.09	1.11
Cambridge	All car trips	10945	15103	11325	13739	1.03	0.91	1.11	1.11
South Cambridge	All car trips	21225	21311	26033	29269	1.23	1.37	1.12	1.11
East Cambridgeshire	All car trips	10353	9305	13438	13249	1.30	1.42	1.11	1.11
Total	All car trips	61619	64778	75584	80083	1.23	1.24	1.10	1.11

Table 4.9 AM All Car trip growth

4.9.2 2043

Area	Purpose	2018		2043		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	Commute	8473	8579	13564	11601	1.60	1.35	1.06	1.16
Cambridge	Commute	4363	6822	6012	8855	1.38	1.30	1.16	1.16
South Cambridge	Commute	9119	9727	12331	15987	1.35	1.64	1.19	1.17

Area	Purpose	2018		2043		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
East Cambridgeshire	Commute	4738	4170	7205	8598	1.52	2.06	1.16	1.16
Total	Commute	26693	29298	39112	45041	1.47	1.55	1.14	1.16

Table 4.10: 2043 AM Car Commute growth

Area	Purpose	2018		2043		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	Business	863	1138	1901	2157	2.20	1.89	1.09	1.18
Cambridge	Business	599	799	1141	597	1.90	0.75	1.18	1.18
South Cambridge	Business	924	1185	1772	2835	1.92	2.39	1.21	1.18
East Cambridgeshire	Business	461	546	832	1805	1.81	3.30	1.18	1.18
Total	Business	2847	3668	5646	7395	1.98	2.02	1.16	1.18

Table 4.11 2043 AM Car Business growth

Area	Purpose	2018		2043		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	Other	9761	9291	16334	12282	1.67	1.32	1.29	1.35
Cambridge	Other	5982	7482	4177	4347	0.70	0.58	1.34	1.35
South Cambridge	Other	11181	10400	16673	20333	1.49	1.96	1.40	1.38
East Cambridgeshire	Other	5155	4589	9195	10300	1.78	2.24	1.38	1.37
Total	Other	32079	31761	46379	47263	1.44	1.49	1.35	1.36

Table 4.12 2043 AM Car Other Growth

Area	Purpose	2018		2043		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
Huntingdonshire	All car trips	19097	19008	31799	26041	1.67	1.37	1.14	1.23
Cambridge	All car trips	10945	15103	11331	13799	1.04	0.91	1.23	1.24

Area	Purpose	2018		2043		TEnds growth (model)		TEnds growth (TEMPro)	
		Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
South Cambridge	All car trips	21225	21311	30775	39156	1.45	1.84	1.26	1.24
East Cambridgeshire	All car trips	10353	9305	17232	20703	1.66	2.22	1.24	1.24
All areas	All car trips	61619	64778	91137	99699	1.48	1.54	1.21	1.24

Table 4.13 2043 AM All Car trip growth

4.9.3 Summary

From above tables it is noted that the A10E2C model trip ends growth is a lot higher than TEMPro growth for "Commute" and "Business" trip purposes, but relatively close on "Other". This difference is due to the different planning assumptions within the CSRM2 forecast models (upon which the A10E2C forecasts are based) and NTEM.

According to the "CSRM2 C-series Forecasting Report v2.0" the planning assumption for workers within the CSRM2 model was a lot higher than that of NTEM, while the population and household growth were similar. Table 4.14, is a summary of the growth in workers, populations and households, across the area covered by the model (Cambridge, South Cambs, East Cambs, Huntingdonshire) for both NTEM v7.2 and the CSRM2 model. The CSRM2 growth figures are taken from tables 3-3, 3-6, 3-8 and 3-12 of the CSRM2 forecasting report, for Household, Population, Jobs and Workers respectively.

Data	NTEM growth	CSRM2 total growth
Household	27%	26%
Population	20%	21%
Jobs	7%	16%
Workers	5%	17%

Table 4.14 Planning assumption TEMPro vs CSRM2, 2015-2031

These differences give rise to the difference in trip end growth between CSRM2 and TEMPro, and in turn, between the A10E2C and TEMPro (where for 2043, the growth is extrapolated). The differences here are consistent with the A10E2C model (with growth derived from CSRM2) having trip end growth for purposes "Commute" and "Business" which is higher than TEMPro (just as the growth in workers and jobs in CSRM2 is higher than in NTEM), but for "Other" purposes having growth which is fairly similar.

The driver of much of the increases of the CSRM2 growth (and therefore the A10E2C growth) above TEMPro is the assumptions regarding growth in workers, which is three times higher in CSRM2 than it is in NTEM. The differences are most stark for Huntingdonshire, where, for the period between 2015 and 2031 NTEM assumes a growth in workers of just 1%, whereas for CSRM2, the growth over the same period, based on Local Plan data is 15%.

The differences in demographic growth between CSRM2 ("Foundation Case" forecasts) and TEMPro are due to the land use assumptions within the CSRM2 forecasts, which use bottom-up, locally led land use forecasts, largely derived from Local Plans, as opposed to being controlled to any NTEM land uses. The CSRM2 forecasts took this approach for reasons as set out in the CSRM2 C-Series Forecasting report. This describes that the Foundation Case represents a scenario agreed with CCC which is consistent with the proposed Local Plans (as of

January 2018,) of the districts represented in CSRM2. In addition, it uses locally based assumptions on household size, and employed populations (i.e. workers). It is intended to represent a known case against which other studies can be compared and provides a common starting point for scheme-specific Do Minimum scenarios. The approach also ensures consistency in land use assumptions and a common approach to all forecast modelling in Cambridgeshire, in that all forecasts derive directly or indirectly from the CSRM2 forecasts.

The Pre-SOBC modelling report acknowledged the discrepancy between NTEM and the CSRM2 forecasts but highlights that it was the only way to reflect employment growth predicted at two key sites within the corridor of the A10; at Cambridge Northern Fringe East and Cambridge Science Park. Whilst this could potentially lead to overestimating benefits, it is important to note that at this stage of scheme development the modelling is largely being used to identify the better performing options from a shortlist, and that any overestimation of benefit is likely to apply equally to all options being assessed and therefore not lead to bias in the selection of those options. The approach of using the existing CSRM2 forecasts rather than incurring the extensive resource requirement for developing new forecasts is also proportionate to the current level of assessment.

When further assessment of the better (or best) performing option is undertaken for the Outline Business Case it will be important to ensure that a forecast which has land use estimates consistent with NTEM is developed.

5. Forecast Model Assignments

5.1 Assignment Convergence

The generalised cost parameters used in the model forecasts were update from the base parameters according to the TAG data book. The parameters used are detailed in section 3.1 of this report.

Using these parameters, it was then important to ensure a high level of assignment convergence. A high level of model convergence is key to ensuring that the results contained within the model are a true reflection of the demand and modelled network. A model that is not sufficiently converged will include a large amount of random bias and white noise due to appropriate trip routing not yet having been achieved. To avoid that situation, the modelled assignments have been run with the intention to achieve a high level of convergence, attempting to obey Wardrop's First Principle of Traffic Equilibrium as per TAG M3.1 paragraph 2.7.3:

"Traffic arranges itself on networks such that the cost of travel on all routes used between each OD pair is equal to the minimum cost of travel and all unused routes have equal or greater cost."

In order to meet TAG criteria, the convergence analysis was done by using the following measures of convergence indicators:

- The percentage of links on which flows or costs change by less than a fixed percentage (recommended as 1%) between successive iterations.

- The difference between the costs along the chosen routes along the minimum cost routes, summed across the whole network, as expressed as a percentage if the minimum costs, usually known as 'Delta or the '%GAP'.

- The degree to which the total area under the cost/flow relationships is minimised (also the uncertainty in the objective function), sometimes known as 'Epsilon'.

The convergence criteria from TAG are summarised in the table below

Measure of Convergence	Acceptable Values
Delta and %Gap	Less than 0.1% or at least with convergence fully documented and all other criteria met
Percentage of links with flow change < 1%	Four consecutive iterations greater than 98%
Percentage of links with cost change < 1%	Four consecutive iterations greater than 98%

Table 5.1: TAG convergence measures

TAG states that GAP is the single most valuable indicator of overall model convergence. It requires that reasonable levels of convergence are achieved, and that a GAP value of 0.1% or less is required, as identified in Table 5.1.

A summary of the assignment convergence for all 2043 forecast scenarios (which, having the highest demand will be the most difficult models to converge) is detailed in Table 5.2.

Scenario	Time period	No. of Iterations	% Links with flow change <1%	% Links with cost change <1%	% Gap
DM	AM	39	98.6	98.7	0.026
	IP	53	98.1	99.2	0.0084
	PM	42	99.2	97.9	0.051
Option A	AM	36	98	97.8	0.025
	IP	51	98.3	99.2	0.011
	PM	48	97.7	97.3	0.063
Option B	AM	33	97.7	97.8	0.028
	IP	53	97.6	99.2	0.015
	PM	51	99.1	97.7	0.043
Option C	AM	33	97.7	98.1	0.029
	IP	35	97.6	98.9	0.013
	PM	42	98.5	96.5	0.083
Option D	AM	37	98.4	98.5	0.02
	IP	46	98	98.5	0.04
	PM	45	98.3	97.5	0.042
Option E	AM	38	98.5	98.2	0.025
	IP	41	98.8	99	0.026
	PM	38	99.1	97.8	0.045
Option F	AM	37	98.2	98.4	0.022
	IP	46	97.6	98.7	0.03
	PM	42	98.4	97.6	0.051
Option G	AM	39	98.9	98.5	0.026
	IP	41	97.5	99	0.015
	PM	39	98	96.9	0.064

Table 5.2: Summary of assignment convergence, all scenarios

The assignment statistics demonstrate that a very low GAP value is achieved for all of the 2043 forecast scenarios and in practically all cases the proportion of links with flow or cost changes less than 1% exceeds 98%. This indicates that the 2043 forecast scenarios achieved a more than adequate level of convergence and that the forecast assignments are therefore stable. Whilst the convergence results for the 2028 forecasts are not presented here, since they have lower levels of demand, they all achieve a level of convergence which is as good as the convergence of the 2043 assignments.

6. Model outputs and results

6.1 Forecast Model Performance

As an indicator of the overall performance of the models in terms of levels of congestion etc. Table 6.1 details a selection of “Summary Statistics” provided by the software. These statistics are presented as a total across the whole network (simulation and buffer) and as a total across the modelled time period and the next time period. These are given for the 2043 AM and PM peak scenarios.

Scenario	Time Period	Trips loaded (pcus)	Over-capacity queues (pcu-hrs)	Total Travel Time (pcu-hrs)	Total travel distance (pcu-kms)	Average Speed (kph)
DM	AM	142,206	22,183	145,387	6,688,784	46.0
	PM	157,046	54,401	195,797	7,468,176	38.1
Option A	AM	142,379	21,868	144,809	6,712,023	46.4
	PM	158,459	55,570	197,482	7,518,633	38.1
Option B	AM	142,379	21,763	144,760	6,714,889	46.4
	PM	158,459	58,173	199,996	7,523,655	37.6
Option C	AM	142,379	21,975	145,238	6,719,294	46.3
	PM	158,460	58,612	200,732	7,526,141	37.5
Option D	AM	142,379	21,773	144,656	6,714,360	46.4
	PM	158,459	57,270	199,134	7,527,148	37.8
Option E	AM	142,379	21,954	144,962	6,712,563	46.3
	PM	158,460	55,660	197,471	7,517,605	38.1
Option F	AM	142,379	21,988	145,265	6,718,481	46.2
	PM	158,459	58,530	200,606	7,528,904	37.5
Option G	AM	142,412	22,021	145,399	6,699,021	46.1
	PM	157,647	56,396	198,460	7,478,752	37.7

Table 6.1: Selected Summary Statistics (2043)

The summary statistics indicate that the speeds remain relatively consistent across all of the modelled scenarios, which indicates that the influence of the scheme is relatively small when measured against the scale of all trips included in the model (at around 150,000 pcus, there are a lot of trips).

6.2 Forecast Flows

To demonstrate the effect the scheme has on traffic flows, the forecast flows for the north, south and middle sections of the A10 are presented in the table below. The flows are given for each modelled scenario by time period. For reference, Figure 6-A illustrates the location points of the flows.

Figure 6-A shows the locations of flows presented in table 6.

Scenario	Time period	2028						2043					
		A10- North		A10- Middle		A10- South		A10- North		A10- Middle		A10- South	
		NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
DM	AM	988	980	1024	1138	979	1597	1191	1001	1123	1061	999	1577
	IP	954	877	1027	975	982	1182	994	1056	1096	1010	988	1187
	PM	912	943	1077	1009	599	1218	1239	995	1315	944	823	1213
Option A	AM	1183	1320	1422	1732	385	415	1566	1339	1677	1648	363	345
	IP	1241	1085	1469	1254	398	338	1615	1427	1949	1474	381	290
	PM	1610	1188	2113	1290	350	453	2224	1299	2802	1345	435	394
Option B	AM	1160	1281	1372	1776	387	427	1676	1315	1558	1719	371	360
	IP	1210	1031	1465	1259	406	346	1583	1381	1948	1492	371	296
	PM	1565	1130	2092	1329	363	444	2144	1210	2780	1379	423	394
Option C	AM	1161	1172	1324	1554	378	406	1472	1183	1479	1561	362	356
	IP	1106	969	1393	1177	403	338	1467	1185	1831	1349	357	290
	PM	1394	994	1959	1197	369	445	1522	1103	2419	1255	443	460
Option D	AM	419	253	642	647	686	773	504	243	634	636	680	752
	IP	335	281	556	493	677	698	410	330	592	480	605	633
	PM	446	336	866	575	800	745	711	341	1056	476	661	753
Option E	AM	1171	1324	1331	1814	1462	2213	1511	1340	1585	1666	1656	2137
	IP	1236	1087	1471	1299	1569	1518	1595	1431	1896	1538	1832	1734
	PM	1527	1204	1969	1358	1885	1523	2125	1312	2551	1390	2198	1592
Option F	AM	1149	1167	1306	1564	1372	2027	1462	1191	1470	1519	1492	1983
	IP	1106	968	1389	1180	1514	1439	1468	1185	1808	1345	1780	1574
	PM	1393	1001	1860	1207	1850	1444	1514	1106	2439	1253	2184	1498
Option G	AM	1047	1020	1037	1138	1057	1575	1327	1072	1195	1101	1077	1567
	IP	981	858	1048	975	985	1145	1392	1066	1313	1012	1107	1174
	PM	1334	898	1505	769	1477	965	1473	979	1889	486	1632	538

Table 6.2: Forecast flows for all modelled scenarios by time period on the A10

It should be noted that these are actual flows rather than demand flows. These flows demonstrate that all of the scheme options lead to an increase in traffic on the A10, with the exception of those options which include an off line alignment. This is notable from Option D, which is the full offline alignment and for which flows at all points of the A0 are lower than in the do minimum. Options A, B and C are similar in that that they have reduced flows compared to the DM and the other scenarios for the southern part of the A10 – where there is an off-line alignment bypassing the section. For those options where there is no offline alignment for a given location, it is notable that the lowest increase in each scenario occurs for Option G, which has only junction improvements. This is indicative of that scenario not being as attractive, or not freeing up as much capacity, as those other options which include some form of dualling improvement.

6.3 Forecast Flow Increases from Base Year

The figures below indicate the increase in flows from the base year model to the Do minimum models (2028 and 2043) as an indicator of the expected growth in traffic levels independent of any A10 scheme.

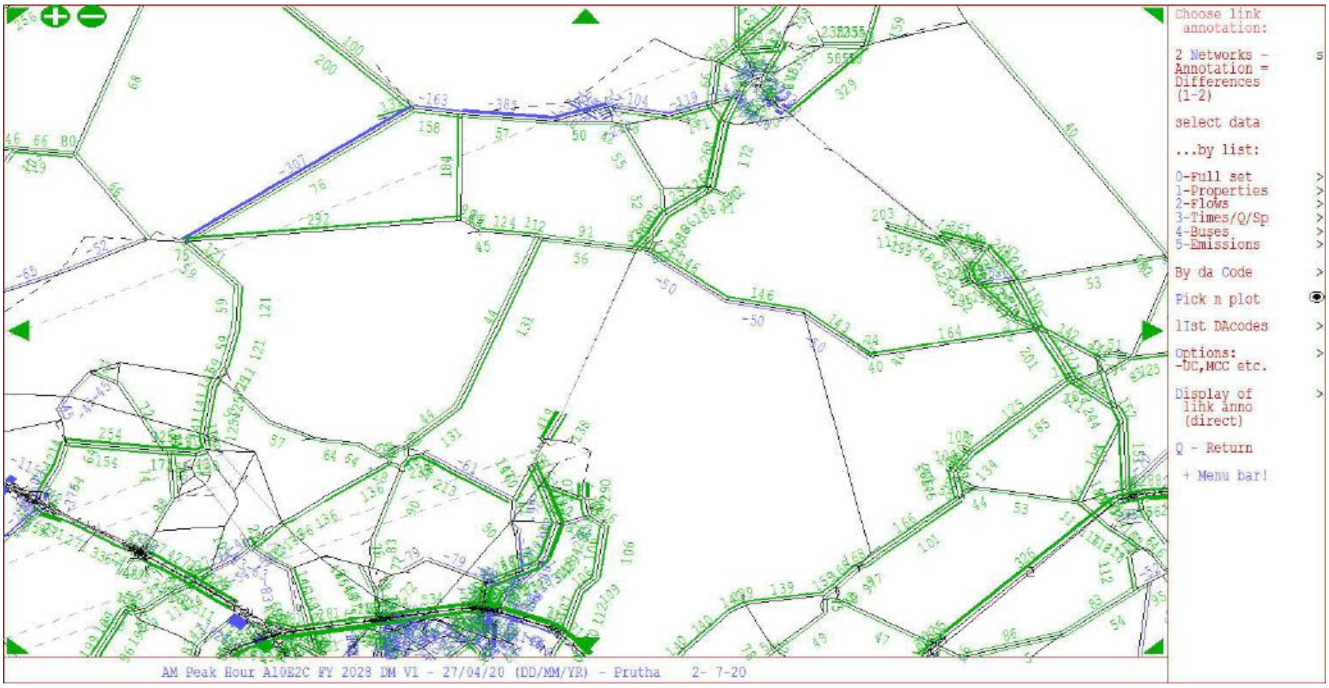


Figure 6-B 2028 DM Flow change from base (2018)- AM

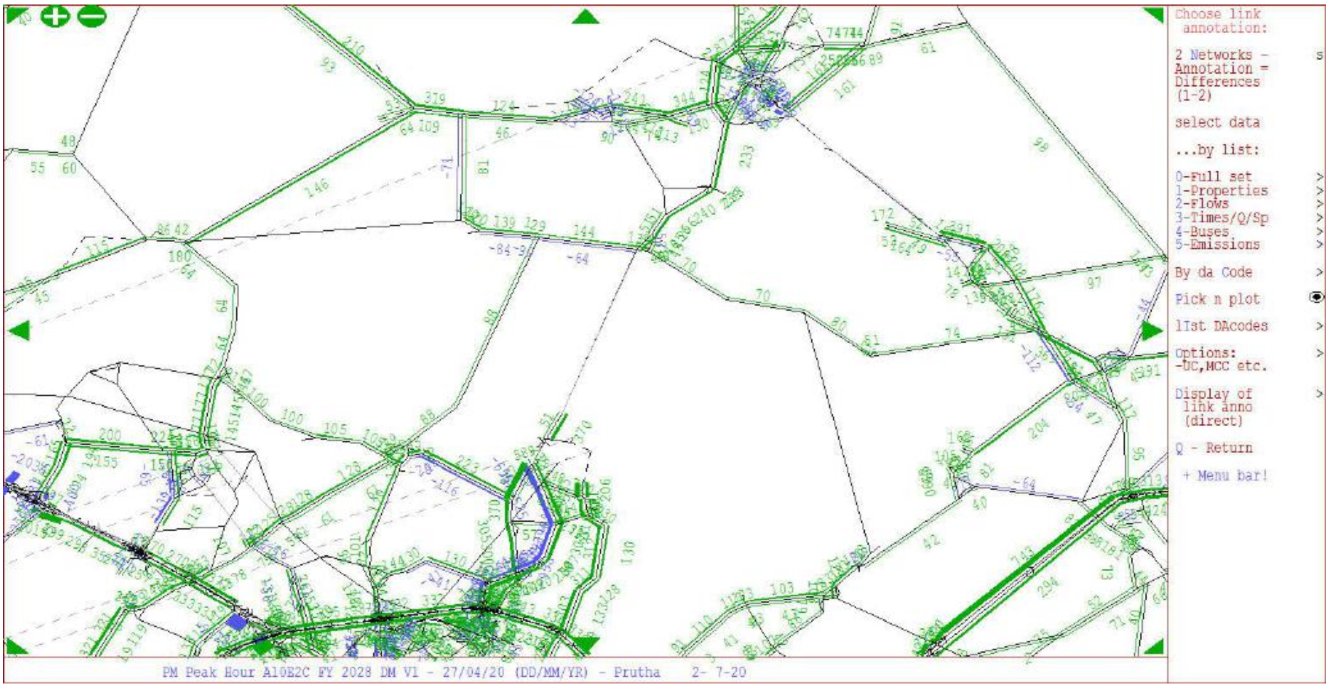


Figure 6-C 2028 DM Flow change from base (2018)- PM

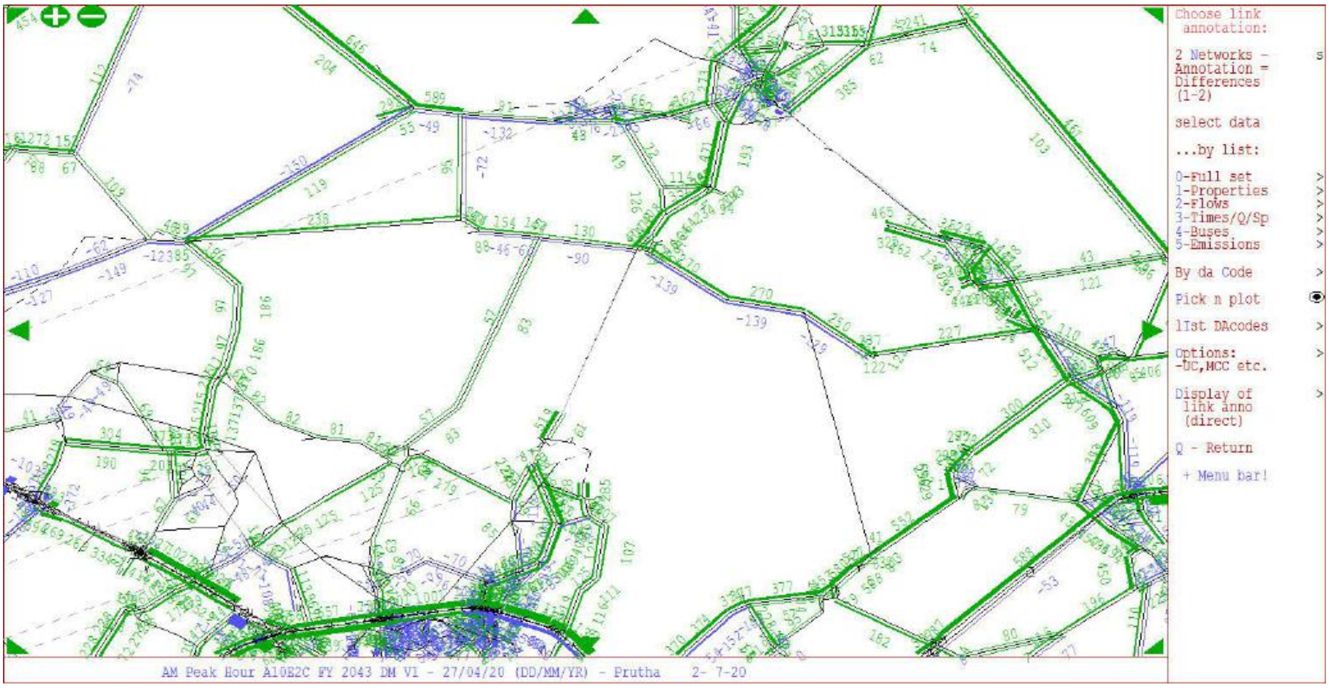


Figure 6-D 2043 DM Flow change from base (2018)- AM

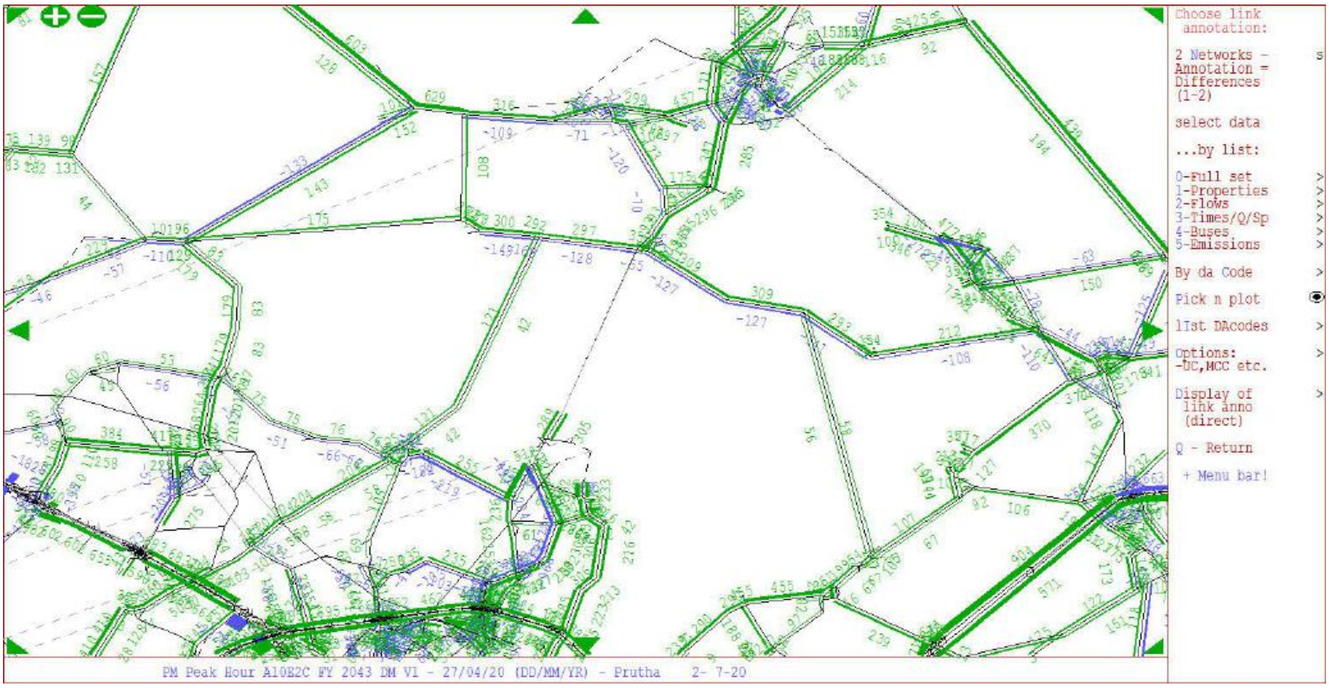


Figure 6-E 2043 DM Flow change from base (2018)- PM

As shown, generally there is an overall increase in flow across the network as expected from a base year of 2018 to 2028 and 2043. However, there is a decrease in flow on the A10 by Waterbeach in the both the 2028 and 2043 PM peak periods. This is due to relatively high levels of delay in that area of the A10 compared to the base year, which causes some flow metering and some reassignment away from the area, rather than due to a genuine reduction in demand for travel along that link. This underlines the reasons for requiring improvement along the corridor. A reduction in flow is also observed northbound on the B1381. It is considered that this is related to reassignment of longer distance trips effected by schemes unrelated to the A10, such as the A14 improvement. There are also some reductions in trips going westbound through Stretham. This is considered to be due to increasing congestion at Stretham Roundabout on the A10 (which again advances the case for improvements on the A10) and also due to reassignment of trips to make use of the new Ely Southern bypass which is introduced in the do minimum scheme.

6.4 Flow changes due to Proposed Scheme Option

This section presents the flow changes that occur due to the assessed options 2043 (excluding dependent development) in the AM or PM peak models. The green bars represent increases and the blue bars decreases as a result of the scheme being in place, compared to flows in the DM. Figures for all time periods and all forecast years, including Inter-Peak can be found in Appendix B.

6.4.1 Option A

The flow changes resulting from Option A for 2043 AM peak is in the figure below.

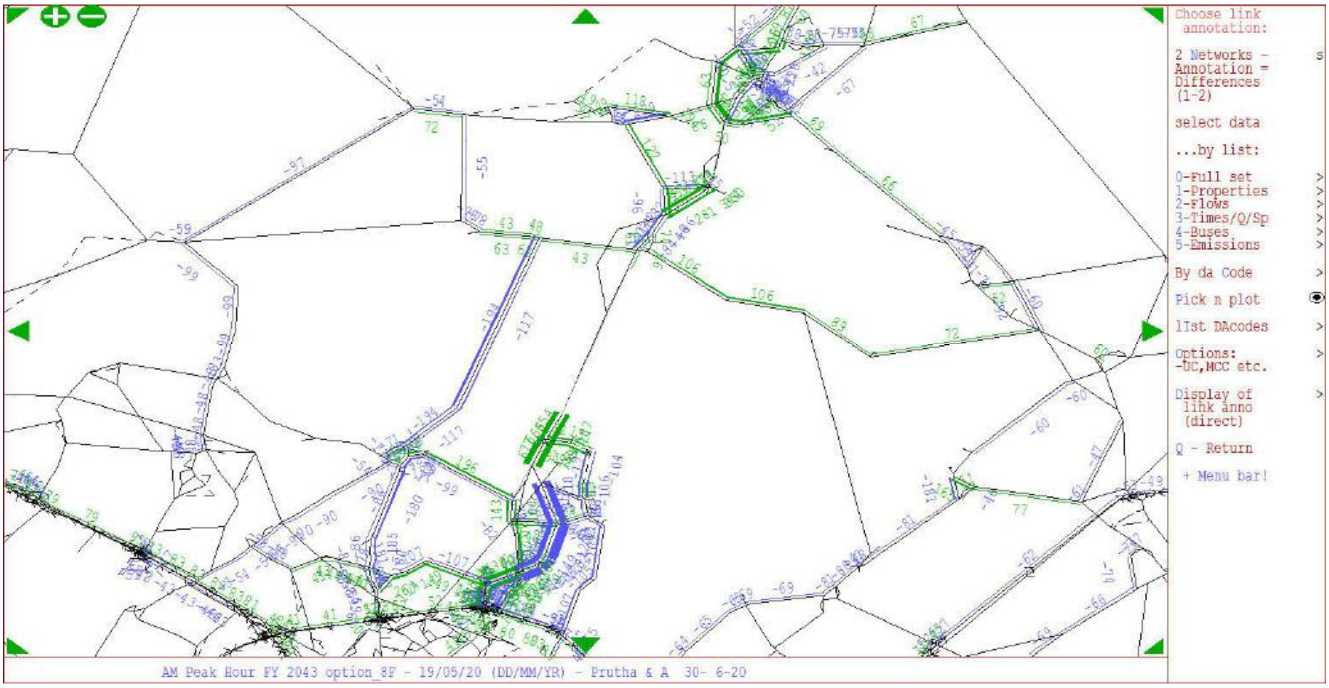


Figure 6-F 2043 Flow change in Option A from DM- AM

Whilst the comparison is limited because in some cases the DS links do not exist in the DM, or they exist with different link references (meaning that the software cannot provide a comparison) the inclusion of Option A demonstrates significant increases in flows along the mainline A10, apart from in those areas where the scheme includes an off-line alignment. Where there is an off line alignment, there are significant decreases on the existing A10 as a result of traffic switching to the new off-line section. There are also significant decreases on routes parallel to the A10, indicative of vehicles switching to take up the increased capacity of the scheme.

This indicates that the scheme is an attractor of trips and that there is latent demand for travel on an A10 route with increased capacity.

It is notable too that there is an increase in flows around Ely at the northern end of the scheme, and that there is an increase in east-west flow through Stretham. This increase is likely the result of increased capacity and a more attractive route on the A10 which attracts some east west trips to make increased use of the A10 to then travel east or west on the A123, rather than using more minor routes. In this sense the scheme improvements appear to be consolidating and increasing the propensity for trips to use more major roads along the corridor.

6.4.2 Option B

The figures showing the flow change resulting from Option B can be found below for the 2043 AM peak period.

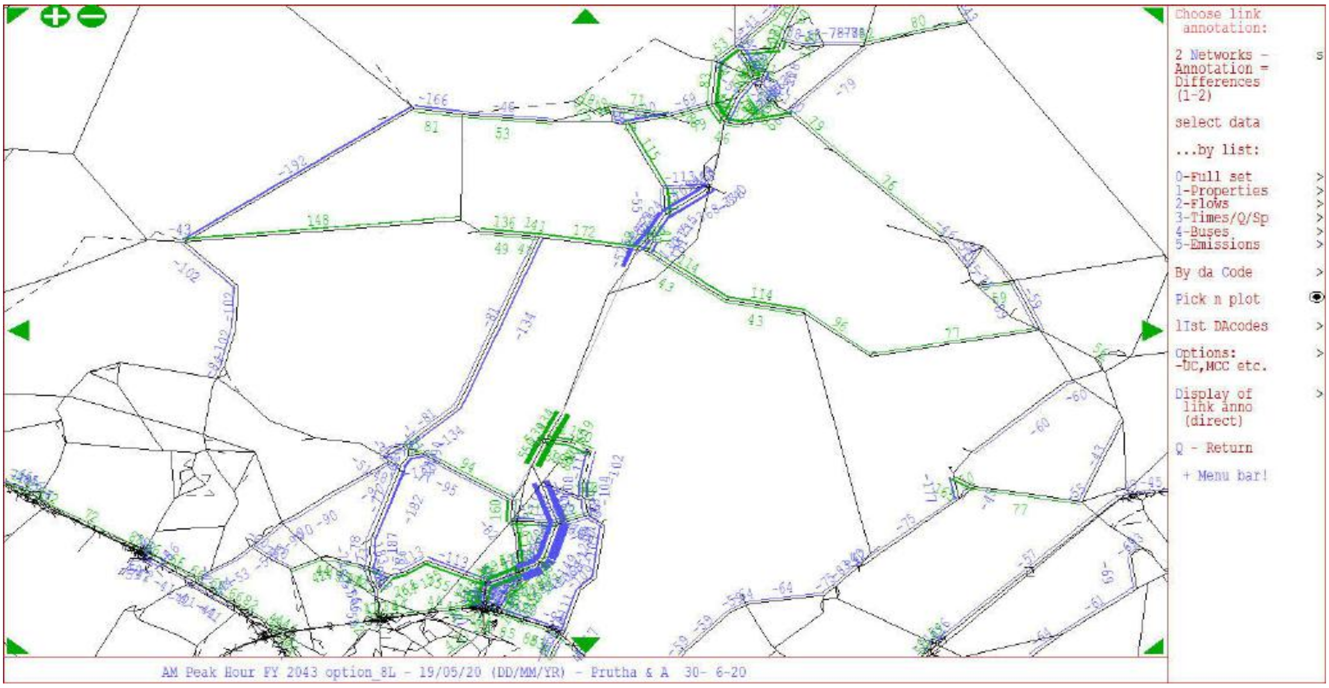


Figure 6-G 2043 Flow change in Option B from DM- AM

Option B shows a similar pattern in flow change as Option A, for similar reasons. The only difference between option A and option B is the bypass of Stretham, which is to the east in this case, and the impacts on flows of the two scenarios is broadly the same.

6.4.3 Option C

Figure 6-H show the flow change in Option C from the DM in the AM peak for 2043.

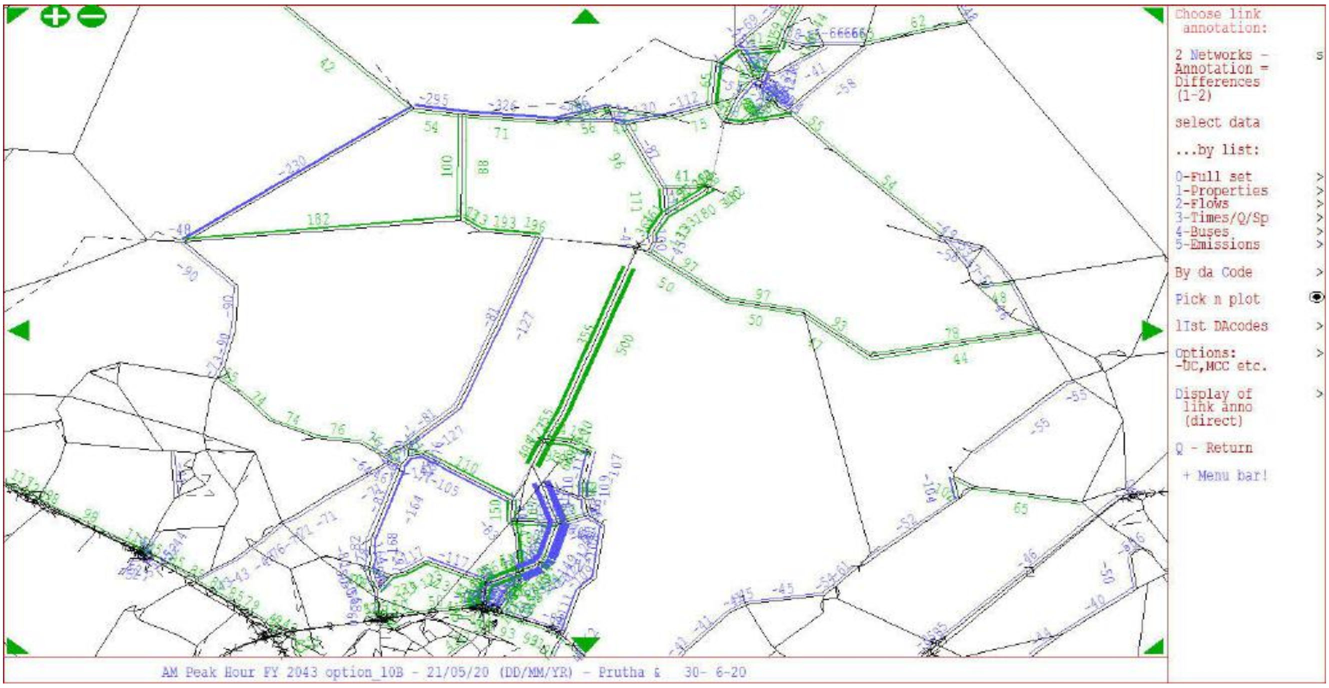


Figure 6-H 2043 Flow change in Option C from DM- AM

The inclusion of Option C has broadly the same impact on flows as options A and B. However, the increase in flow for the middle and northern section of the route is not as high as for those options; whereas the options have dualling in place in those areas, option C just has junction improvements, and retains a single carriageway road. Option C is therefore less attractive for reassignment of trips than Option A and B, albeit there is still a large amount of reassignment occurring.

6.4.4 Option D

The results for Option D are presented below for the PM peak.

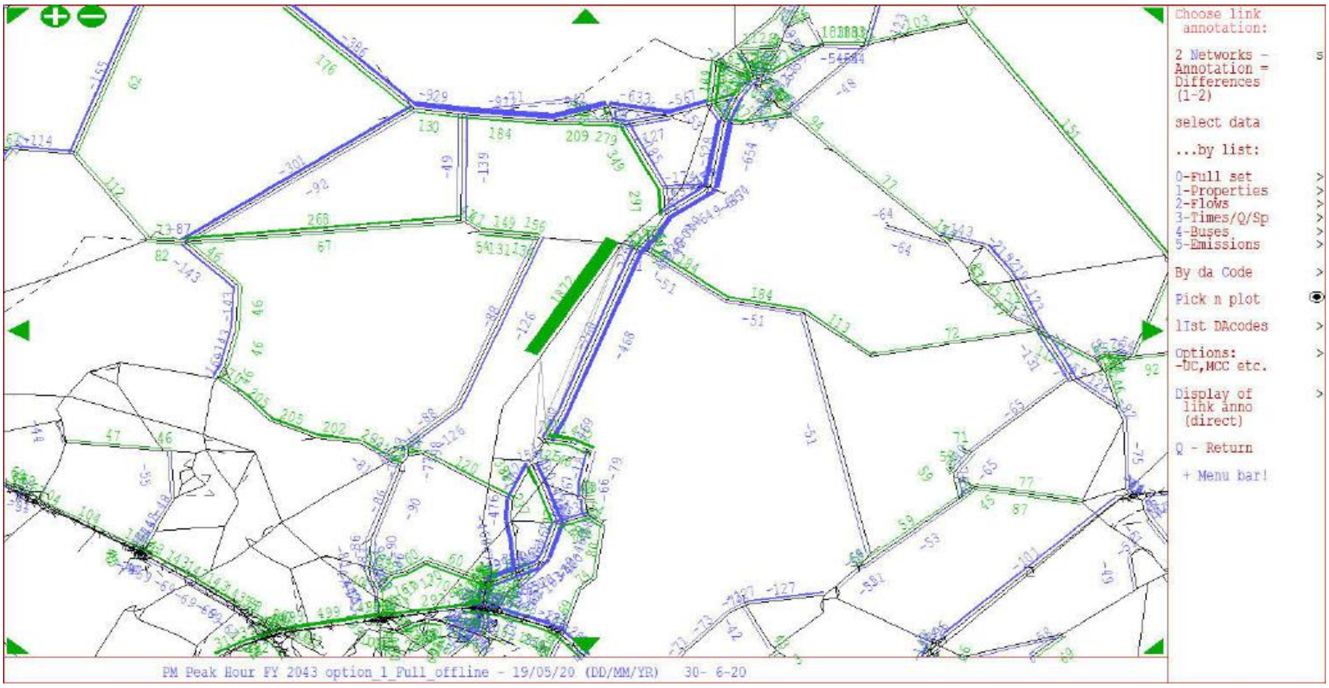


Figure 6-I 2043 Flow change in Option D from DM- PM

Option D has full offline dualling and again shows large decreases in flows on routes parallel to the corridor. However, this option also includes large reductions on the existing A10 itself, which is largely bypassed. There are some nuances of flow changes around Landbeach and Waterbeach which warrant further explanation; even though bypassed, there are increases on the existing A10 northbound (north of Denny End Road) and on Cottenham Road, the eastbound route into Landbeach. This is indicative of the limited amount of connections between the new link and existing links, such that traffic wishing to make use of the new link is funnelled down to a limited number of connecting junctions; in this case, the connecting link which has a left-in/left-out priority junction at either end. A switching of trip routing from the A142 towards Ely to the A1123 towards Stretham is also noted.

6.4.5 Option E

Flow change resulting from Option E are presented below.

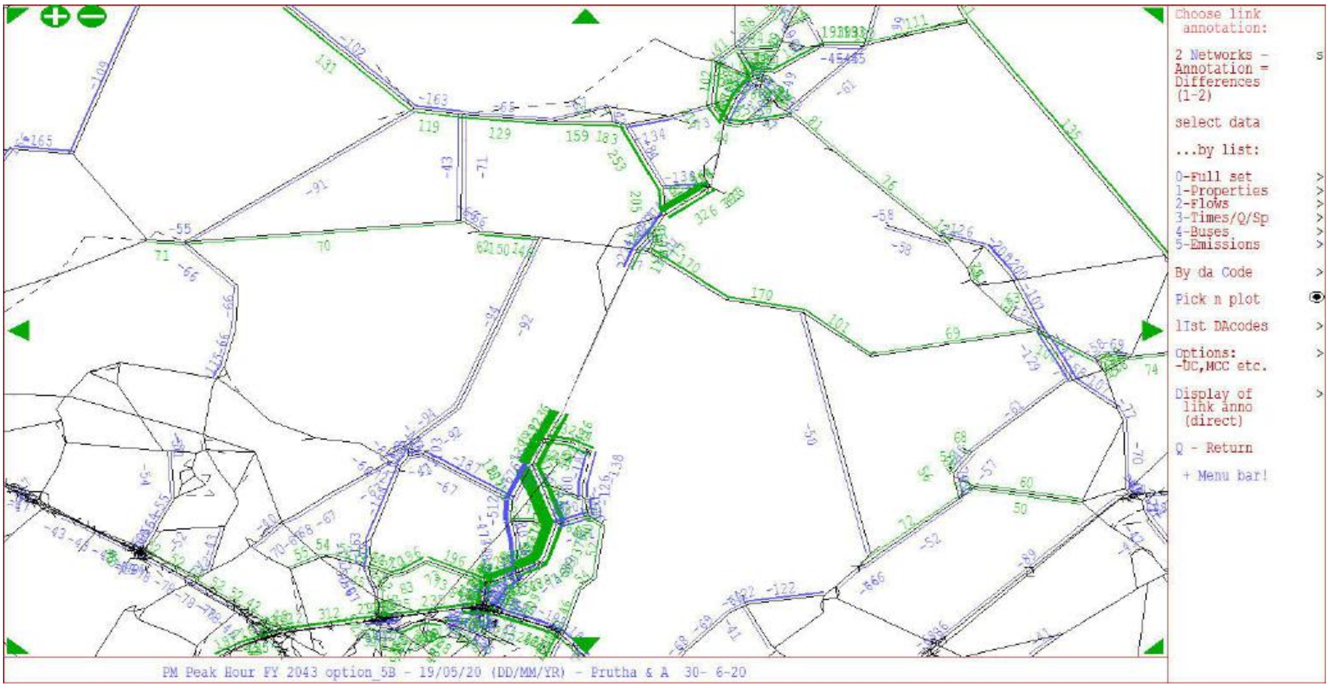


Figure 6-J 2043 Flow change in Option E from DM- PM

Option E is similar to Option A except that there is no off line alignment around Waterbeach. Option E consequently results in flow increases on the A10 by Waterbeach (whereas in Option A the flow here decreases in preference to using the off line section). There are also smaller changes across the network such as increases along the A1123, and roads around Ely.

6.4.6 Option F

Flow change plots for Option F are shown below.

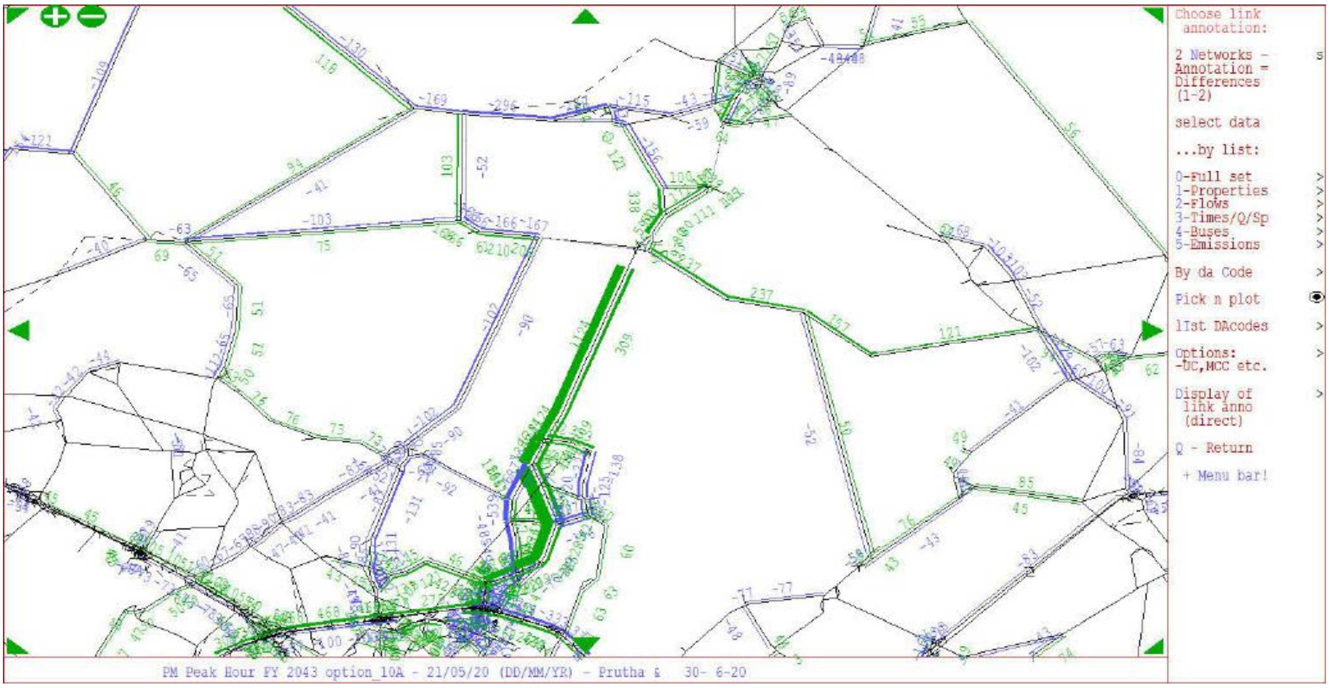


Figure 6-K 2043 Flow change in Option F from DM- PM

The inclusion of Option F shows large increases in flow when compared to the DM along the A10 from Waterbeach to Stretham. Increases are also observed on the Newmarket Road and other local roads.

6.4.7 Option G

Flow differences due to the inclusion of Option G are presented below.

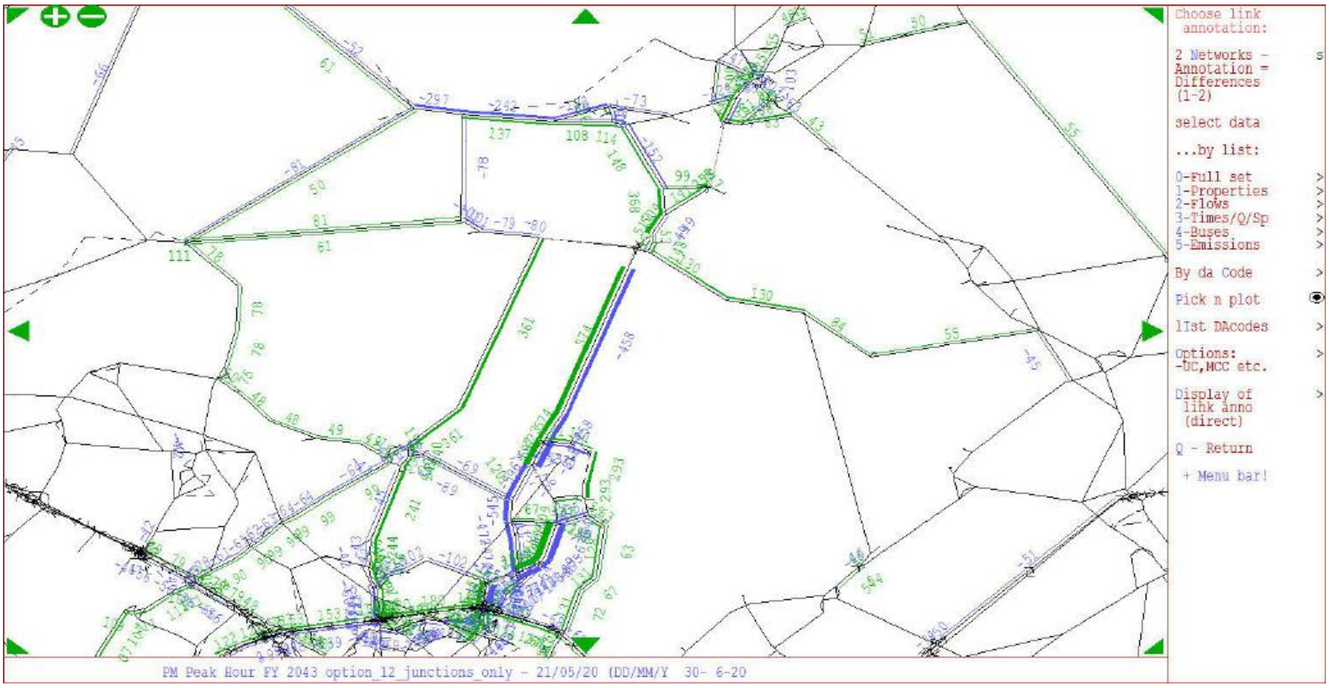


Figure 6-L 2043 Flow change in Option G from DM- PM

The inclusion of Option G shows a far more mixed picture in terms of flow changes. There are some increases in flows along the corridor, but this is not universal. Option G includes only junction improvements and retains the

A10 as a single carriageway road. It is notable that in some cases there is an increase in flows on parallel routes; rather than attracting trips onto the A10, in some cases the scheme pushes trips off the A10. This indicates that Option G is far less successful at dealing with capacity and congestion issues on the A10.

6.5 Delays

A representation of delays in a model provides a wider indication of where the main ‘stress points’ in the network lie. The figures represent delays in the 2043 DS scenarios for the either the AM or PM peak (the PM peak tends to have higher delays and features more in this report, however AM is included where there are points of note) and for reference the delays from the DM scenario are presented alongside. Figures for all time periods and forecast years can be found in Appendix C.

6.5.1 Option A

Delays found as a result of the inclusion of Option A are presented in the figures below (right hand images) with DM delays also included (left hand images).

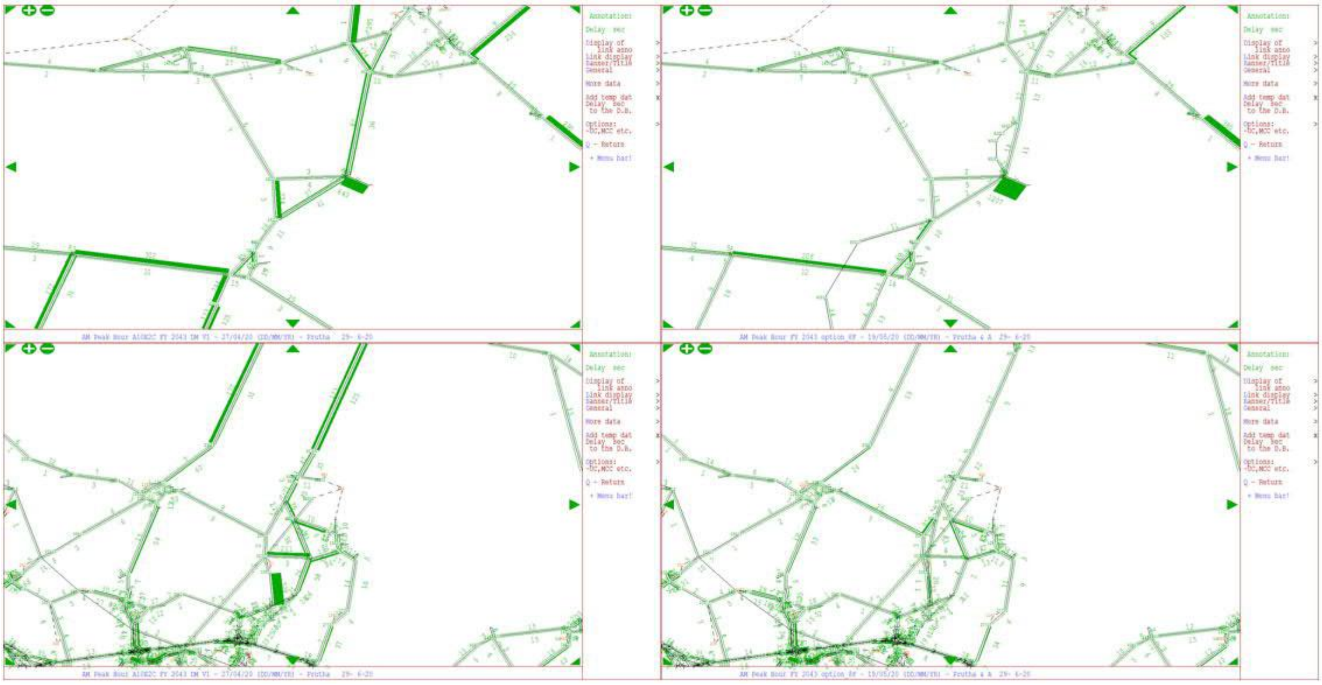


Figure 6-M 2043 Delays Option A- AM

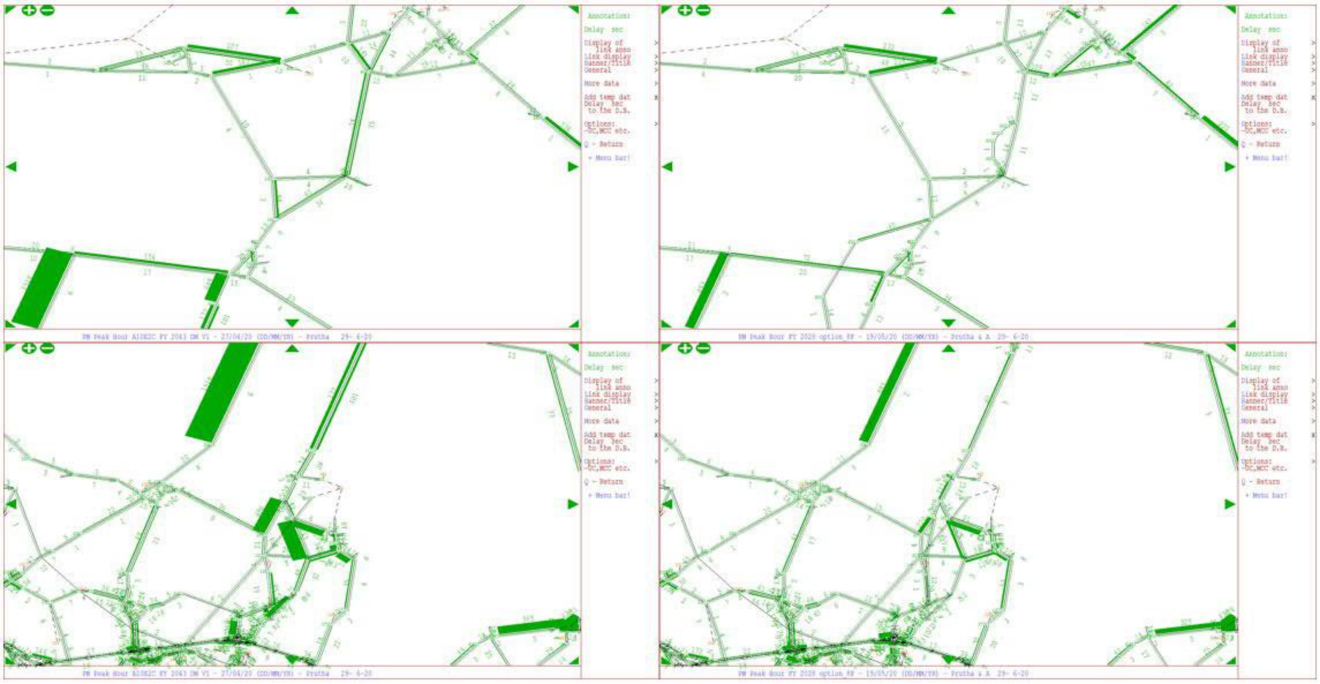


Figure 6-N 2043 Delays Option A- PM

The figures show that Option A is largely successful in reducing delays across the length of the route in the AM peak, with one exception that there are delays at The Wytches junction with the A10 due to increased flow on the mainline route reducing capacity for vehicles trying to get out of The Wytches.

In the PM peak the scheme is similarly successful at remove delays, even at The Wytches, however, there remains a delay to get on to the existing A10 from Waterbeach via Denny End Road. Whilst the situation is an improvement on the DM, which occurs due to large volumes of traffic routing away from the existing route and onto the off line alignment, the Denny End Road junction remains as it is in the DM scenario.

6.5.2 Option B

The figures below present the delays found with the inclusion of Option B.

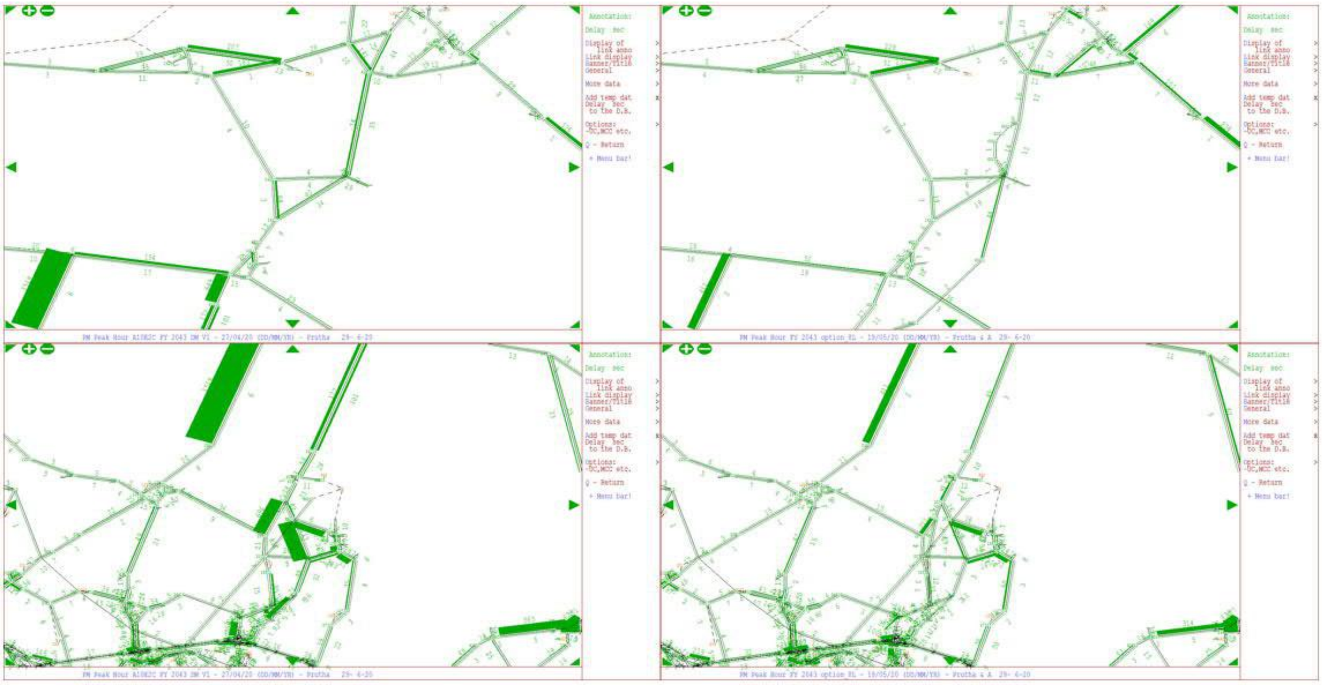


Figure 6-O 2043 Delays Option B- PM

Given that Option B is identical to Option A except for having an eastern rather than western bypass of Stretham, it is not surprising that the delays are broadly the same, including residual delays at Denny End Road. As with Option A the scheme is largely successful at relieving delays along the corridor.

6.5.3 Option C

The delay figures for Option C are shown below.

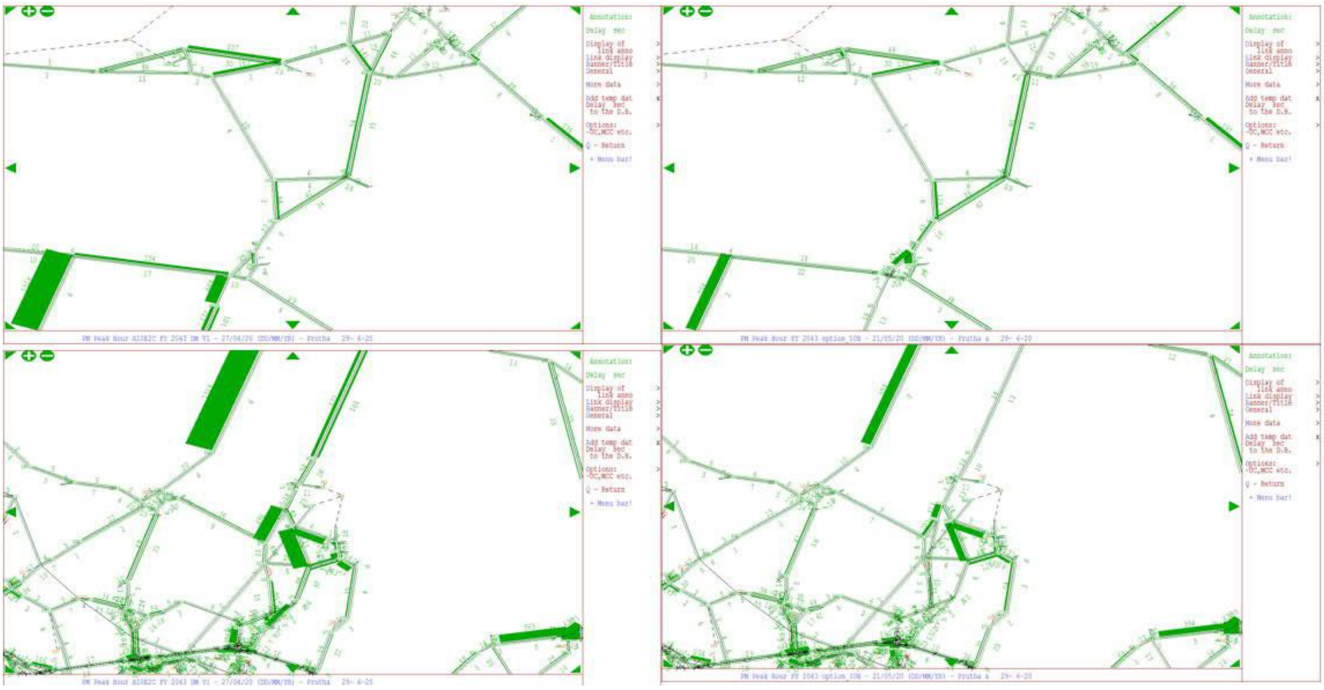


Figure 6-P 2043 Delays Option C- PM

Whilst this option does demonstrate that delays decrease in the PM peak, the reduction is not as great as that seen in the previous options. Option C only has a dualling scheme at the southern end of the A10, with junction improvements only to the north. Those junctions which are improved show a benefit, but this is sometimes to the detriment of other junctions which do not benefit from an improvement, for example the junction with High Street just to the north of Stretham. It is also notable that whilst improved from the DM, delays at Denny End Road are still present and that these are higher than in Options A and B, even though the scheme is essentially the same at this location. This is indicative that a holistic duallling approach along the whole of the route (as with Options A and B) may deliver better results overall (and not just at the points where dualling occurs).

6.5.4 Option D

Option D delay figures are shown below for the AM and PM peak.

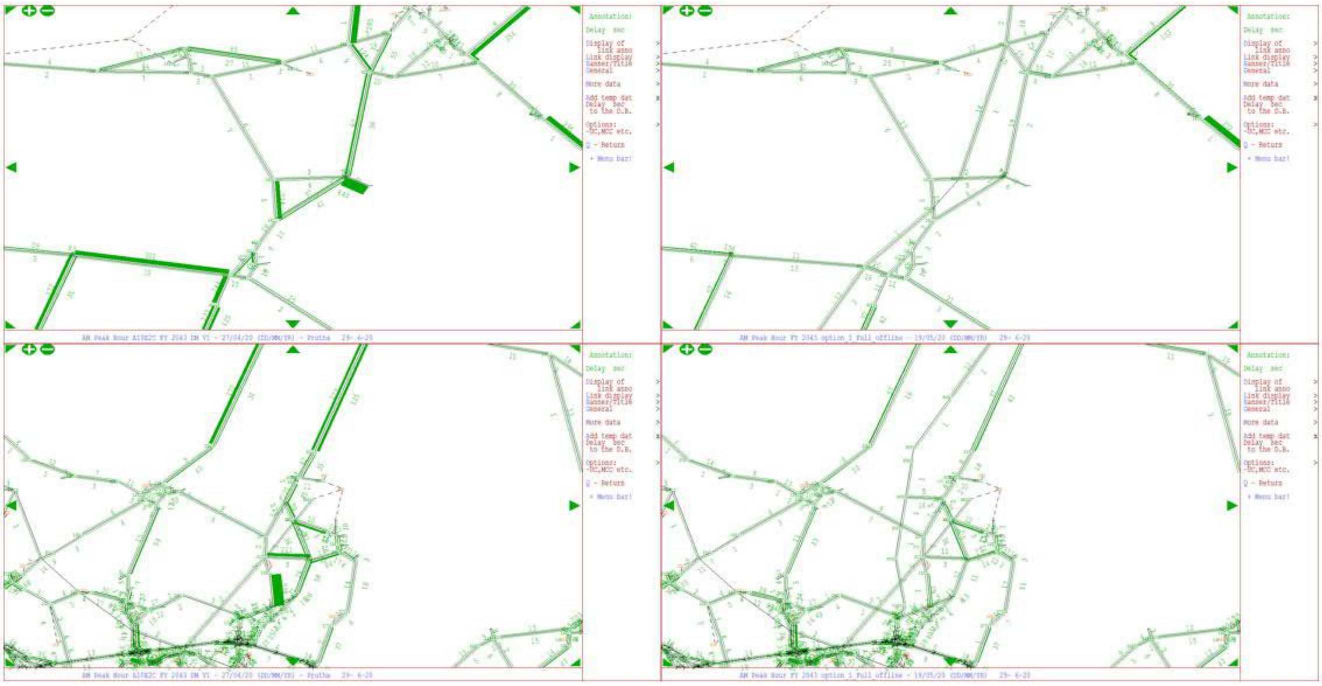


Figure 6-Q 2043 Delays Option D- AM

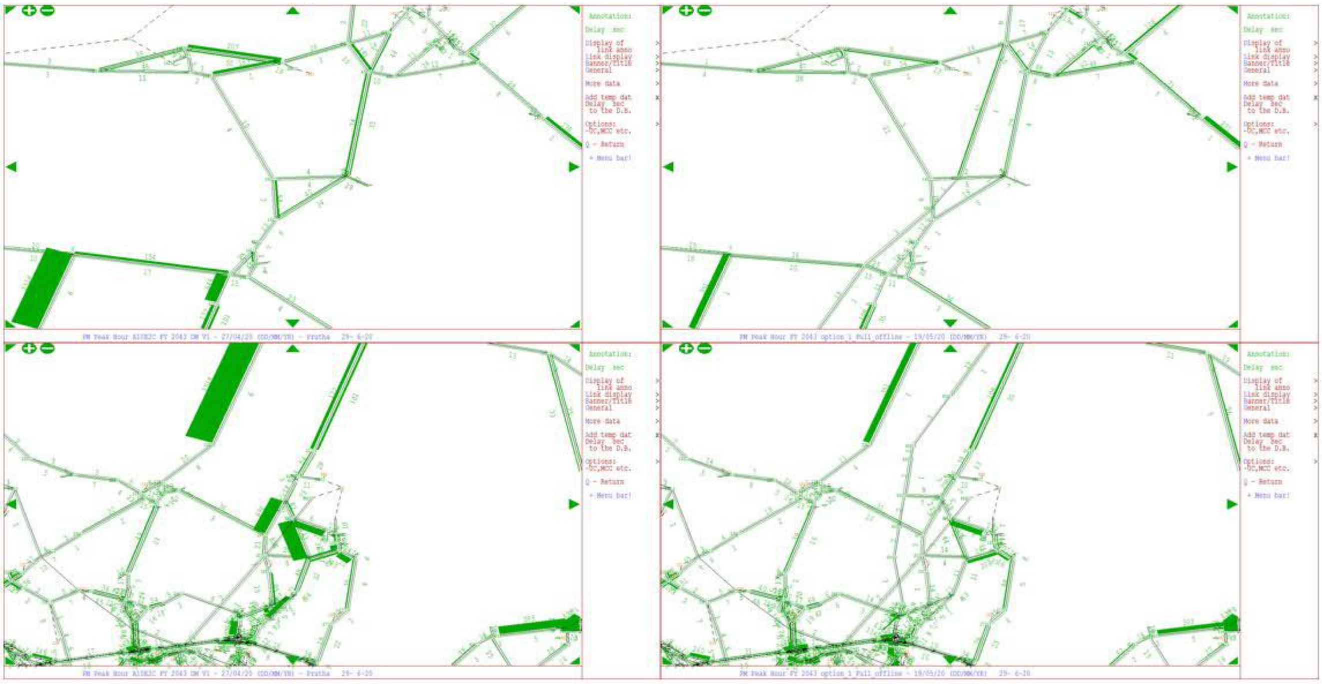


Figure 6-R 2043 Delays Option D- PM

For Option D, the PM peak observes more significant delays that the AM peak. In the AM peak, delays are substantially reduced, including at The Wytches, due to a reduction in flows on that part of the A10. In the PM peak, as noted previously, there are residual delays at Denny End Road. Of note, in comparison to the previous scenarios is that delays on the existing A10 northbound on approach to Stretham Roundabout are higher than for many other options. This is indicative of the 'funnelling' effect of having only a limited number of accesses onto the new alignment, such that what access there are, tend to see increased delays; Stretham Roundabout facilitates access onto the offline alignment which has a junction with Wilburton Road to the East.

6.5.5 Option E

The figures below show the delays in the AM and PM for the 2043 Option E scenario.

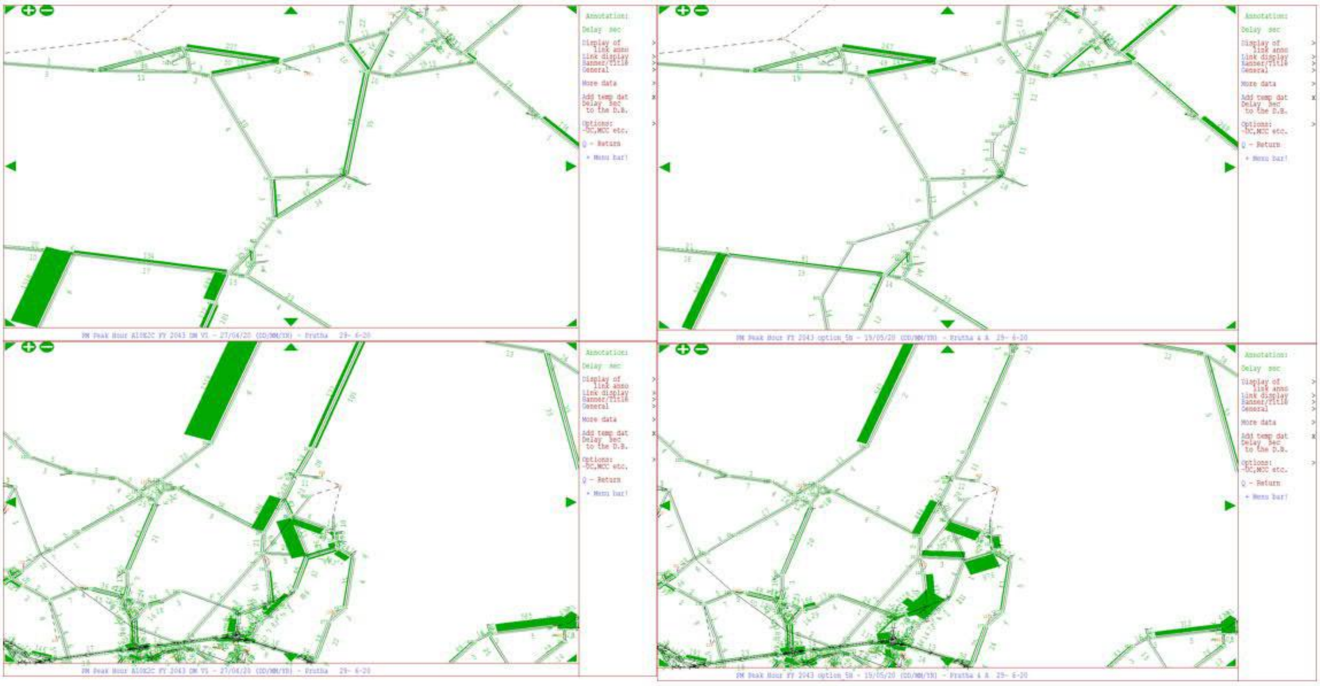


Figure 6-S 2043 Delays Option E- PM

Option E is similar to Option A except that it has online dualling through the southern part of the route (rather than off line dualling). Whilst the scheme is largely successful at remove delays from the A10, it is notable that through the southern section of the route there are large delays on side roads associated with delays in trying to access the A10, which is now dualled and has increased traffic volumes. Through trips would be unaffected by these issues but local trips wanting to use the A10 would be, and should this option be taken forwards further development of the scheme to improve local road access may be worth considering.

6.5.6 Option F

The delays for Option F are shown in the figures below for the 2043 PM peak.

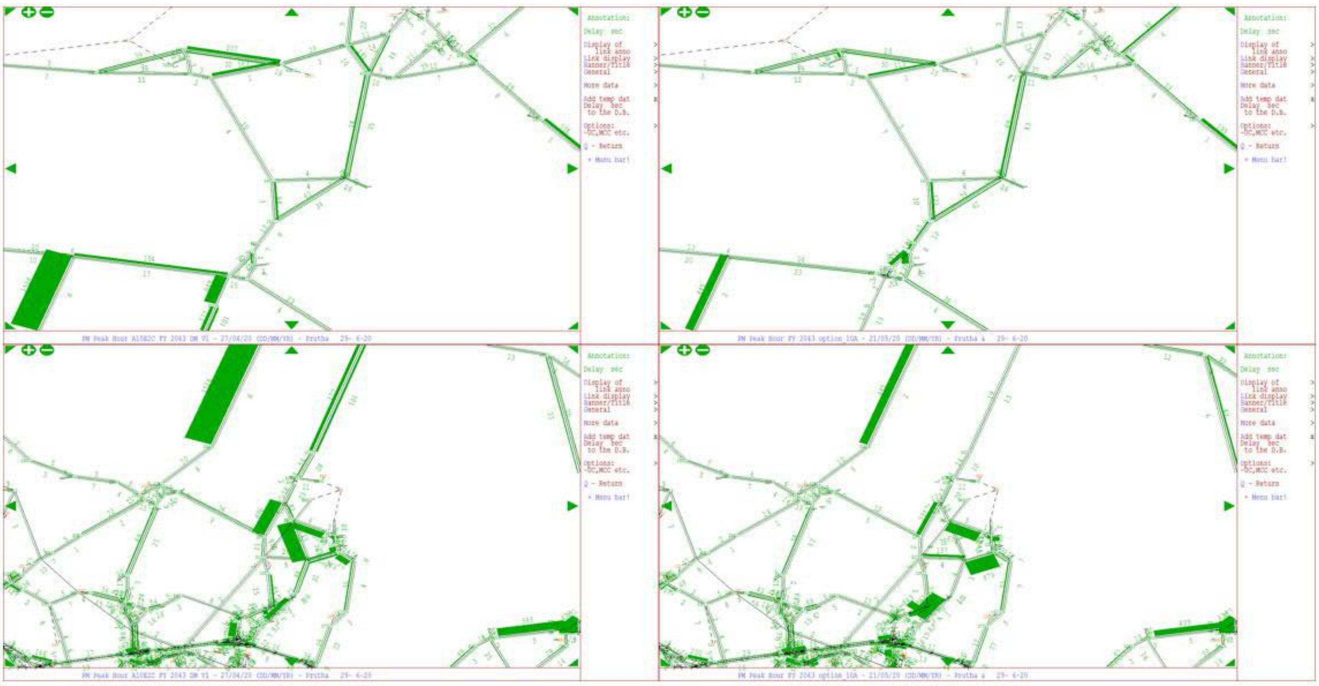


Figure 6-T 2043 Delays Option F- PM

Option F is similar to Option C in that it has dualling to the south and junction improvements to the north. However, in Option D, the dualling is online rather than online, making it similar to Option E in that respect. The delays seen in this option are unsurprisingly an amalgam of those seen in Options C and E with reduced delays to the north where junction improvements have been implemented but increased delays for those junctions which are not improved, such as the junction just north of Stretham. To the southern part of the scheme, the online dualling addresses and removes the delays that occur on the A10 in the DM, but introduces or increases delays on side roads of the A10.

6.5.7 Option G

The figures below present the delays for the 2043 AM and PM peak. Note that the 2028 delays follow a similar pattern to those of 2043 but at a smaller scale of delay.

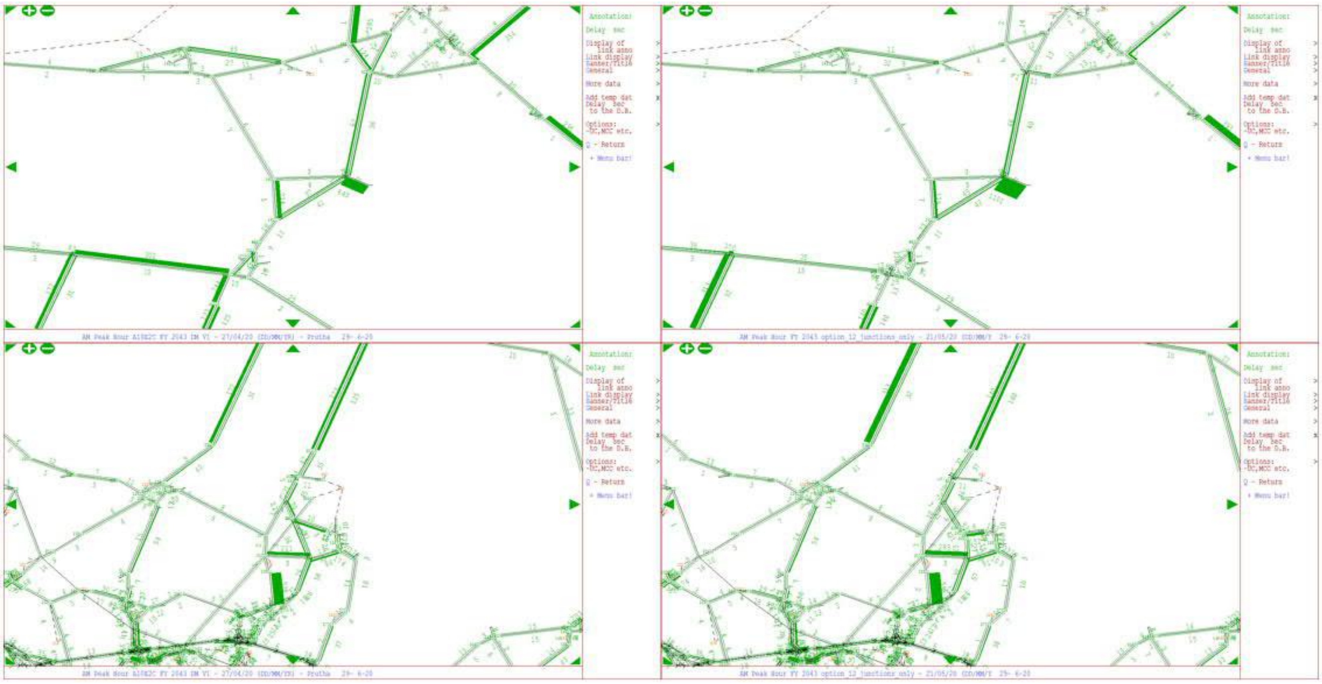


Figure 6-U 2043 Delays Option G- AM

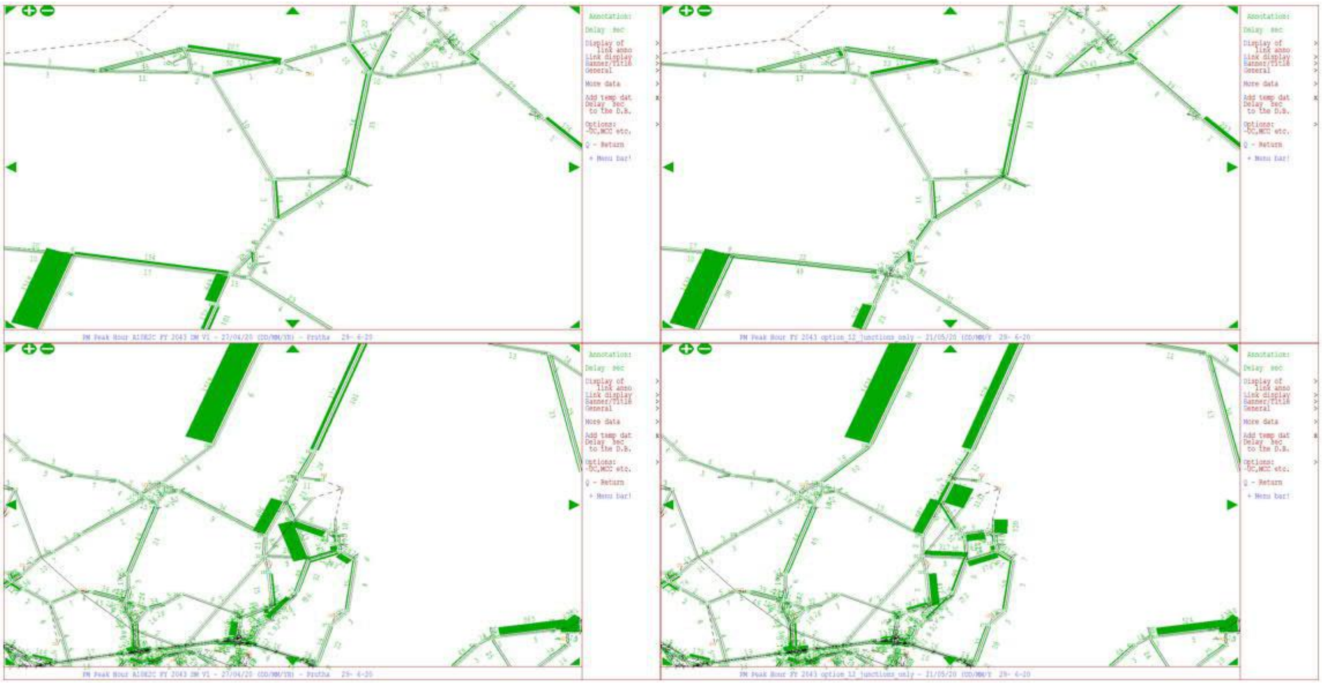


Figure 6-V 2043 Delays Option G- PM

Option G consists of junction improvements only and no dualling. For both the AM and PM peak there is evidence that those junctions which are improved do have reduced delays, however, this is at the expense of increased delays to those junctions which are improved. This is shown most clearly in the PM peak, where improvements at Denny End Road reduce the delays at the junction and allow more traffic to pass through. However, this has a negative impact at the next junction to the north, Green End, because the increased traffic released from the southern junction creates increased delays for vehicles trying to turn across that increased flow.

6.6 Select Link Analysis

A series of select link analysis plots have been produced to show the traffic using the A10 with online and offline options. These plots identify, for the selected link, where the flows on that link have come from and where they are going to. This is useful in trying to identify if the users of the link are largely through trips, or local trips, long-distance trips or short-distance trips, etc. These plots are shown below.

6.6.1 Option A (Online dualling) – Northern section

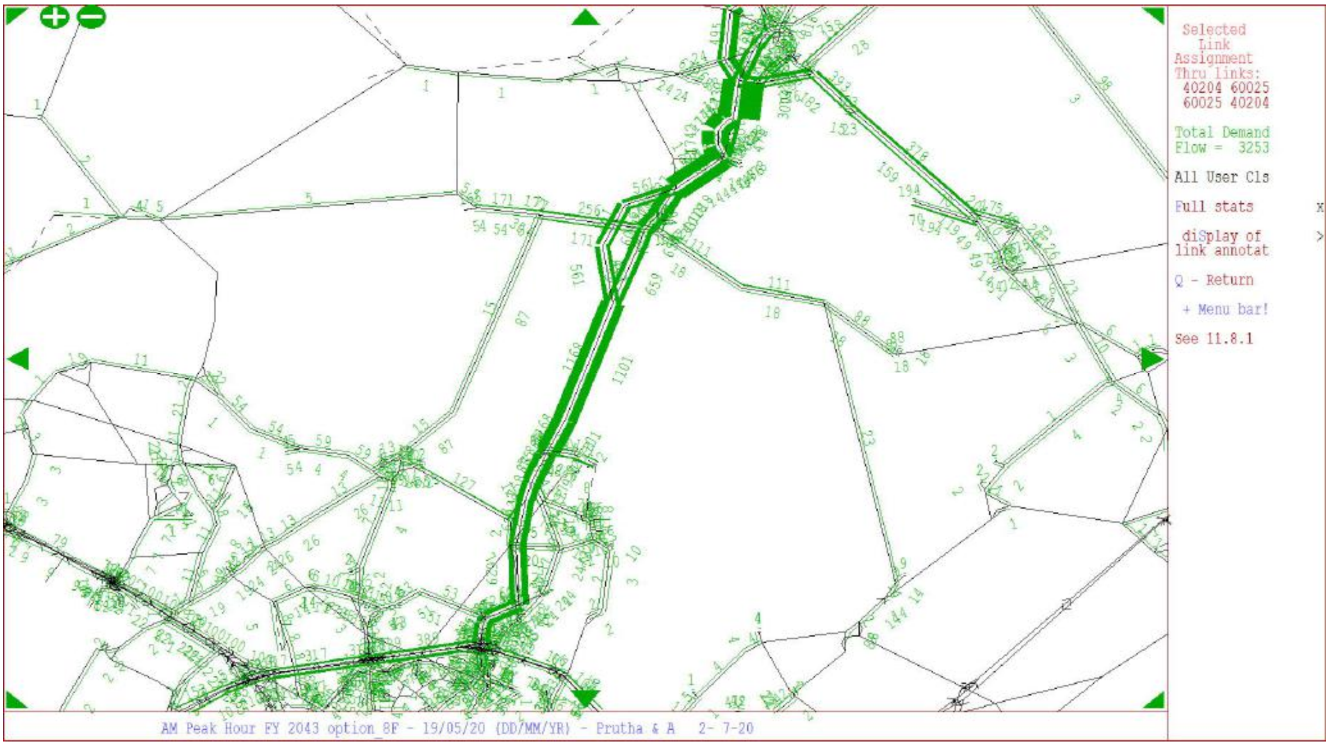


Figure 6-W Select Link Analysis for Option A North- 2043 AM

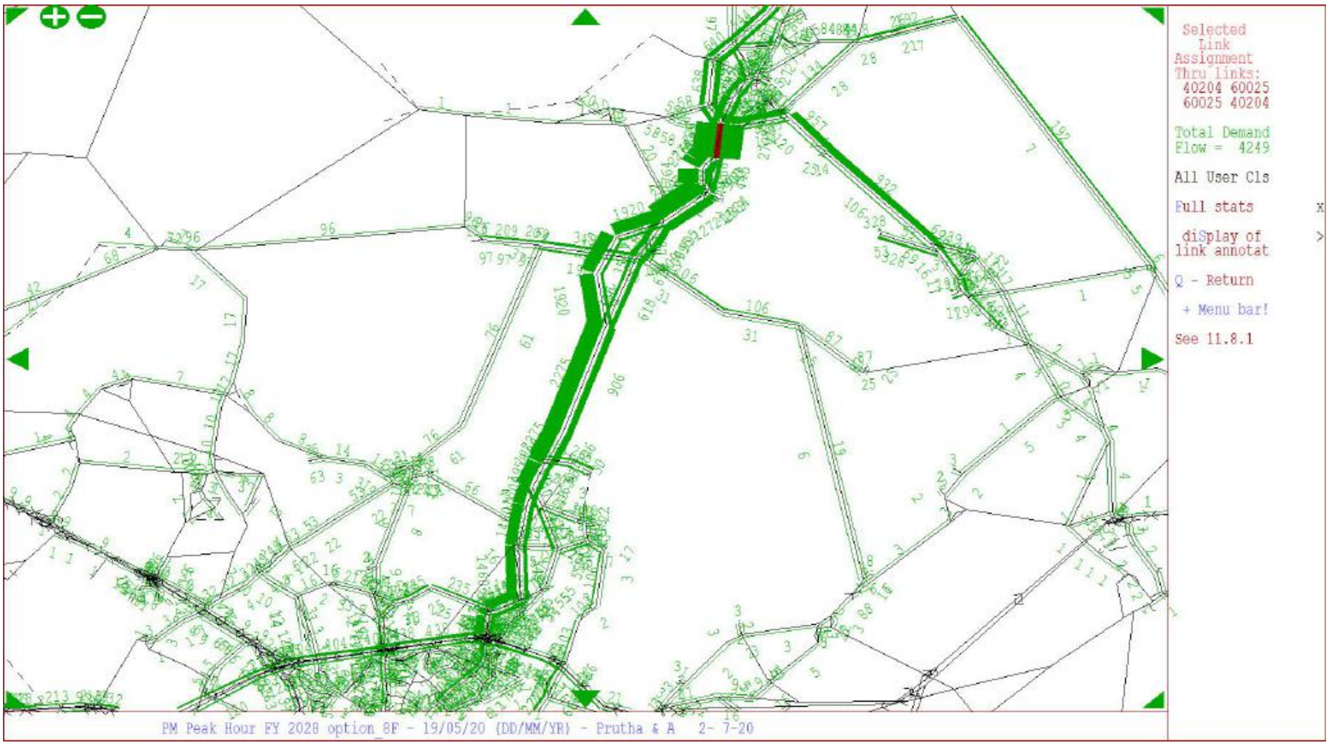


Figure 6-X Select Link Analysis for Option A North- 2043 PM

It is notable from the images above that trips on the A10 just to the south of Ely have a very high concentration of flows on the southern parts of the A10, indicating that the majority of trips at this point tend to travel along most of the length of the route. There are small numbers of trips which join or leave the A10 at Stretham or Waterbeach, but much larger volumes still on the A10 to the South. The balance of trips is also of note; in the AM peak there seems to be approximately equal volumes of north- and south-bound trips, however in the PM peak, there are more trips travelling northbound than southbound.

6.6.2 Option A (Online dualling) – Southern section

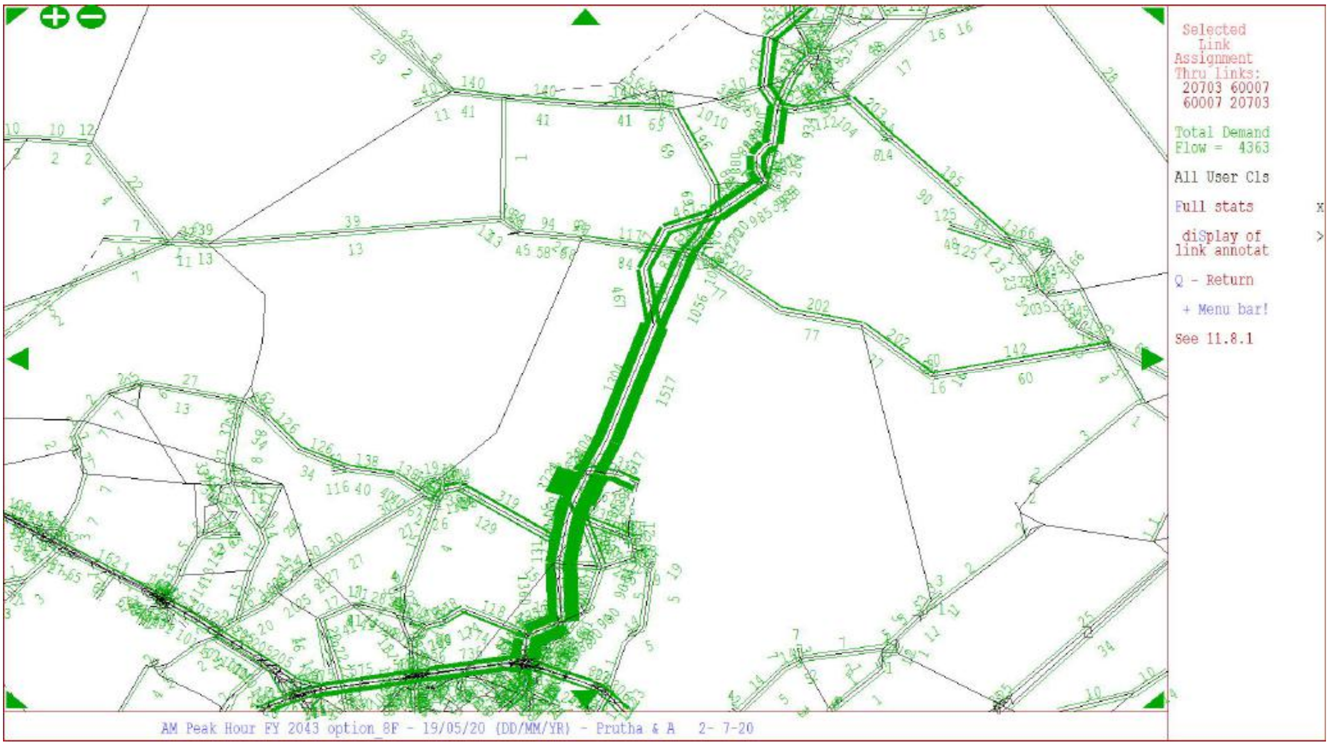


Figure 6-Y Select Link Analysis for Option A South- 2043 AM

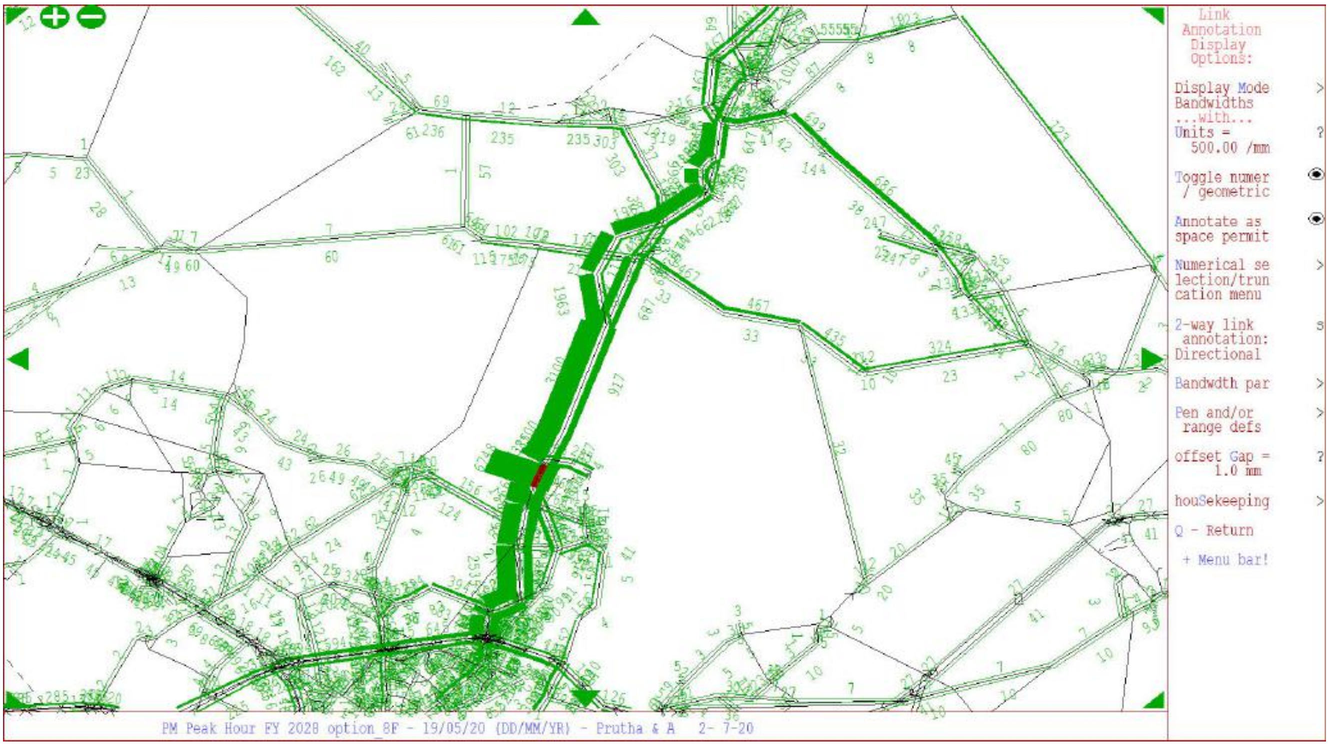


Figure 6-Z Select Link Analysis for Option A South- 2043 PM

At the southern end of the A10, the analysis indicates that there is still a high volume of trips which use the southern section as part of a route including the whole of the A10 up to Ely. However, there doesn't appear to be as great a concentration as there does for the northern section, with proportionately more trips leaving/joining the A10 at Stretham.

6.6.3 Option D (Offline dualling) – Northern Section

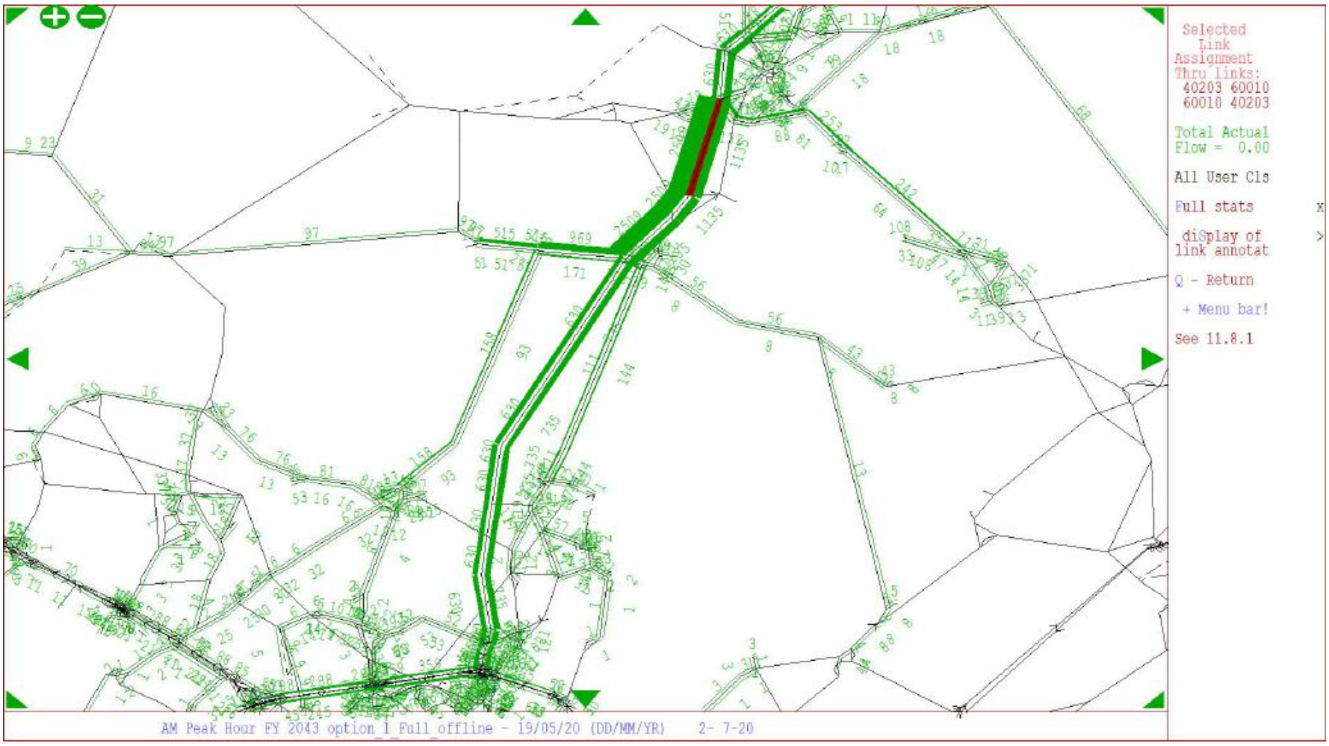


Figure 6-AA Select Link Analysis for Option D (Offline) North- 2043 AM

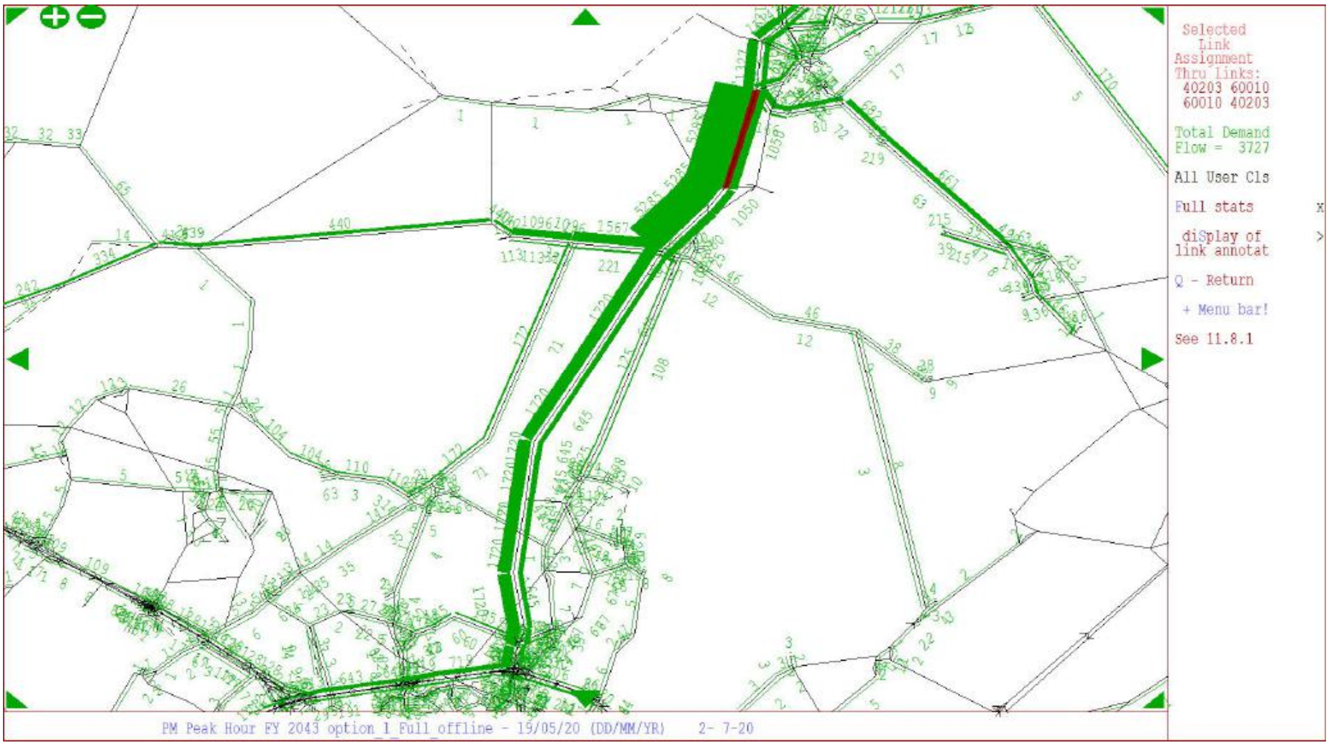


Figure 6-BB Select Link Analysis for Option D (Offline) North- 2043 PM

In contrast to the trip patterns see for the online alignments, for off line alignments the analysis indicates a smaller proportion of trips which travel along the length of the route, with a notable proportion joining the route at Stretham (via the A1123). This effect was evident from the flow difference plots showing that between Option

D and the DM there was a switching of trips from the A142 to the A1123. It may be that the new off line alignment represents a preferable route for trips travelling towards Ely from the West.

6.6.4 Option D (Offline dualling) – Southern Section

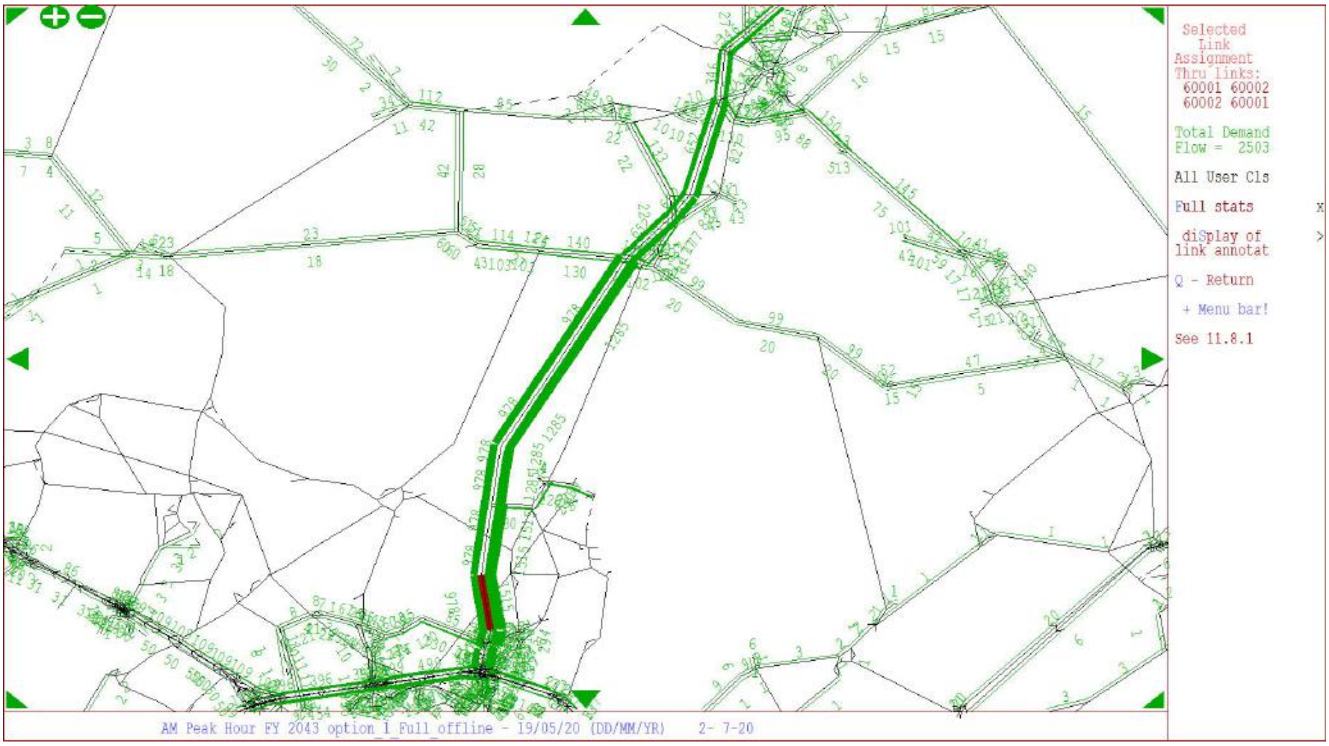


Figure 6-CC Select Link Analysis for Option D (Offline) South- 2043 AM

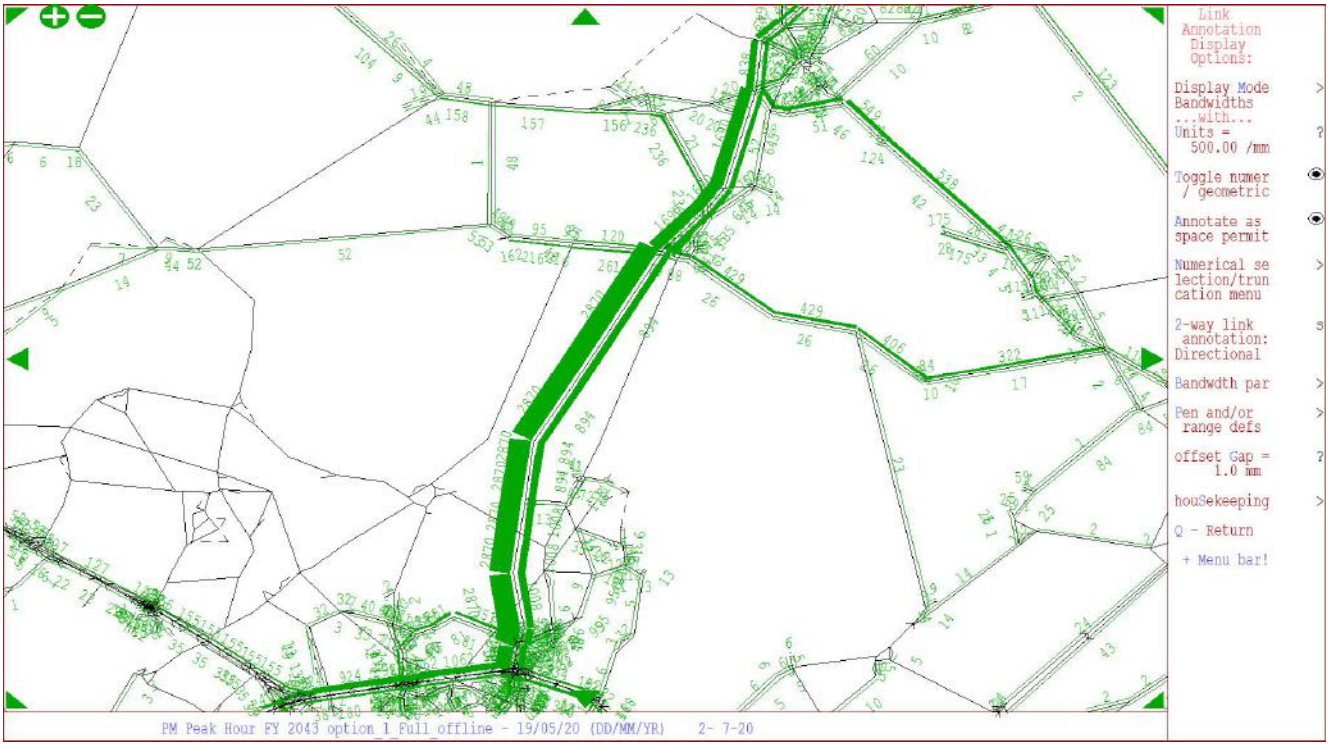


Figure 6-DD Select Link Analysis for Option D (Offline) South- 2043 PM

As with the online equivalent, there is a small amount of traffic which leaves or joins the A10 at Stretham rather than travelling the full length of the route.

7. Summary

7.1 Modelling Methodology

The methodology for the development of the A10E2C model forecasts was proportionate to the level of assessment required at an SOBC stage and made best use of available tools, namely the CSRM2 model forecasts undertaken for the pre-SOBC modelling. These forecasts utilised VDM and had growth which included Local Plan and locally set estimates for demographic and employment data. Whilst the details of the schemes assessed in the pre-SOBC modelling differed slightly from those assessed in the SOBC modelling, the schemes were similar enough such that the VDM effects of the pre-SOBC modelling are considered broadly representative of the likely effects of the similar schemes in the SOBC. Using the CSRM2 model forecasts also ensured consistency with other scheme assessments undertaken in Cambridgeshire which all derive from the same common base (the CSRM2). The pre-SOBC forecasts were developed for a single forecast year (2031) and so interpolation and extrapolation of growth to the forecast years for the A10E2C model was undertaken.

The forecast scenarios thus produced allowed for a consistent reference case against which to compare the relative performance of the different scheme options. It should be noted that due to the Land Use and demographic forecasts underlying the CSRM2 model, and their extrapolation from 2031 to 2043, growth in the A10E2C forecasts is in excess of TEMPro. However, this must be seen in the context of locally developed estimates of growth which are considered to be a more reliable indicator of growth in the modelled area than NTEM v7.2 and the fact that at this stage a significant part of the business case will focus on the relative merits of each scheme option against the others. It is anticipated that forecasting using growth closer to the levels of NTEM would produce reduced scheme benefits, however it is considered unlikely to change the assessment of the relative merits of each scheme.

7.2 Relative Performance of Scheme Options

The scheme options with dualling along the full length of the A10 (Options A, B, D and E) tended to produce the highest increase in flows along the A10 corridor and greatest reductions in delays compared to the DM. All of these options produce improved journey conditions (less congestion etc.) for trips travelling along the mainline A10, however, they all have some disadvantages for trips joining the A10 from side roads; for option E there is a particular increase in delays for vehicles trying to join the A10 via the southern section. For Options A, B and D, this effect does not occur to the same extent as the alignment at the same location is predominantly off line. However, Option D causes slightly increased delays compared to options A and B due a funnelling effect of having only a limited number of connections with the existing network.

Scheme options which have partial dualling (Options C and F) demonstrate some increased flows on the A10 and reduced delays, however the flow increases and delay reductions are not as great as for the full dualling schemes, because the junction improvements are not comprehensive across the corridor; only a limited selection of junctions are improved by the scheme and whilst this is successful in reducing delays and increasing flows at those junctions, there are adverse knock-on implications at downstream junctions which do not have sufficient capacity to accommodate the increased flow unlocked by the improvements at the other junctions.

The option which has the least effect on traffic levels and delays is the junctions only scenario, Option G; as noted above, whilst this leads to an improved performance at those junctions included within the scheme, this is offset by a worsening performance at those junctions which do not receive any form of capacity improvements, whilst at the same time experiencing an increase in flows directly due to improvements elsewhere.

7.3 Recommendations for Further Assessment

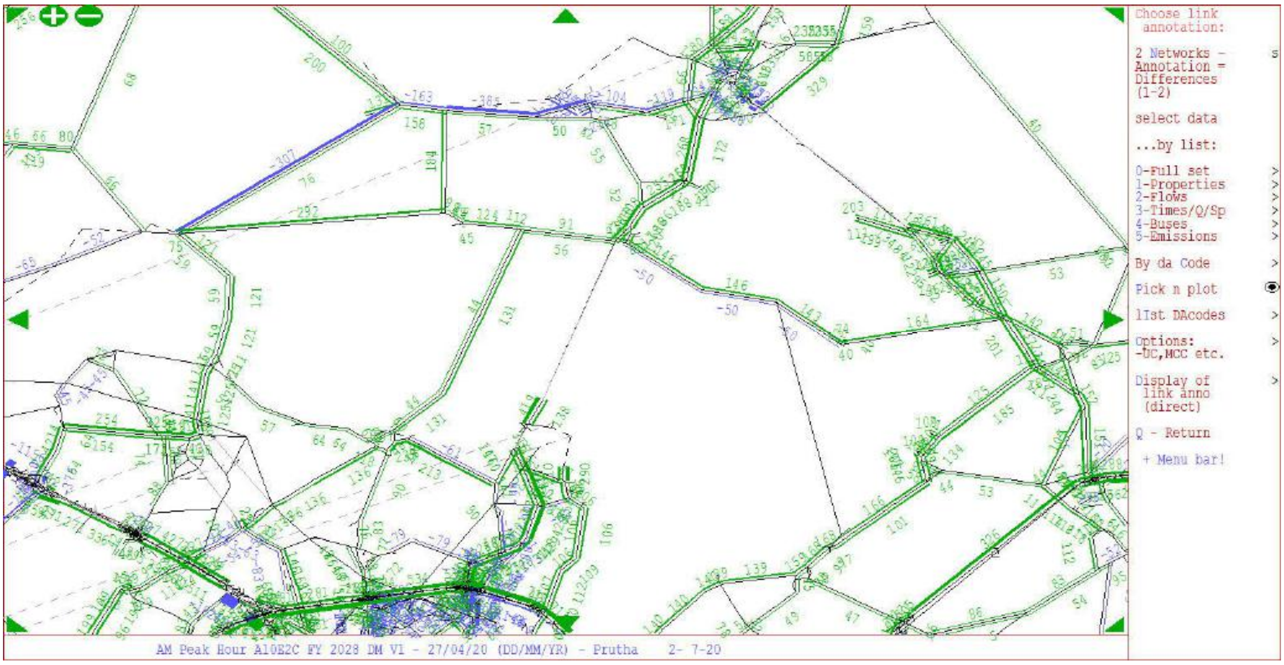
Should the scheme progress through to an Outline Business Case, more detailed modelling using bespoke model forecast runs should be undertaken. Use should continue to be made of the functionality of the CSRM2 model, however, rather than using existing model runs from a single forecast year, new model runs reflecting the specific details of the scheme to be appraised, incorporating updated land use assumptions, and for forecast years which more closely approximate the anticipated scheme opening, and opening plus 15, years. This should also include updated information for key developments in the vicinity of the corridor, such as Waterbeach and Cambridge Science Park. These new forecasts of the CSRM2 should then be used to produce forecasts of the A10E2C model in much the same way as used for the SOBC.

It is also recommended that a growth scenario consistent with NTEM be undertaken, as well as an alternative development scenario with growth consistent with Local Plan forecasts.

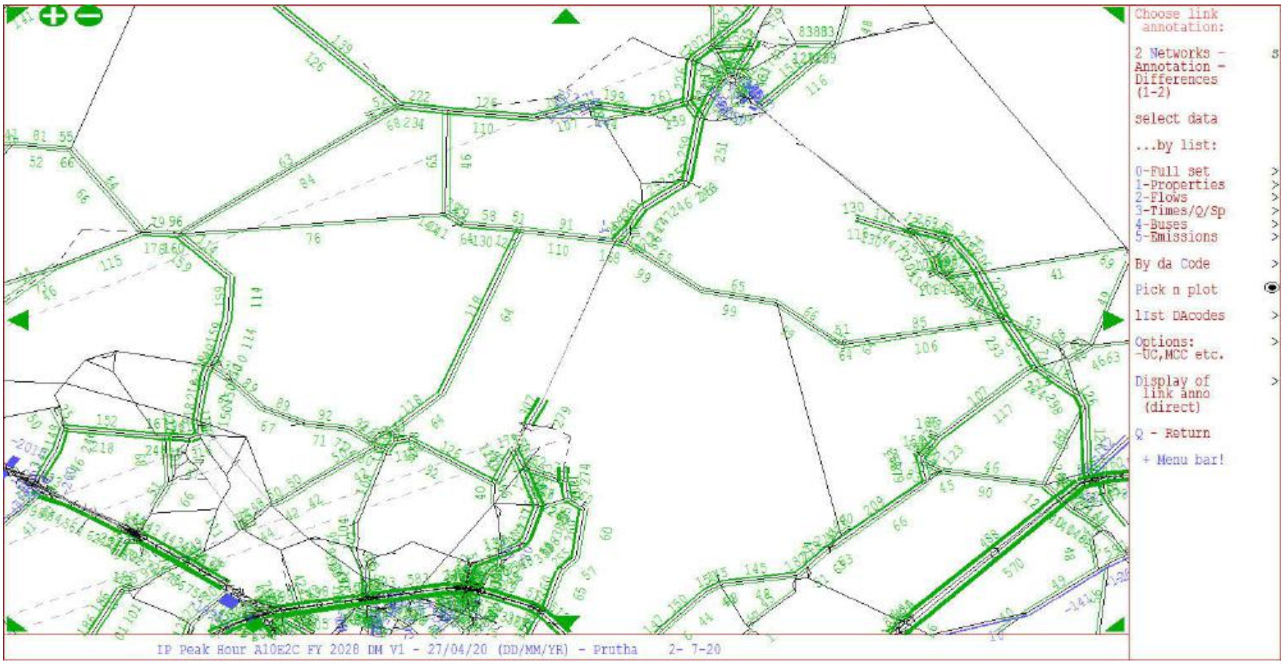
Appendix A. Flow Change from Base

2028 DM

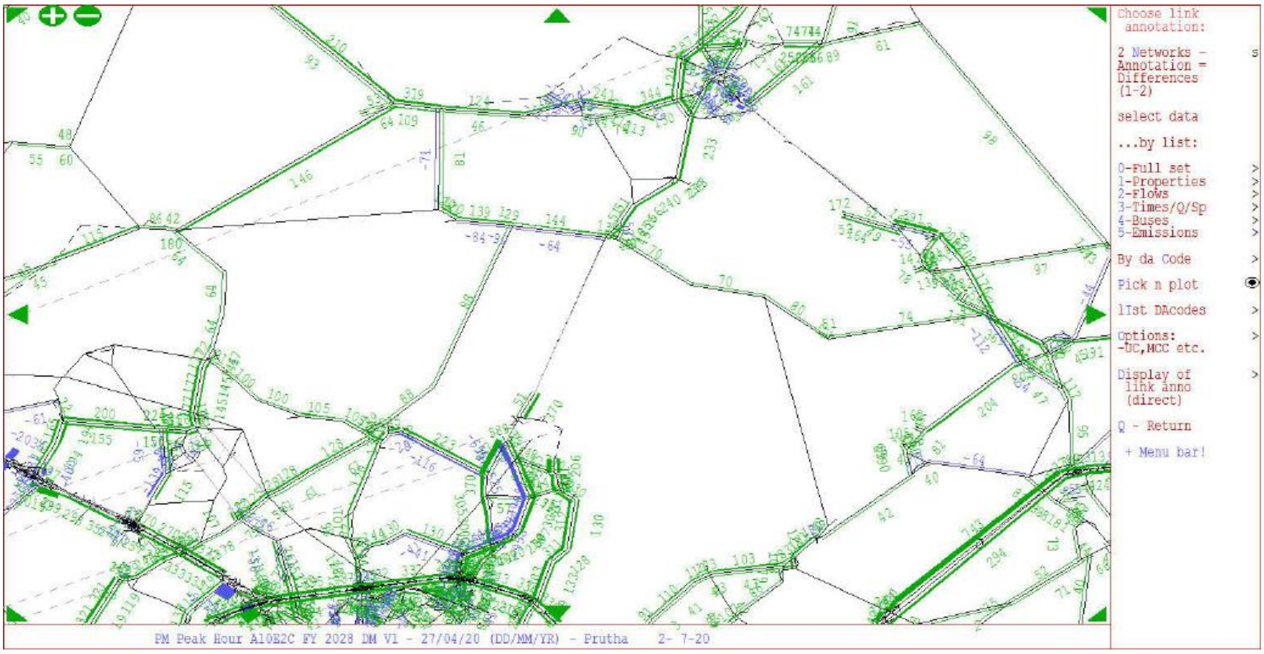
AM



IP

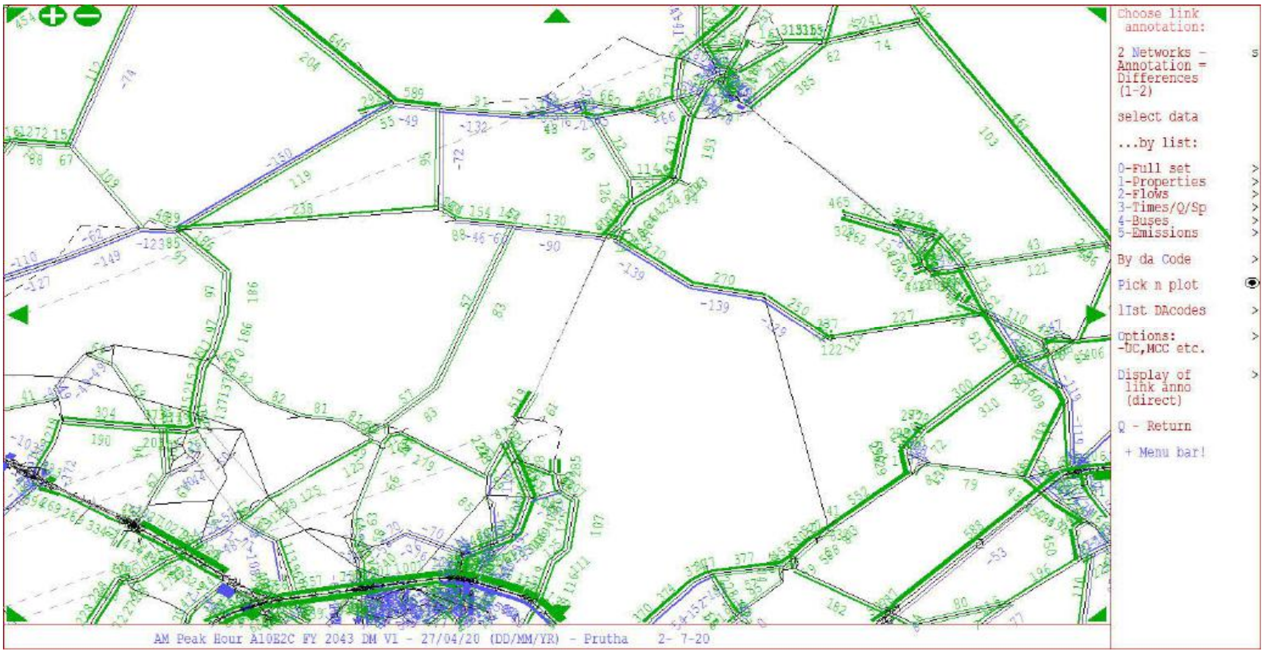


PM


Choose link annotation:
2 Networks - Annotation = Differences (1-2)
select data
...by list:
0-Full set
1-Properties
2-Flows
3-Times/Q/Sp
4-Buses
5-Emissions
By da Code
Pick n plot
1Tst DAcodes
Options: -DC,MCC etc.
Display of link anno (direct)
Q - Return
+ Menu bar!
PM Peak Hour A10E2C FY 2028 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 2- 7-20

2043 DM

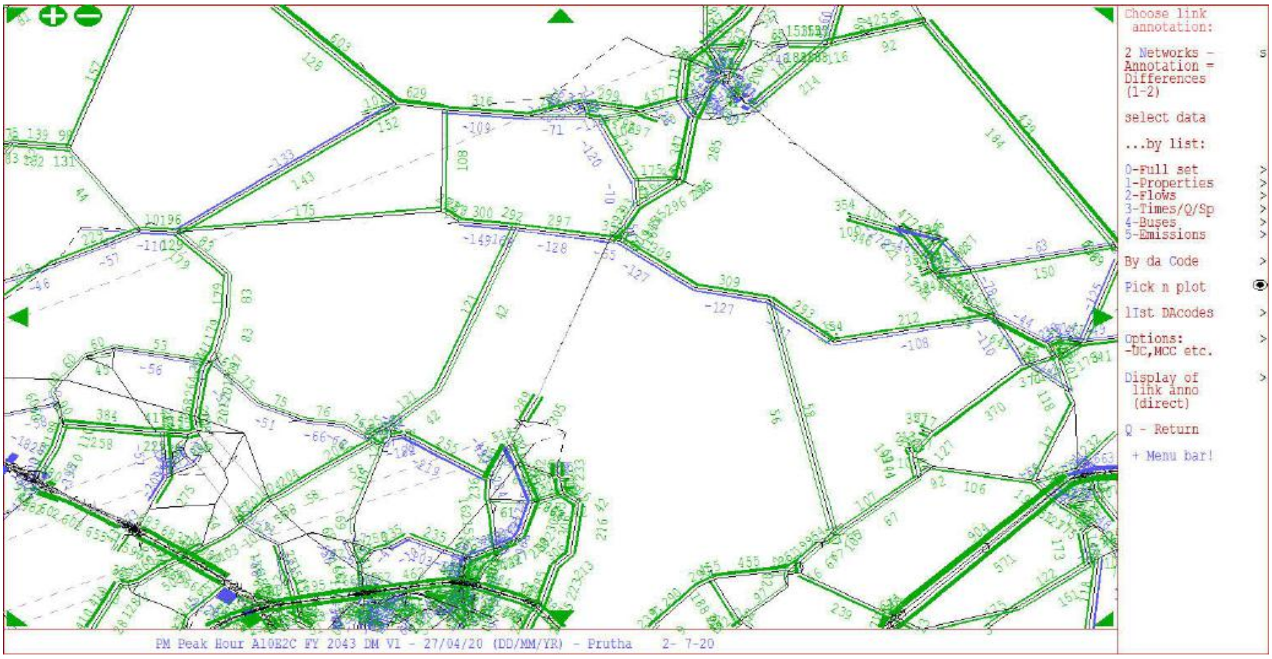
AM


Choose link annotation:
2 Networks - Annotation = Differences (1-2)
select data
...by list:
0-Full set
1-Properties
2-Flows
3-Times/Q/Sp
4-Buses
5-Emissions
By da Code
Pick n plot
1Tst DAcodes
Options: -DC,MCC etc.
Display of link anno (direct)
Q - Return
+ Menu bar!
AM Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 2- 7-20

IP


Choose link annotation:
2 Networks - Annotation = Differences (1-2)
select data
...by list:
0-Full set
1-Properties
2-Flows
3-Times/Q/Sp
4-Buses
5-Emissions
By da Code
Pick n plot
list DAcodes
Options: -UC,MCC etc.
Display of link anno (direct)
Q - Return
+ Menu bar!
IP Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 2- 7-20

PM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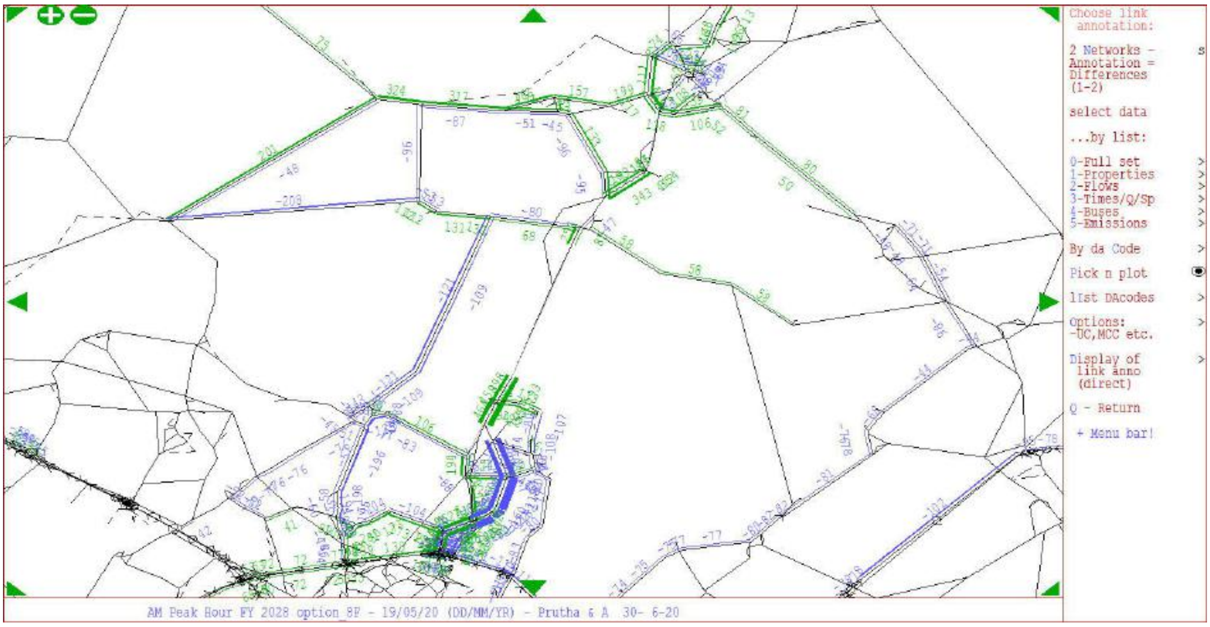
2 Networks - Annotation = Differences (1-2)
select data
...by list:
0-Full set
1-Properties
2-Flows
3-Times/Q/Sp
4-Buses
5-Emissions
By da Code
Pick n plot
list DAcodes
Options: -UC,MCC etc.
Display of link anno (direct)
Q - Return
+ Menu bar!
PM Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 2- 7-20

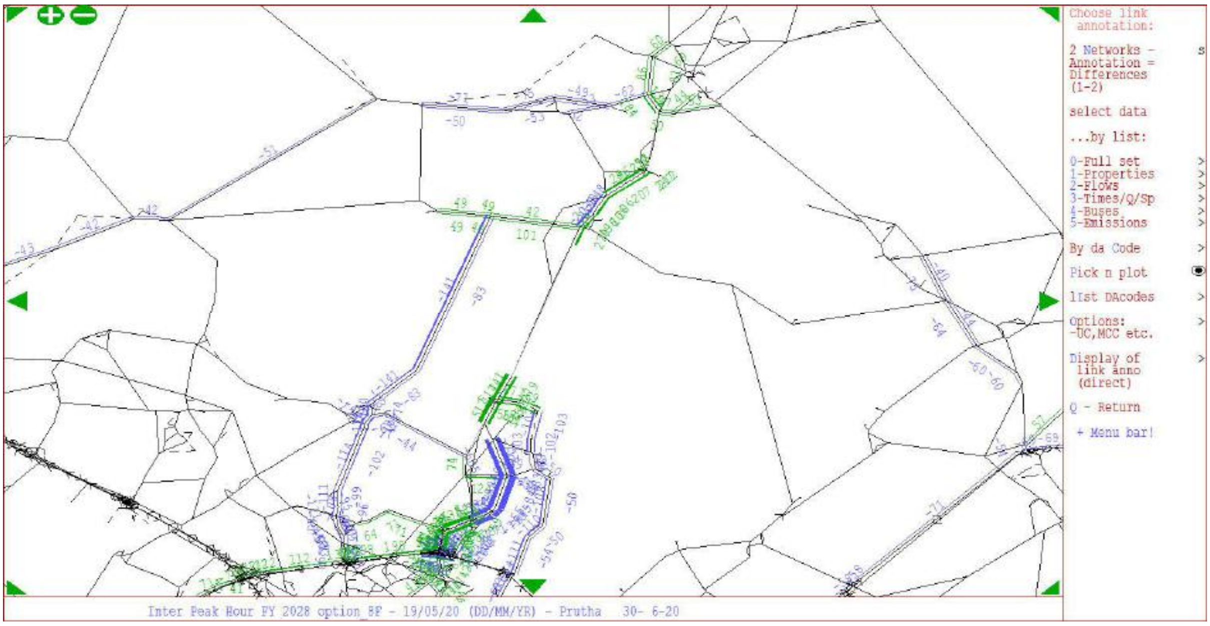
Appendix B. Flow Changes due to Proposed Scheme Option

Option A

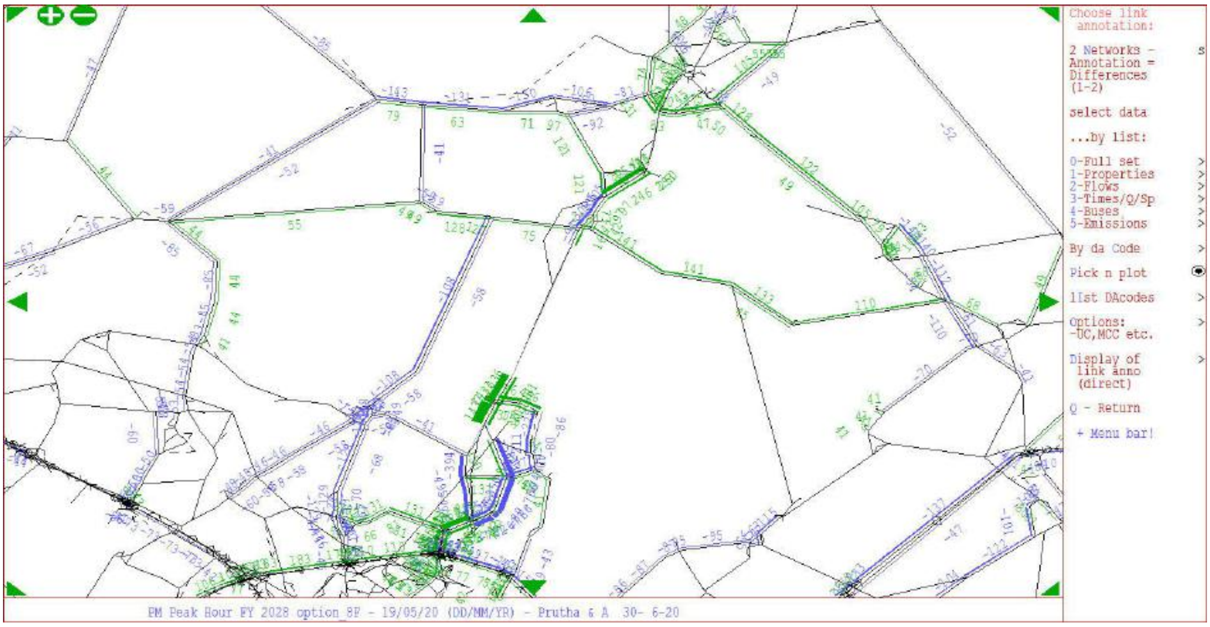
2028- AM



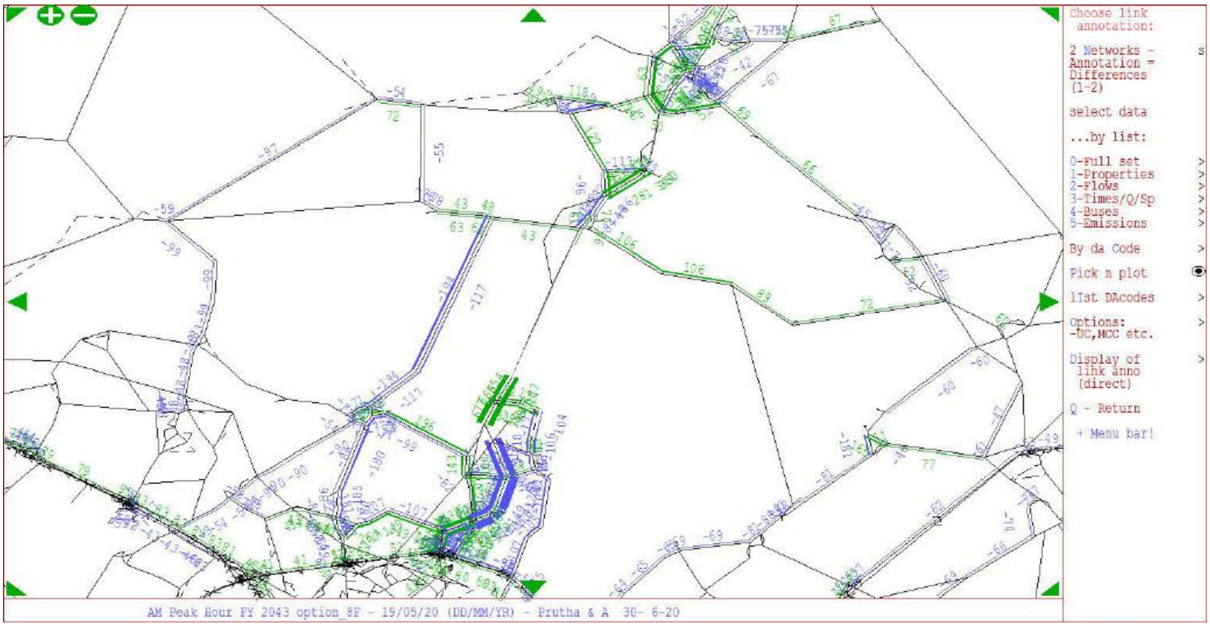
2028- IP



2028- PM



2043- AM



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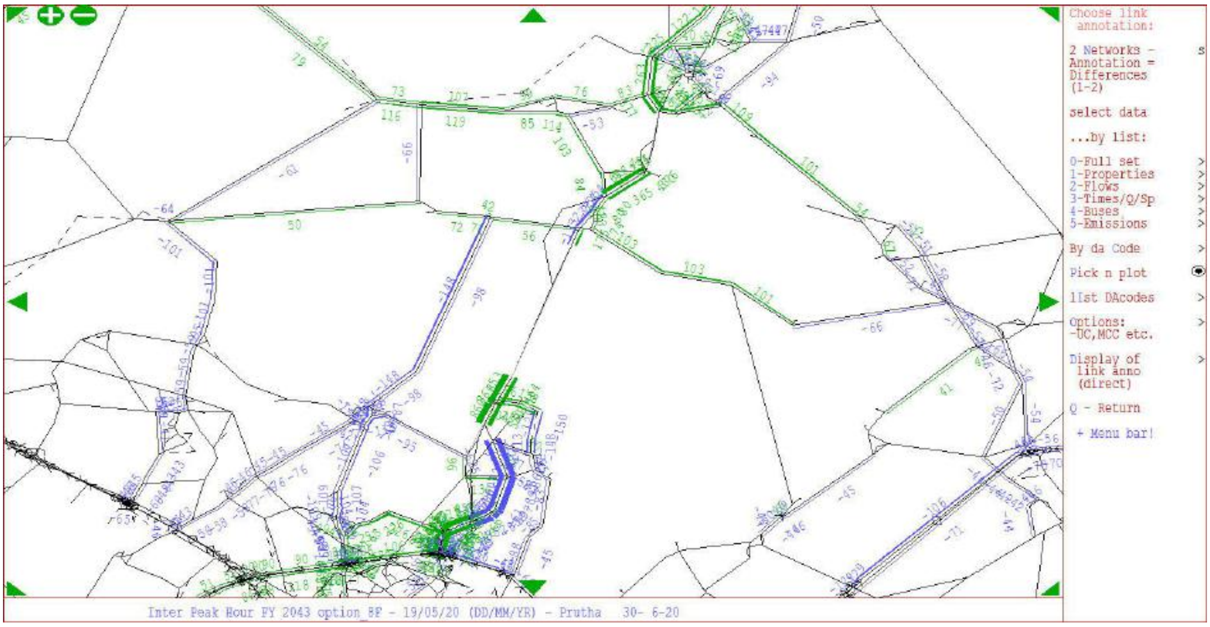
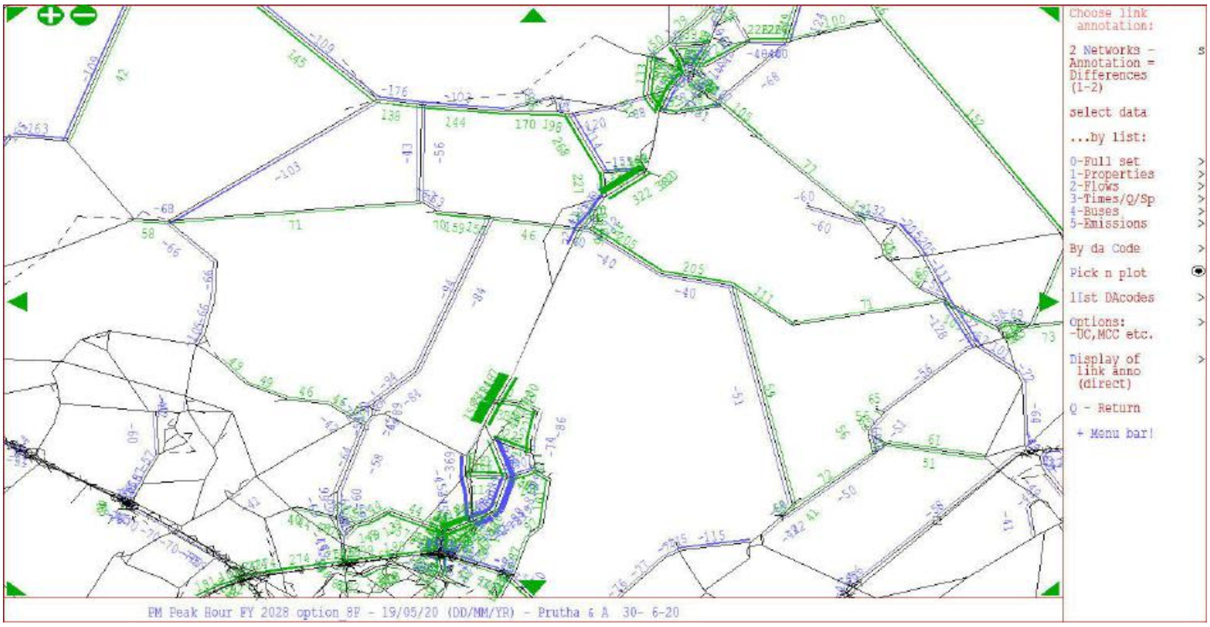
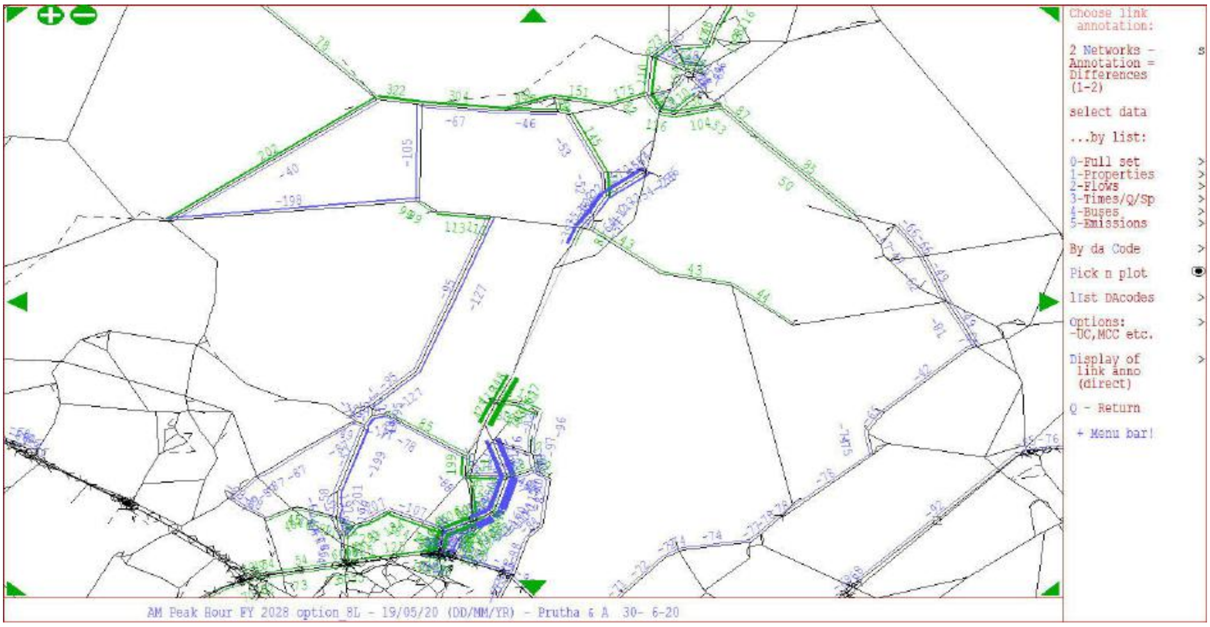


2043- PM



Option B

2028- AM



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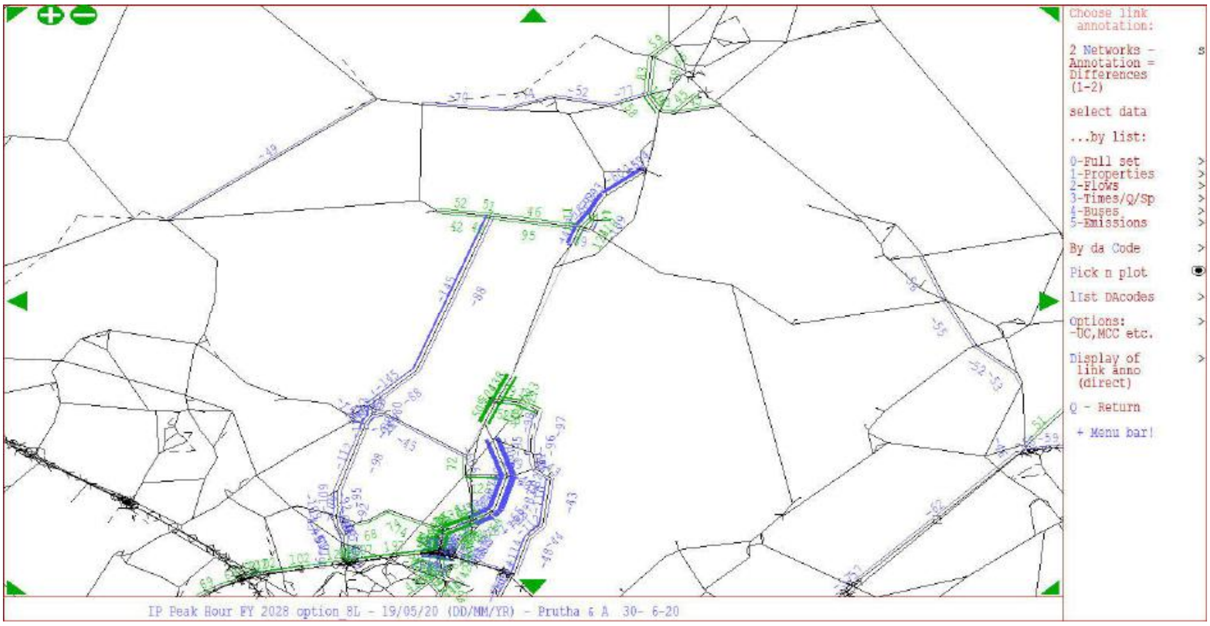

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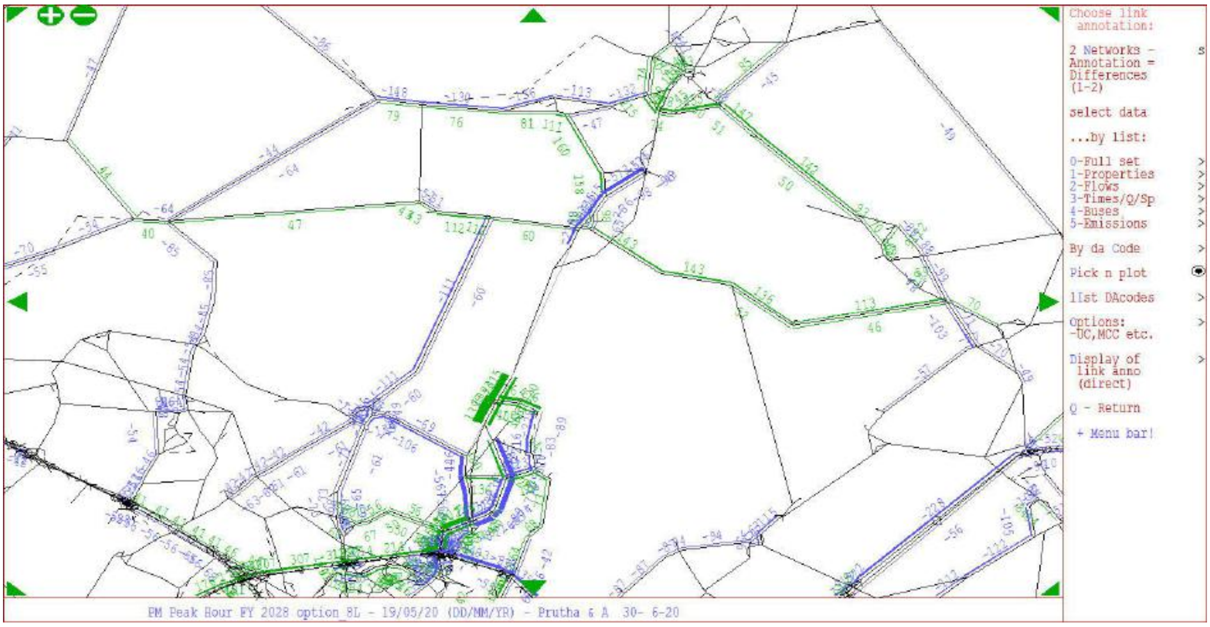

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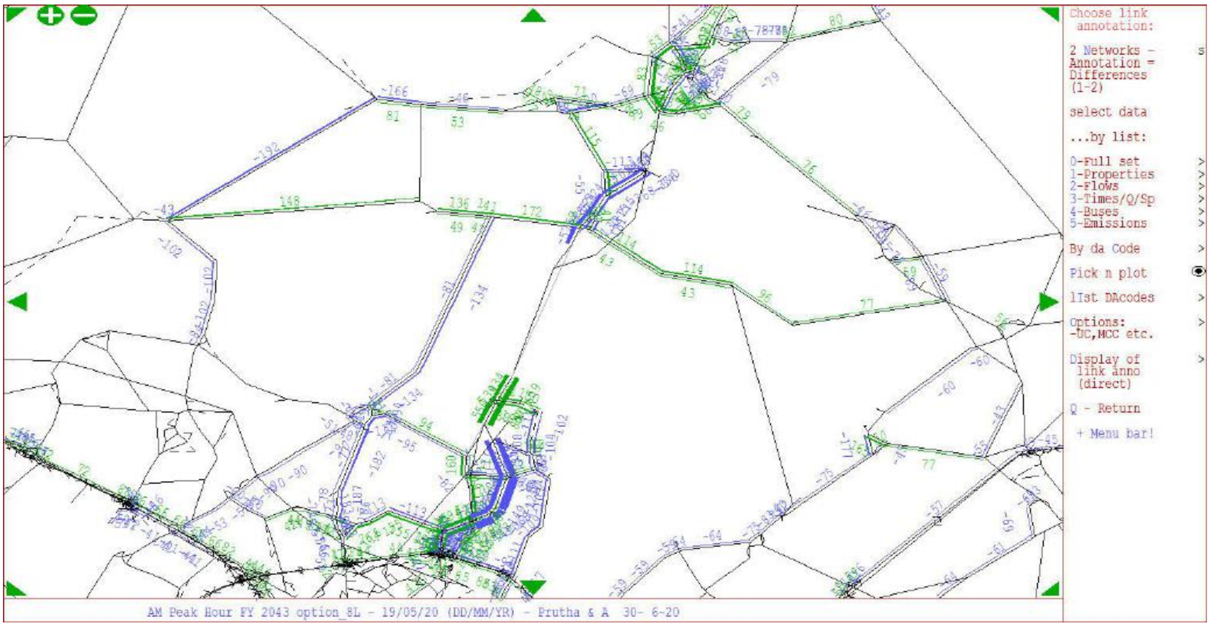

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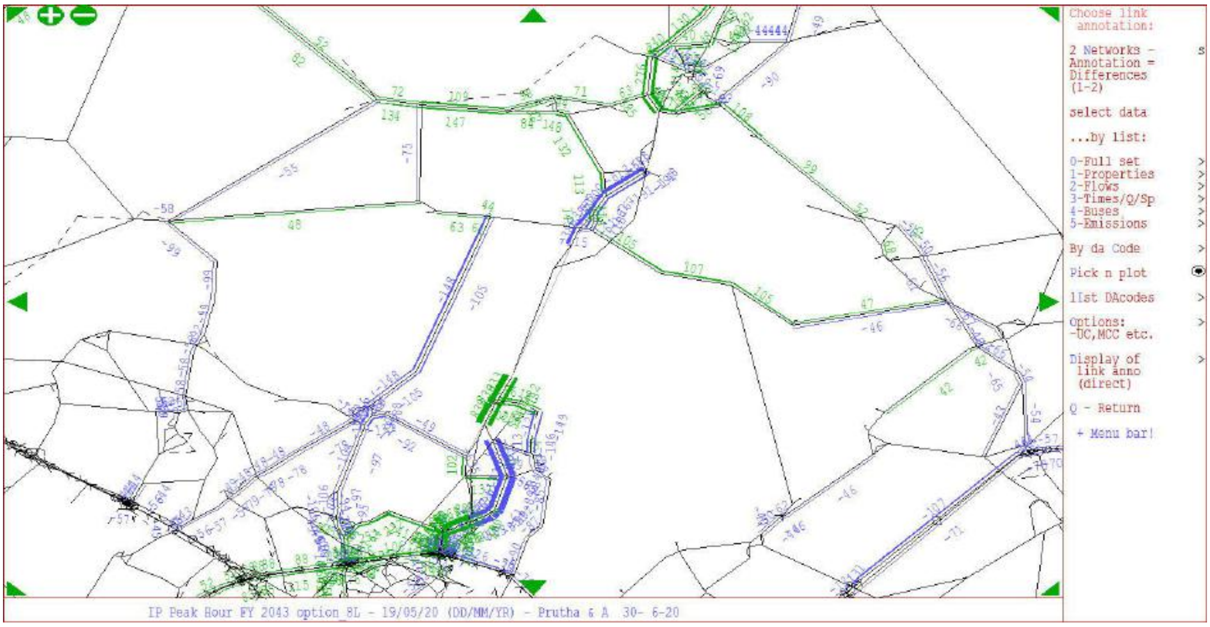

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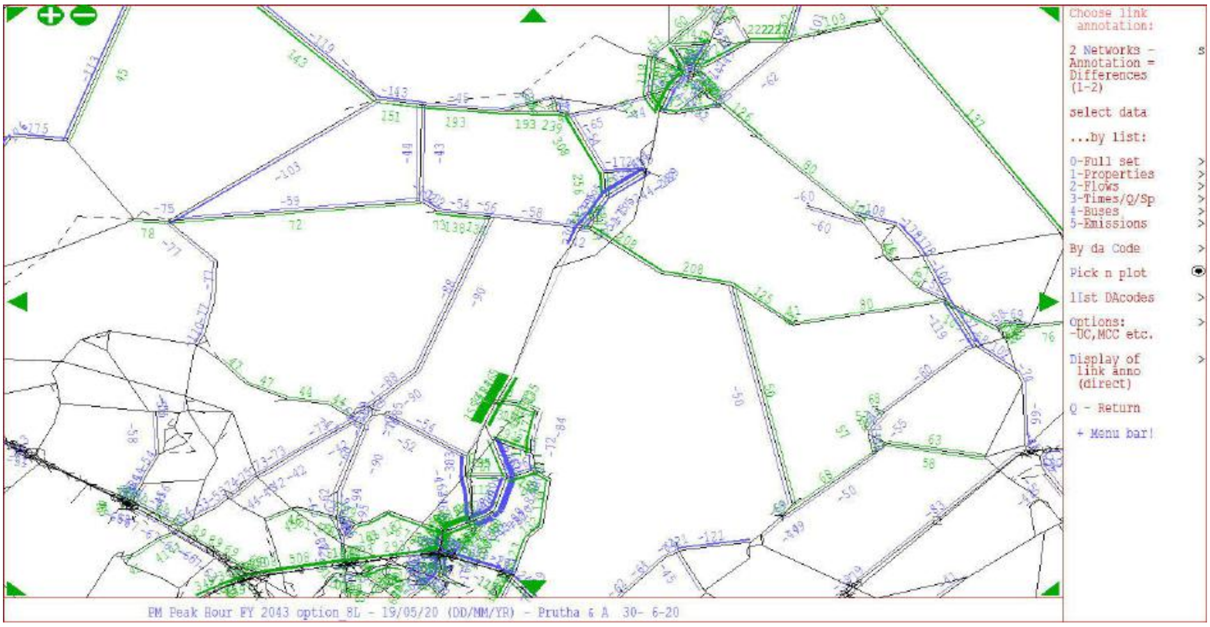
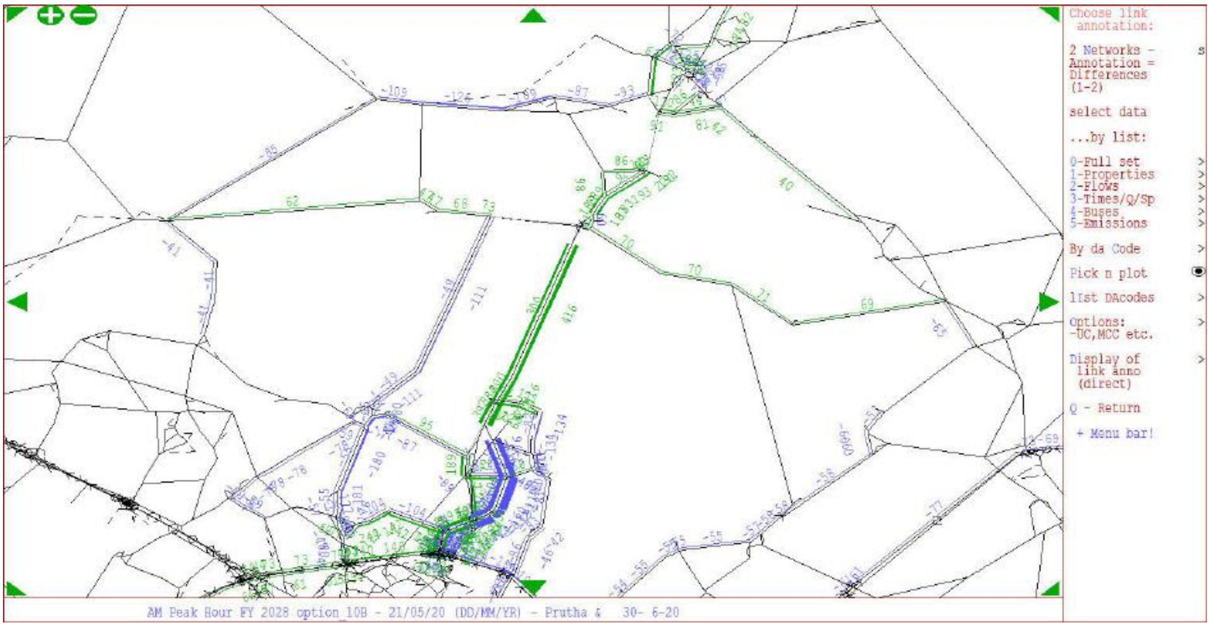


Option C

2028- AM



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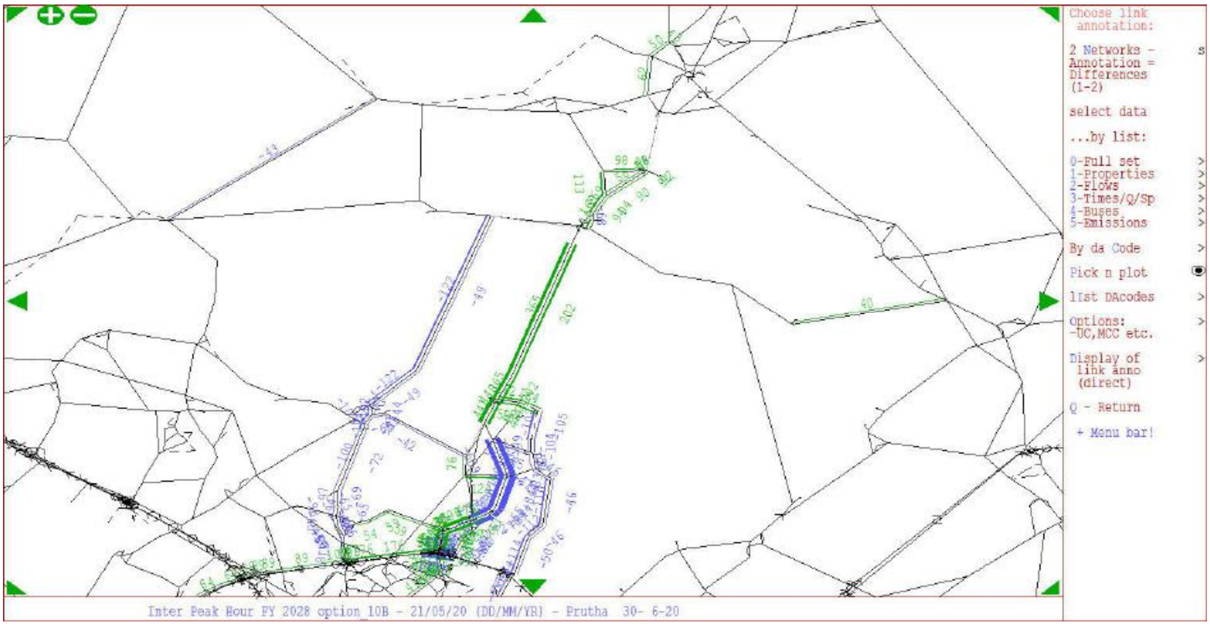

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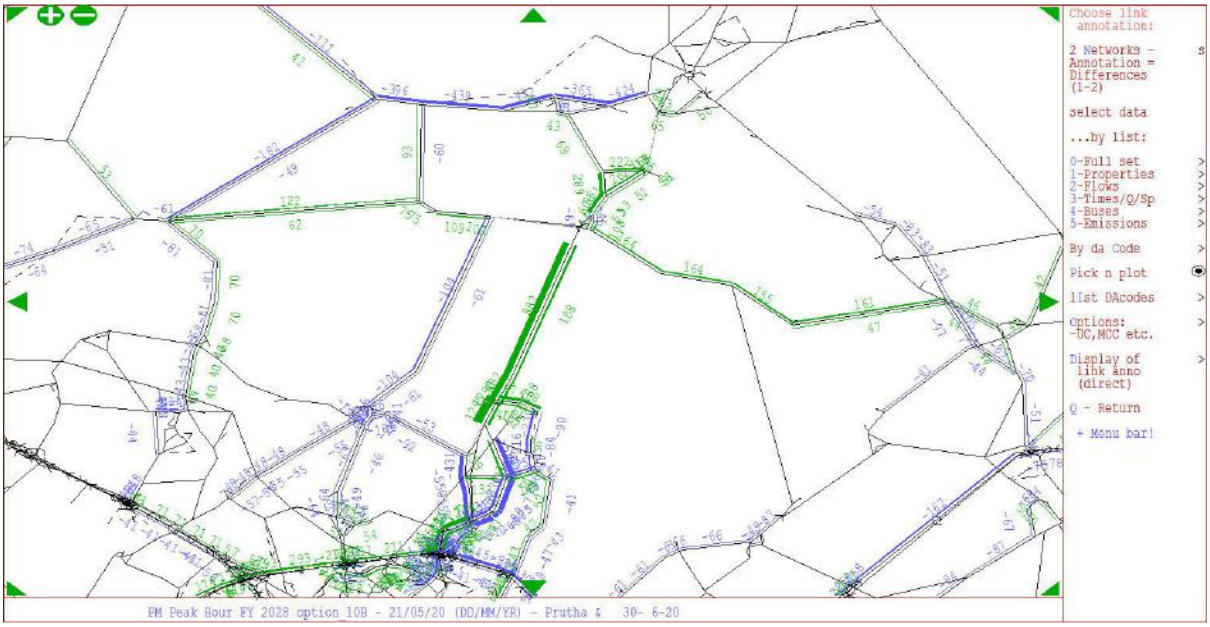
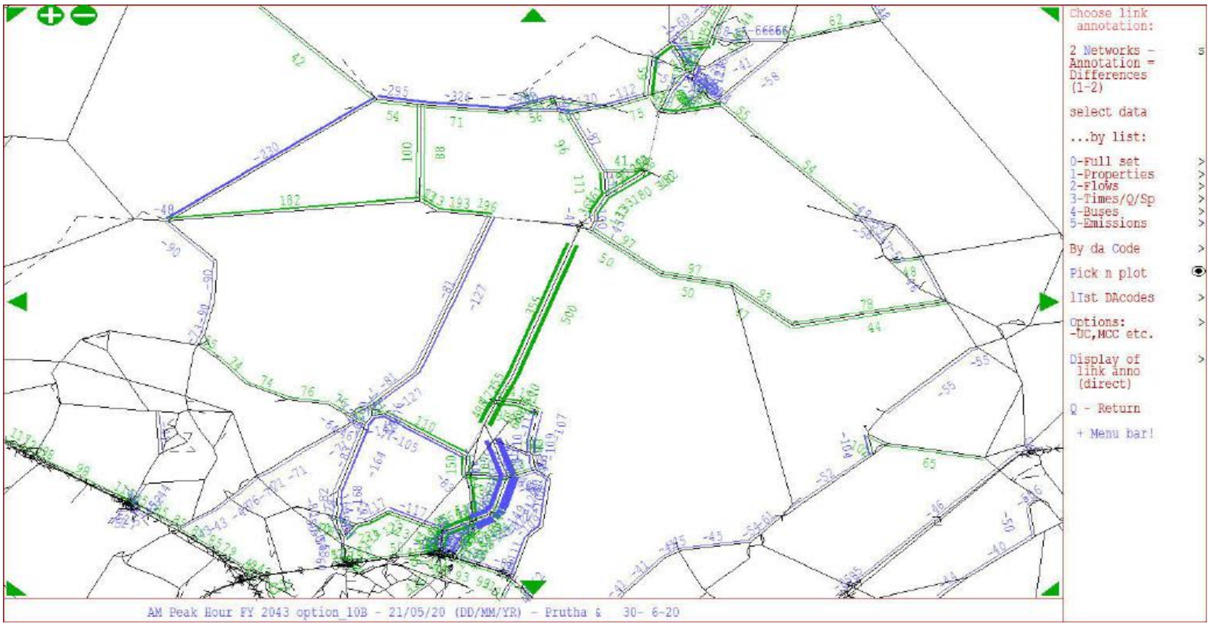


2043- AM



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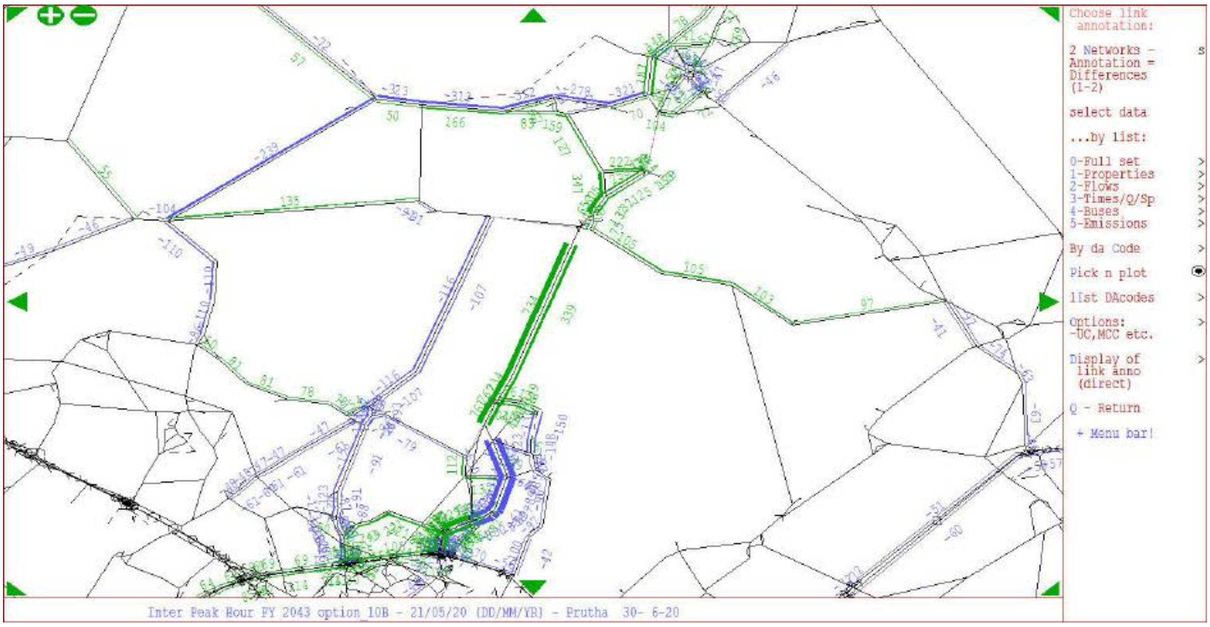
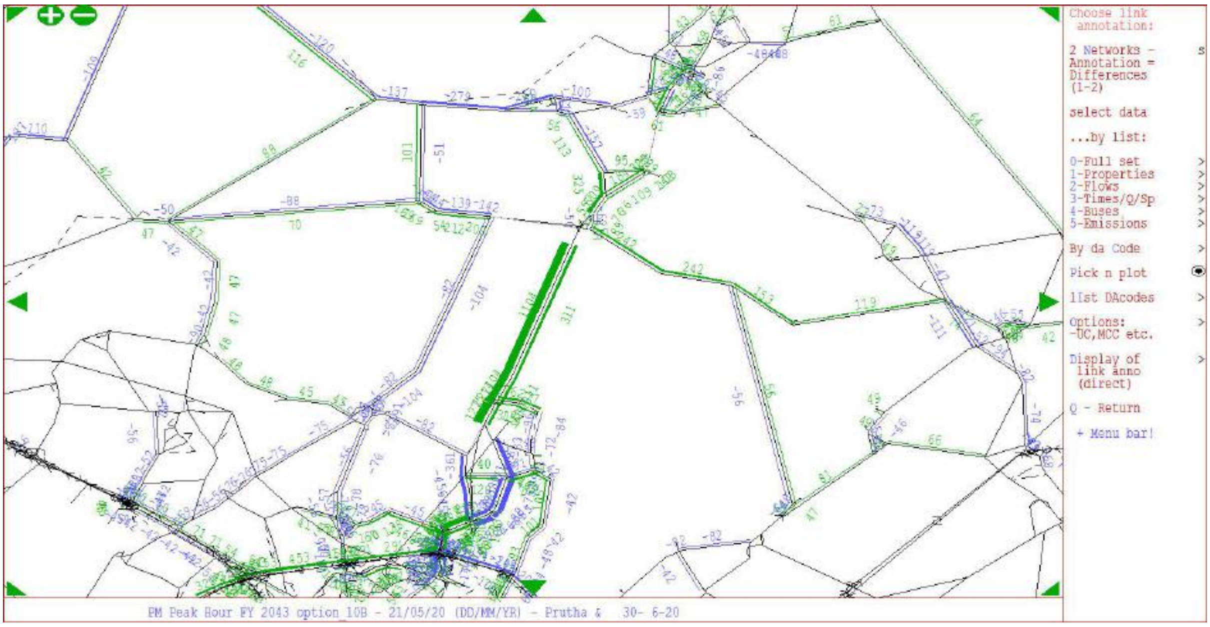
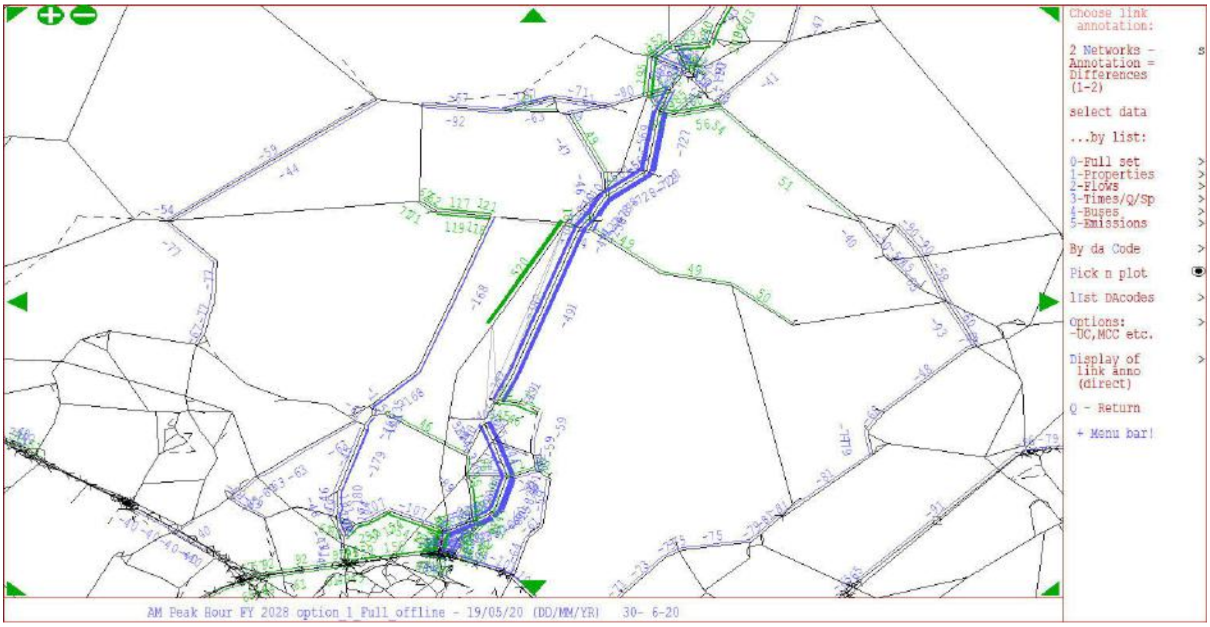


2043- PM



Option D

2028- AM



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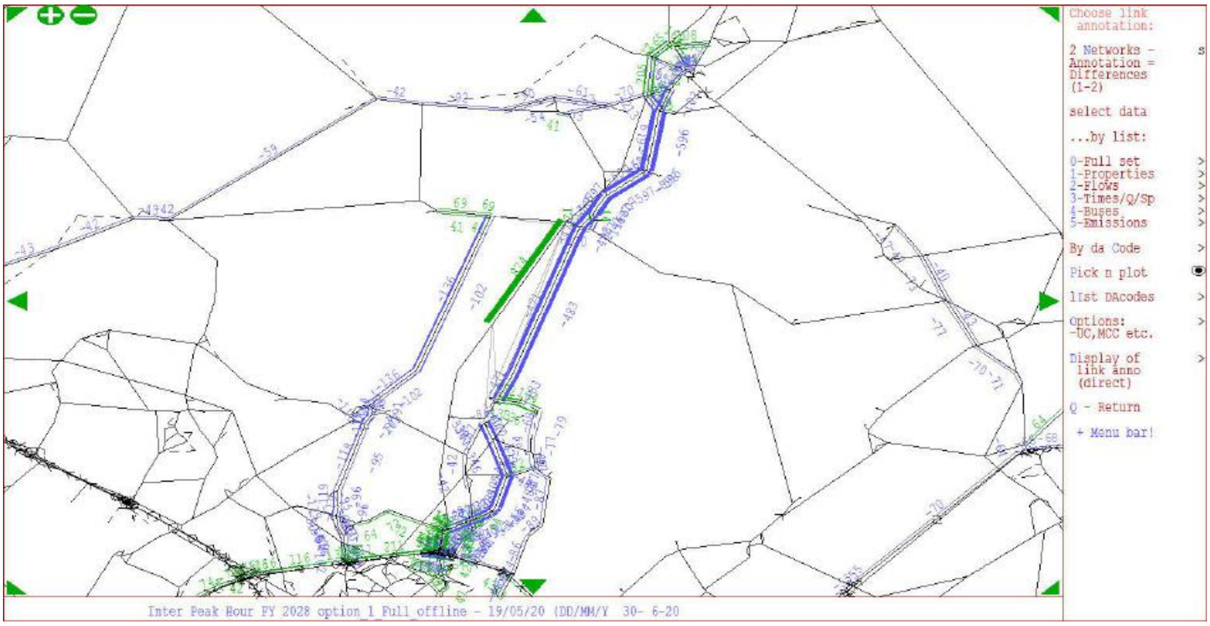

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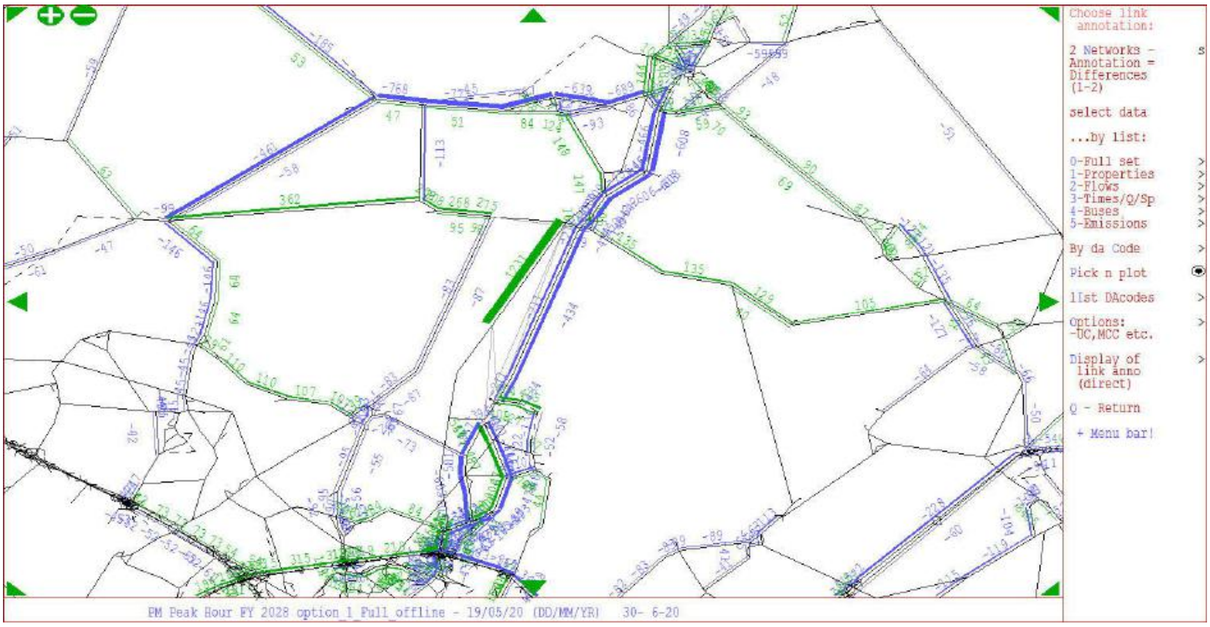

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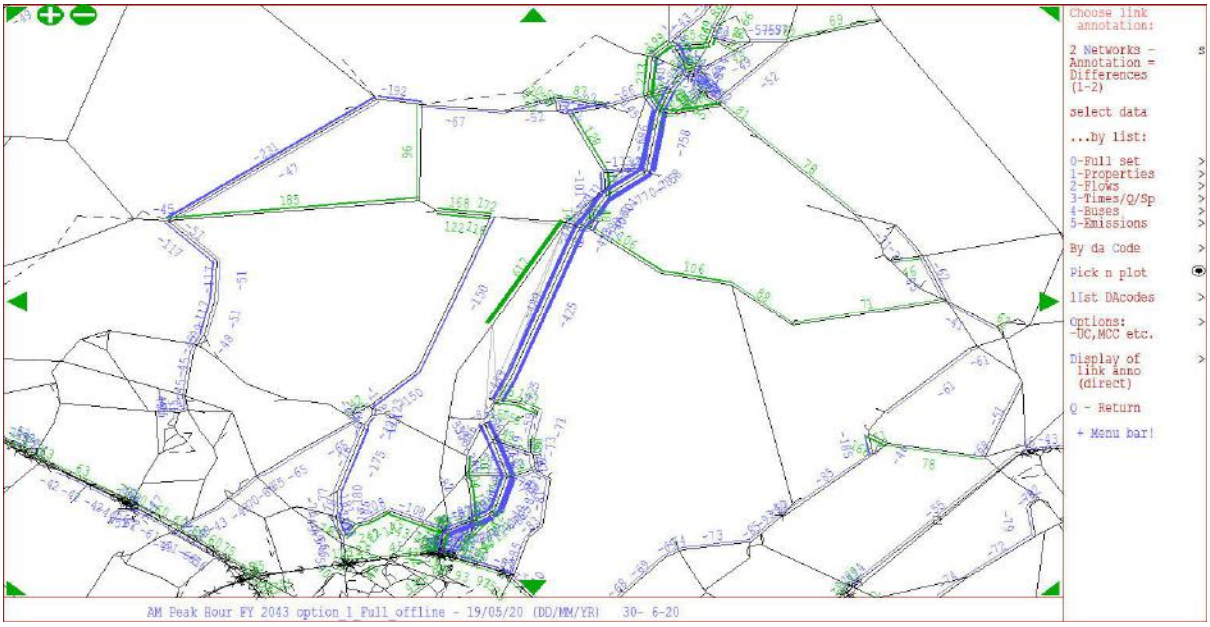

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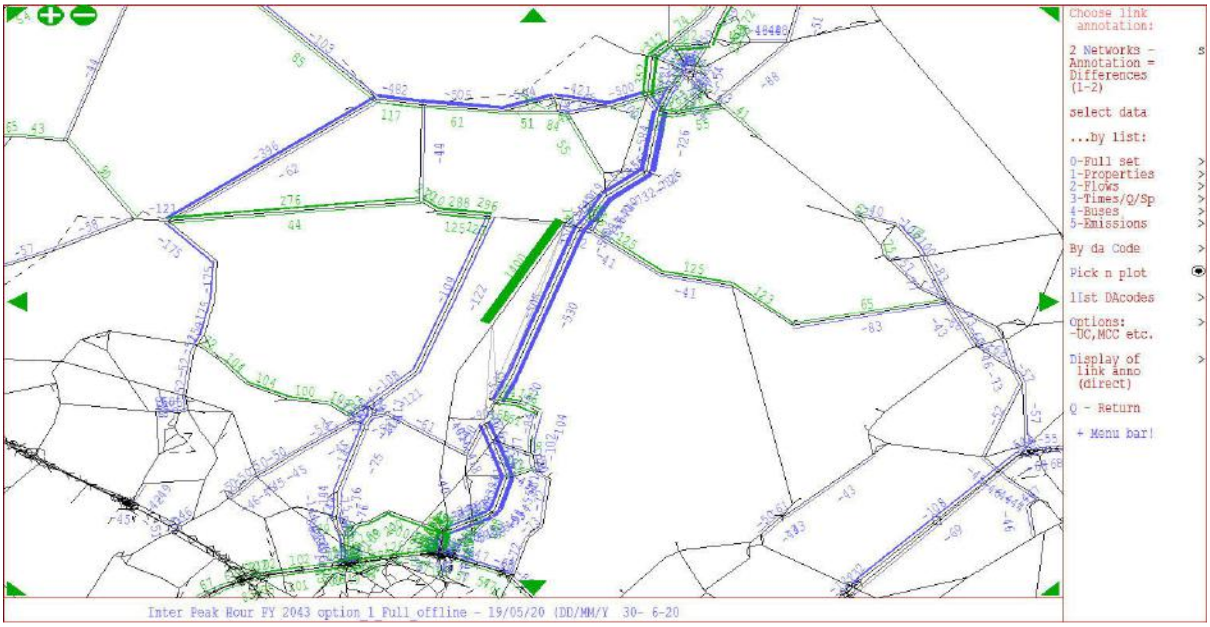
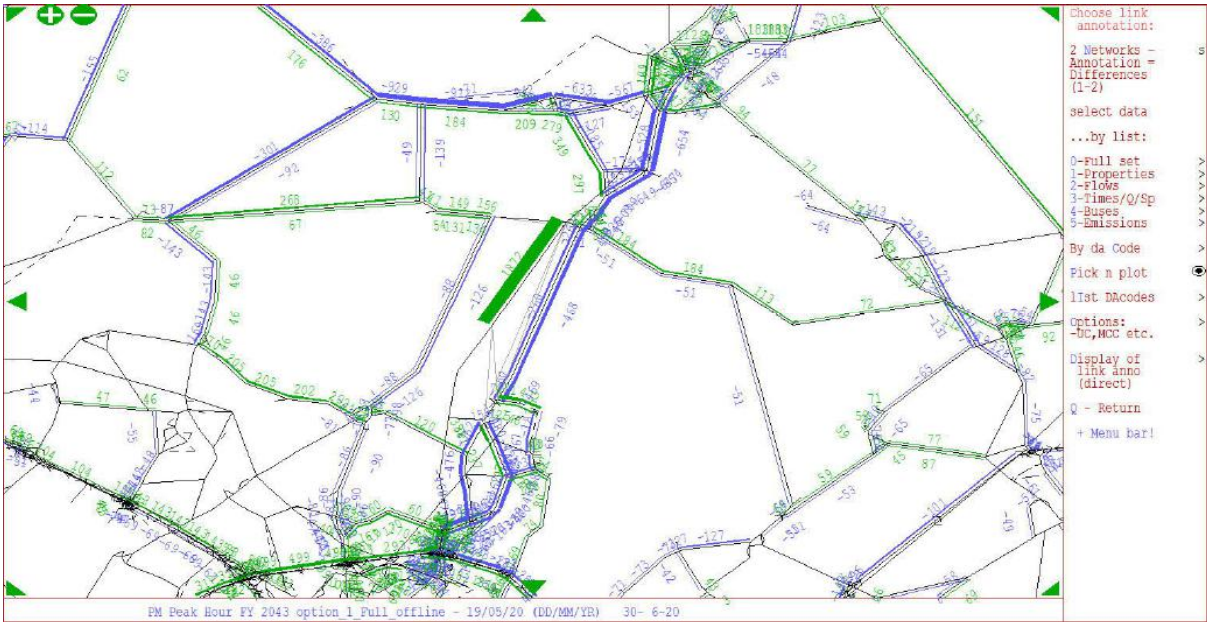
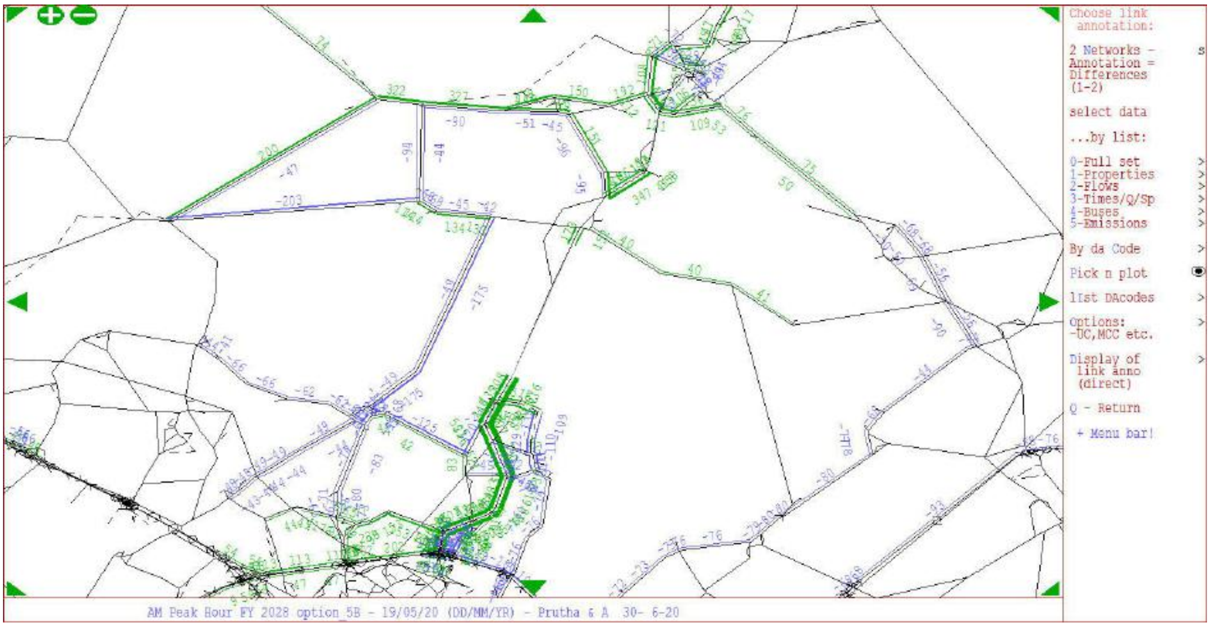


2043- PM

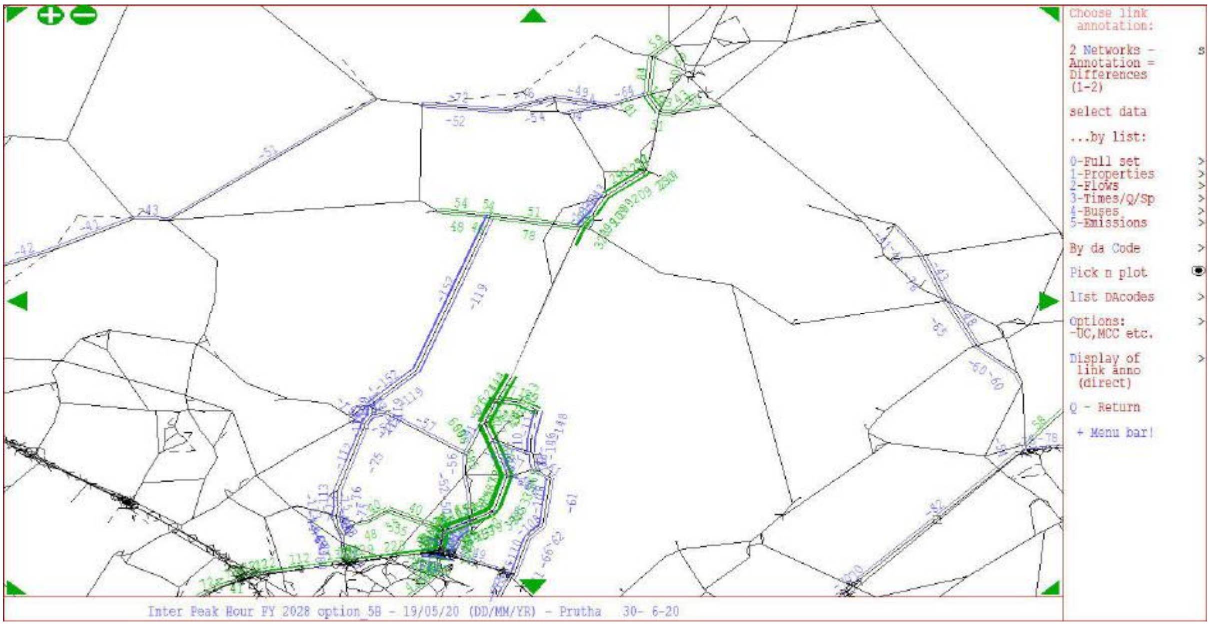


Option E

2028- AM



2028- IP



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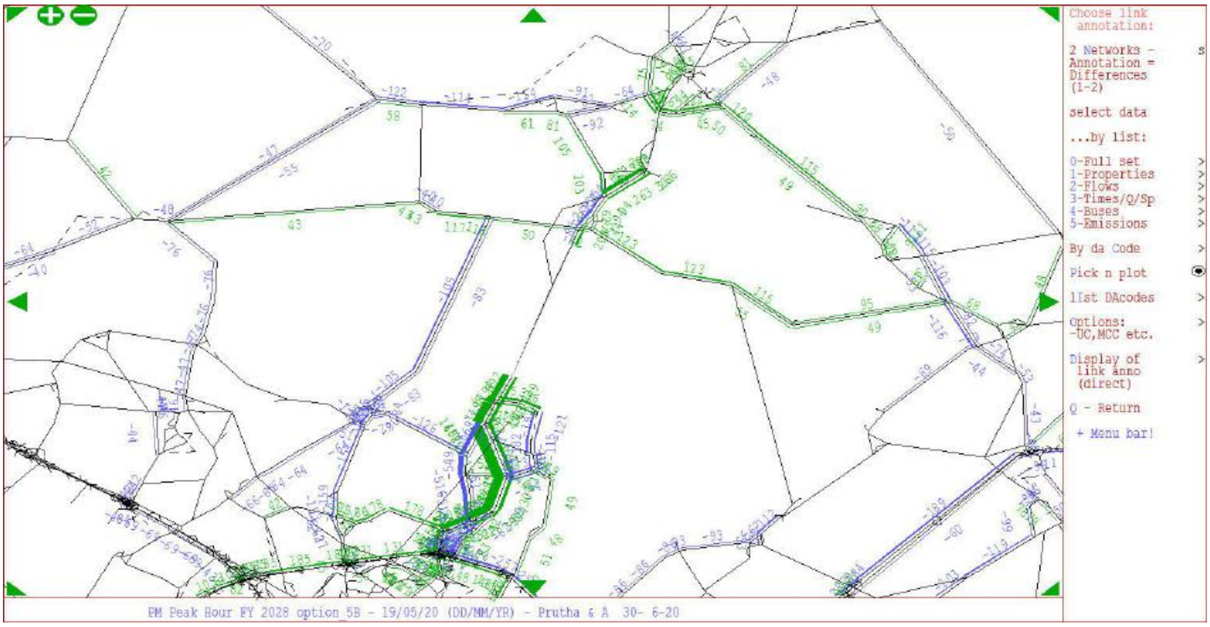

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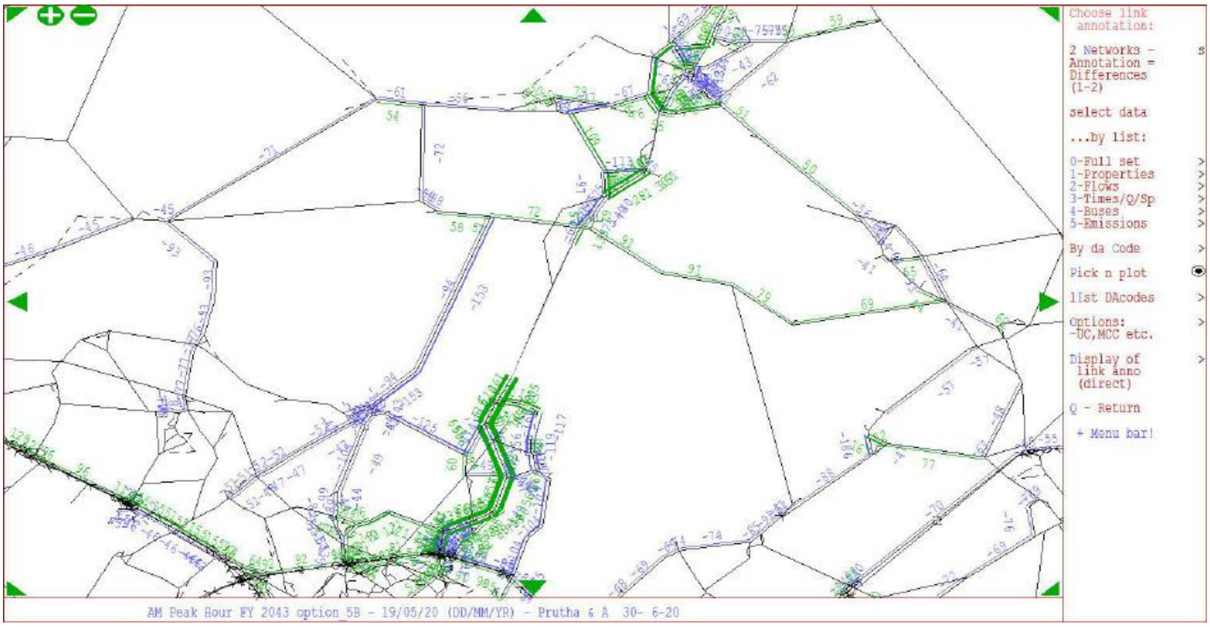

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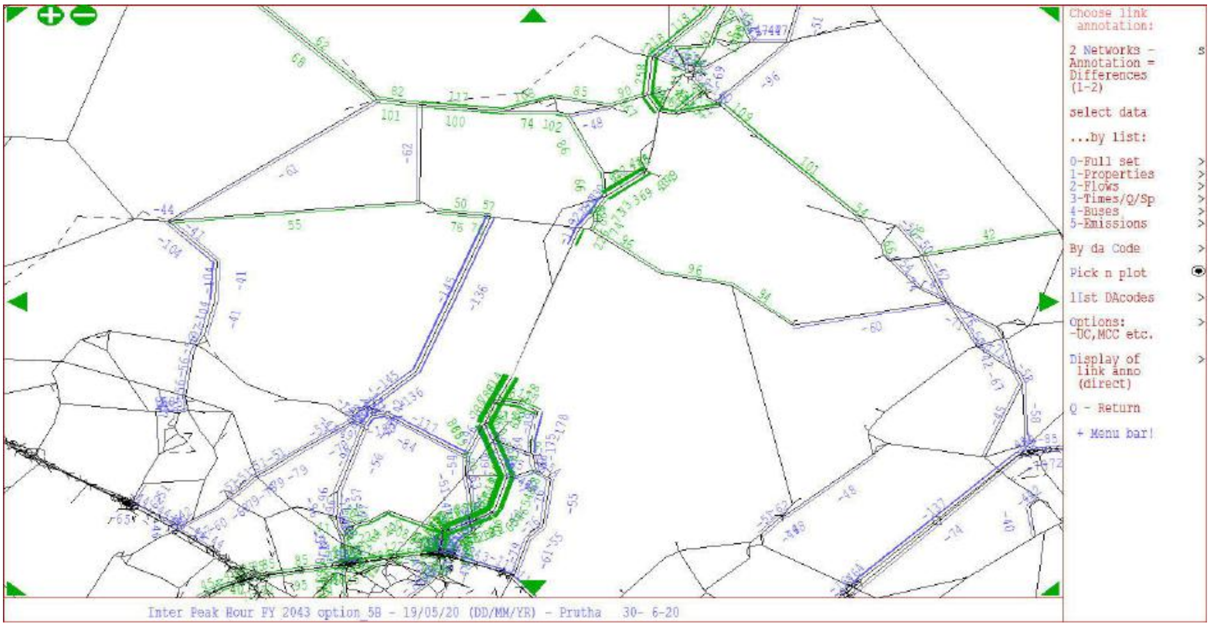
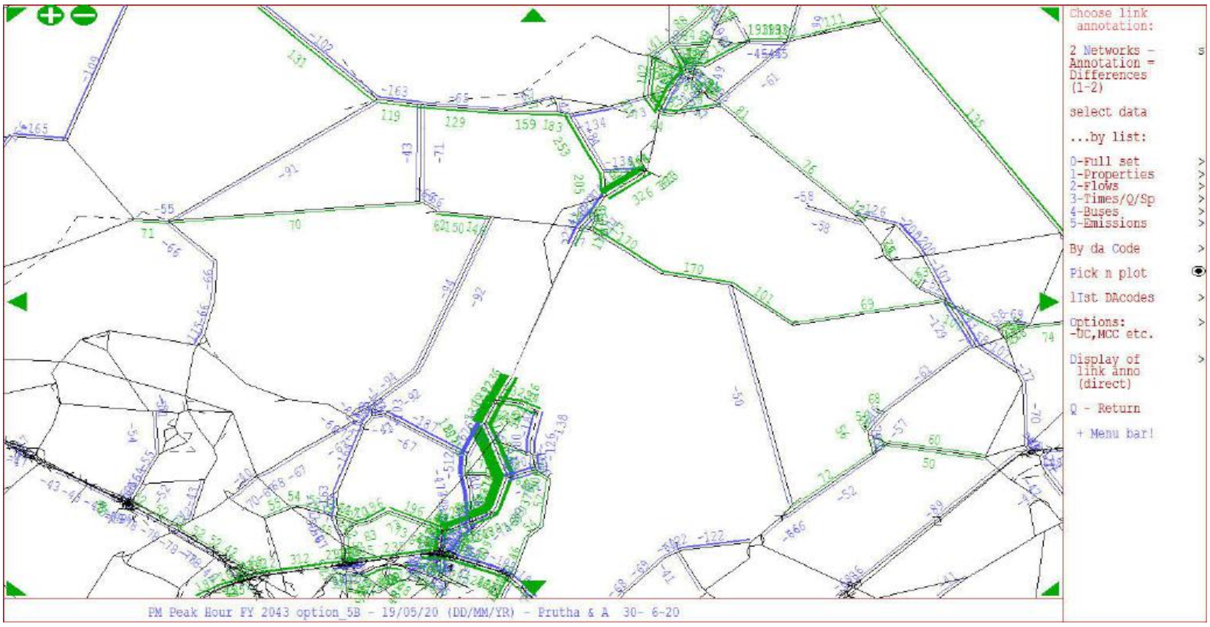
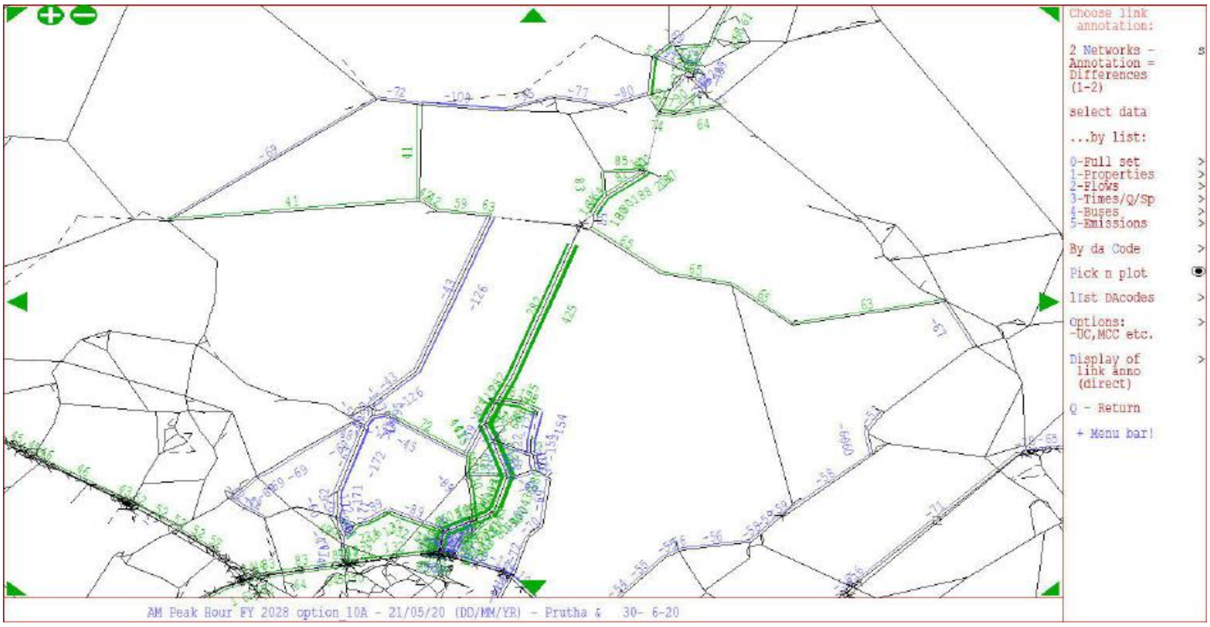


2043- PM



Option F

2028- AM



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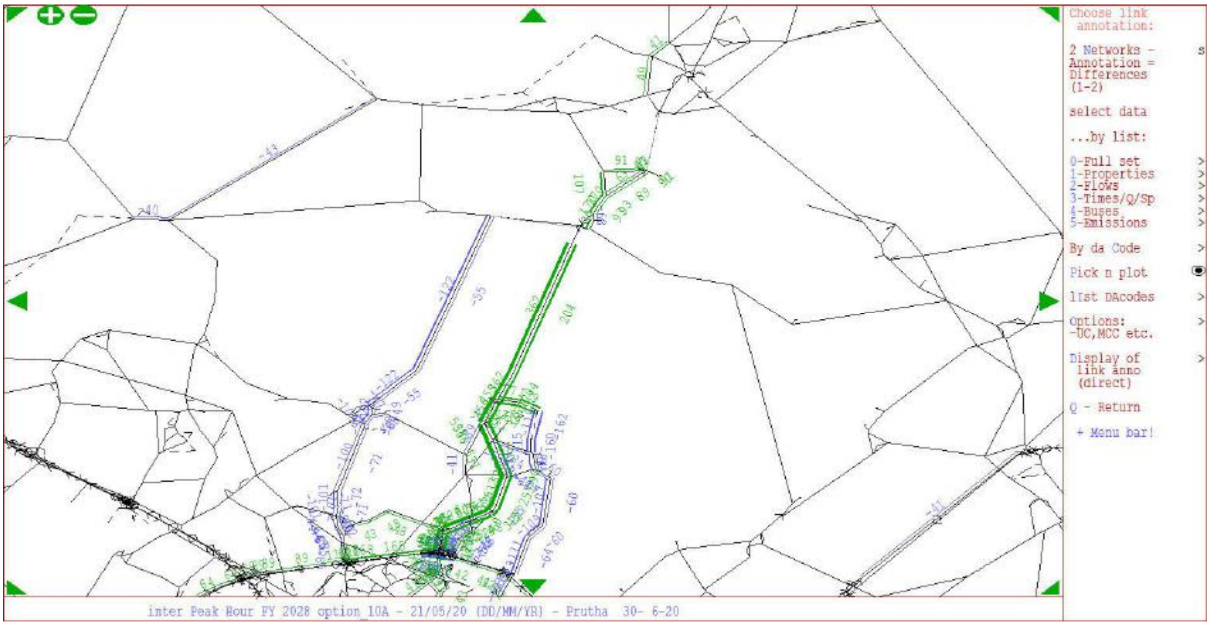
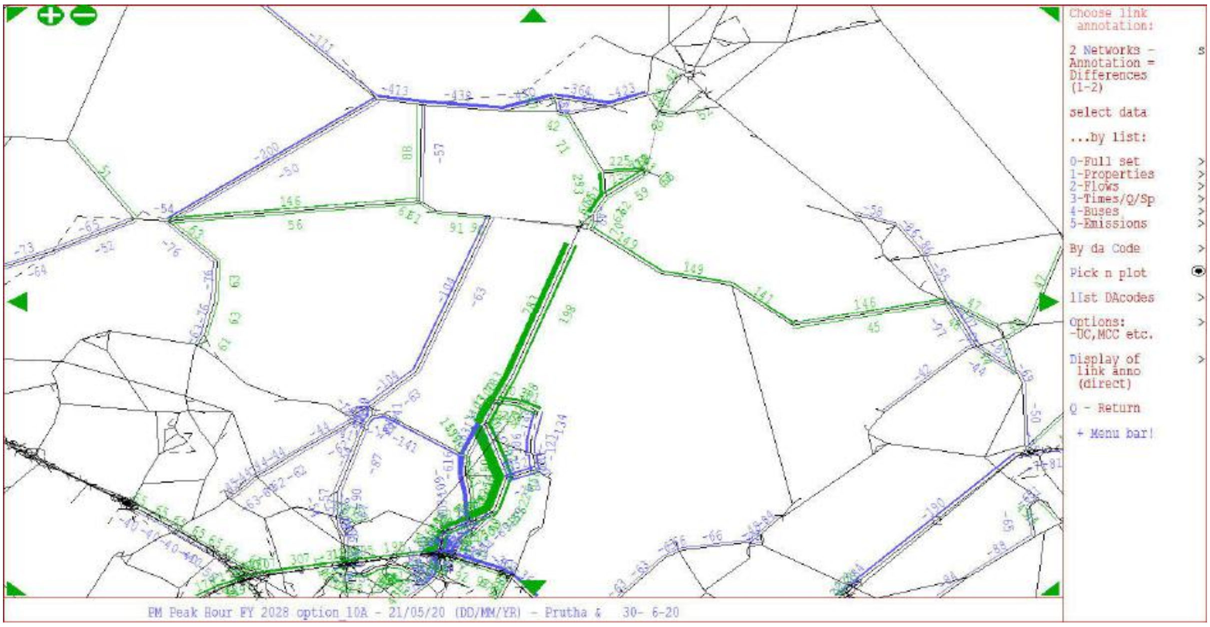
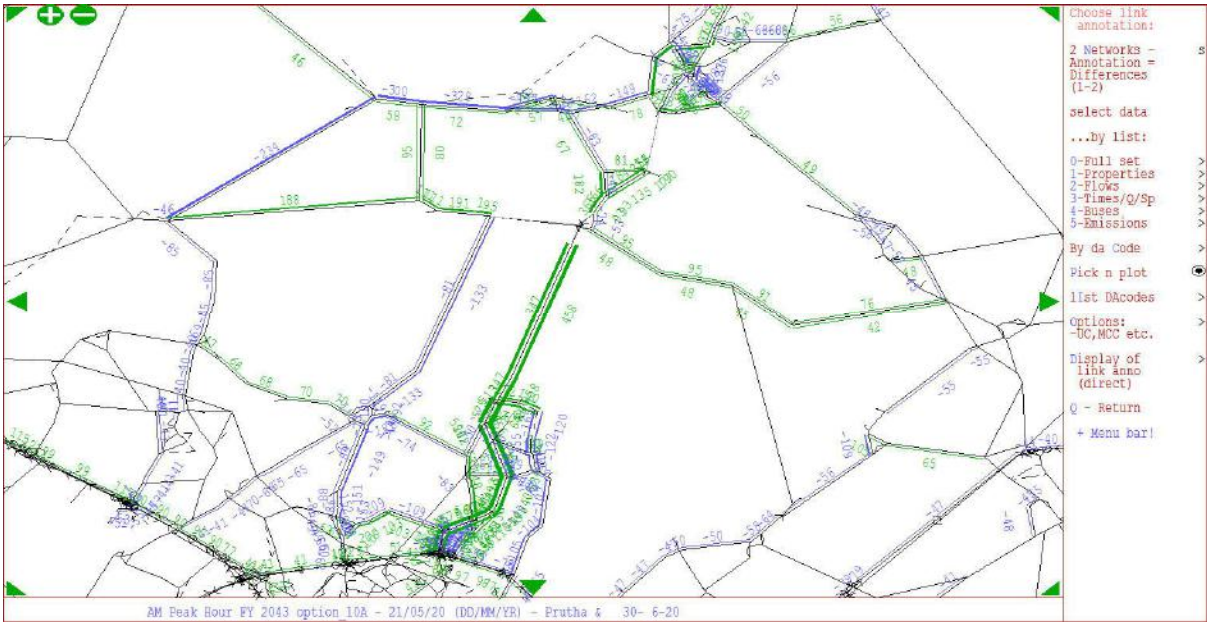


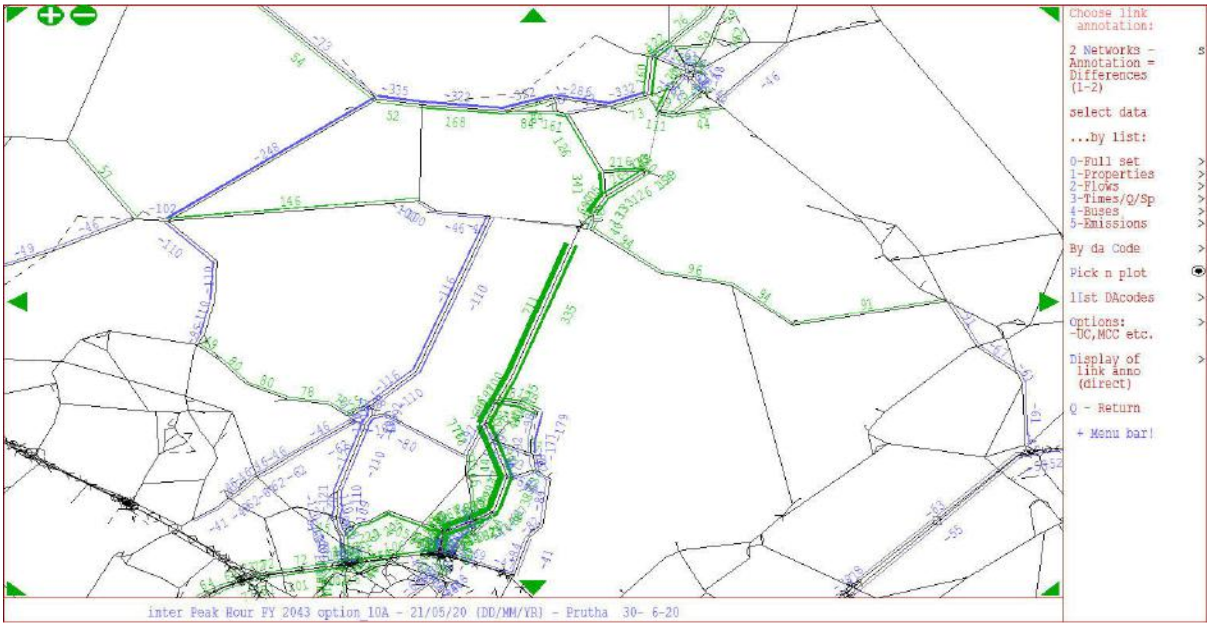
2028- PM



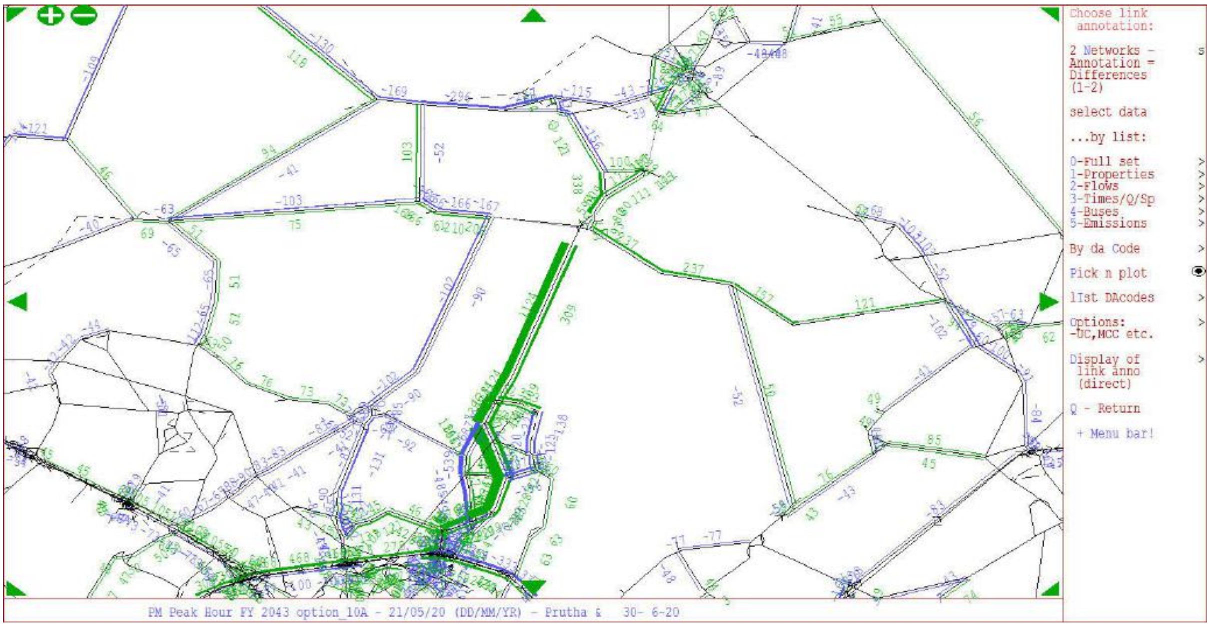
2043- AM



2043- IP

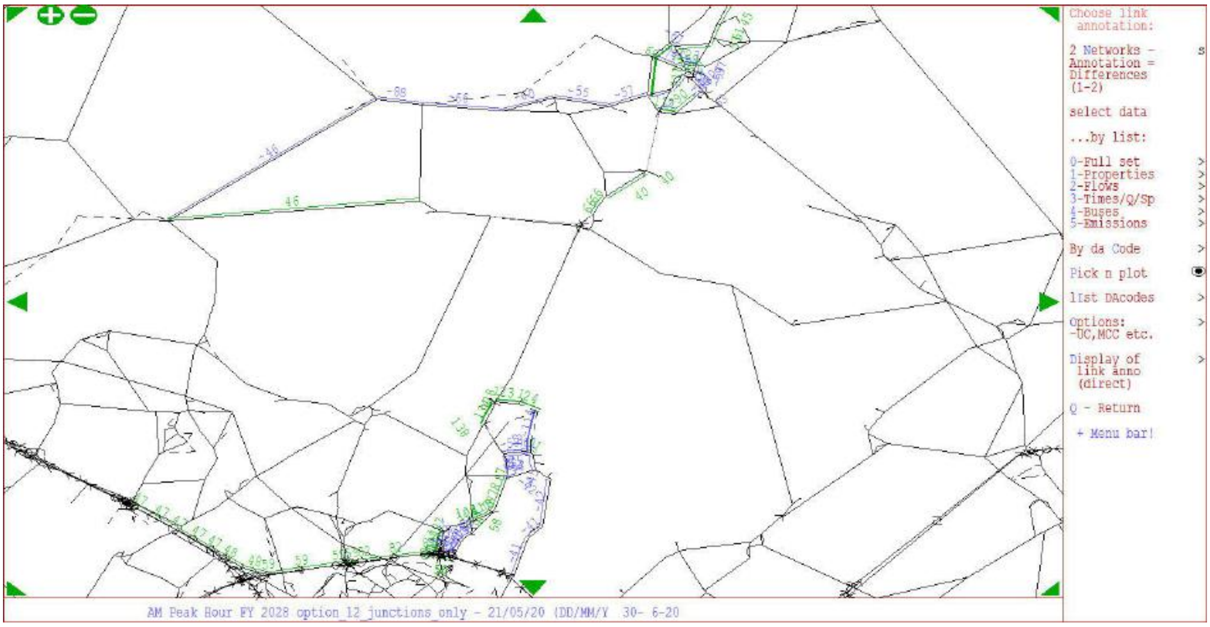


2043- PM

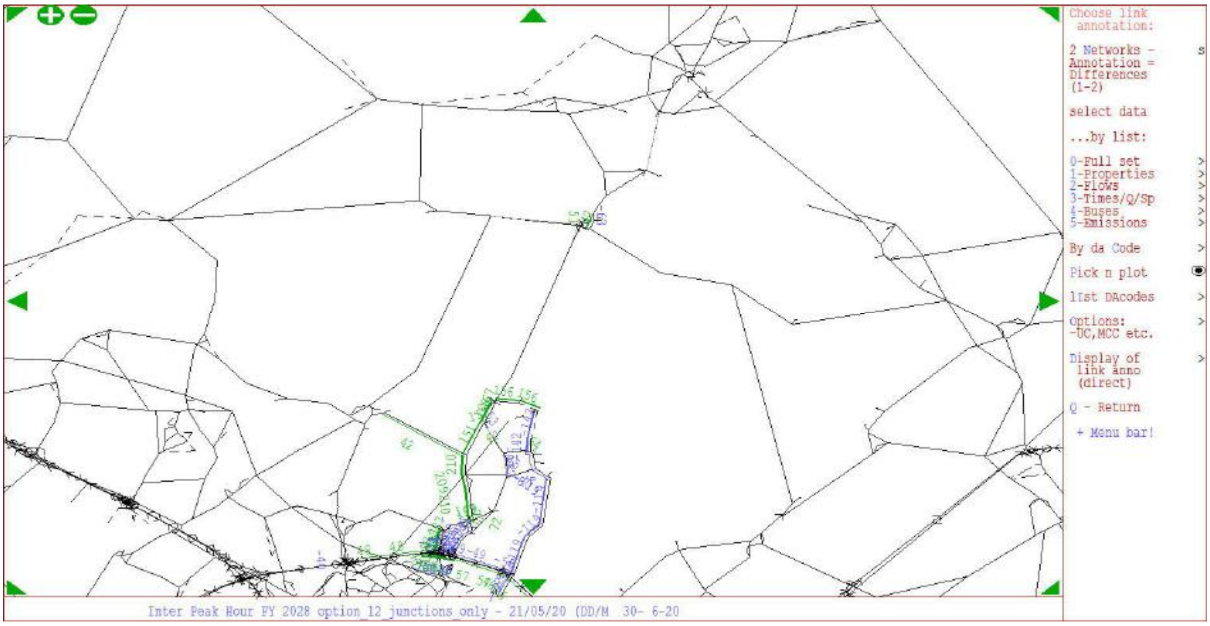


Option G

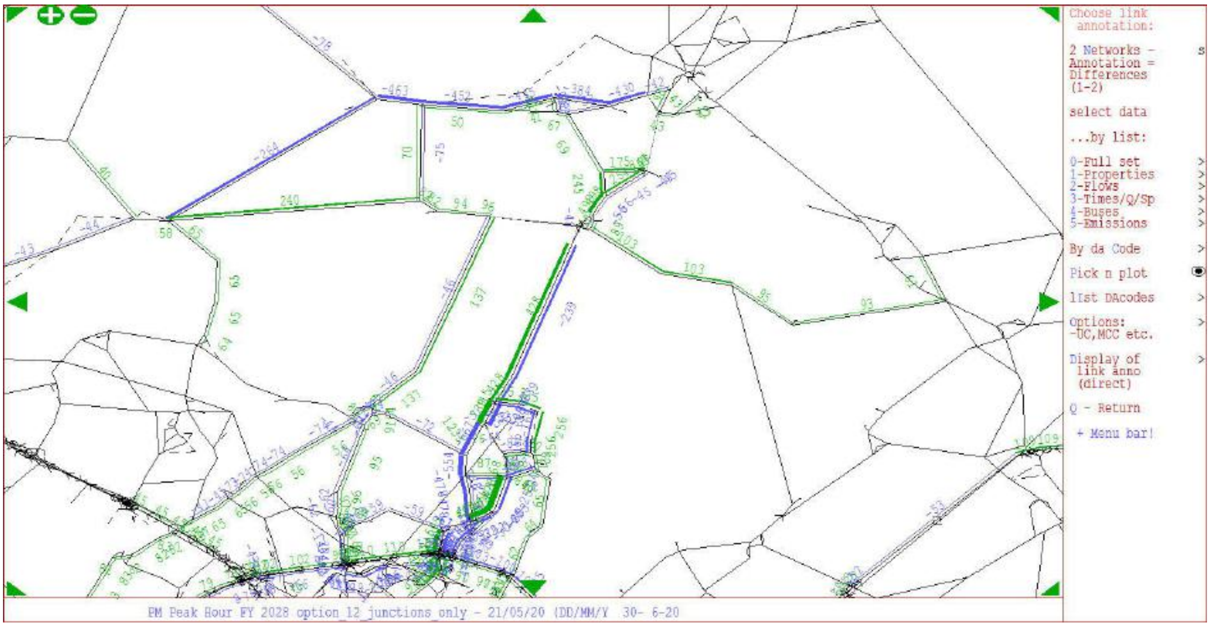
2028- AM



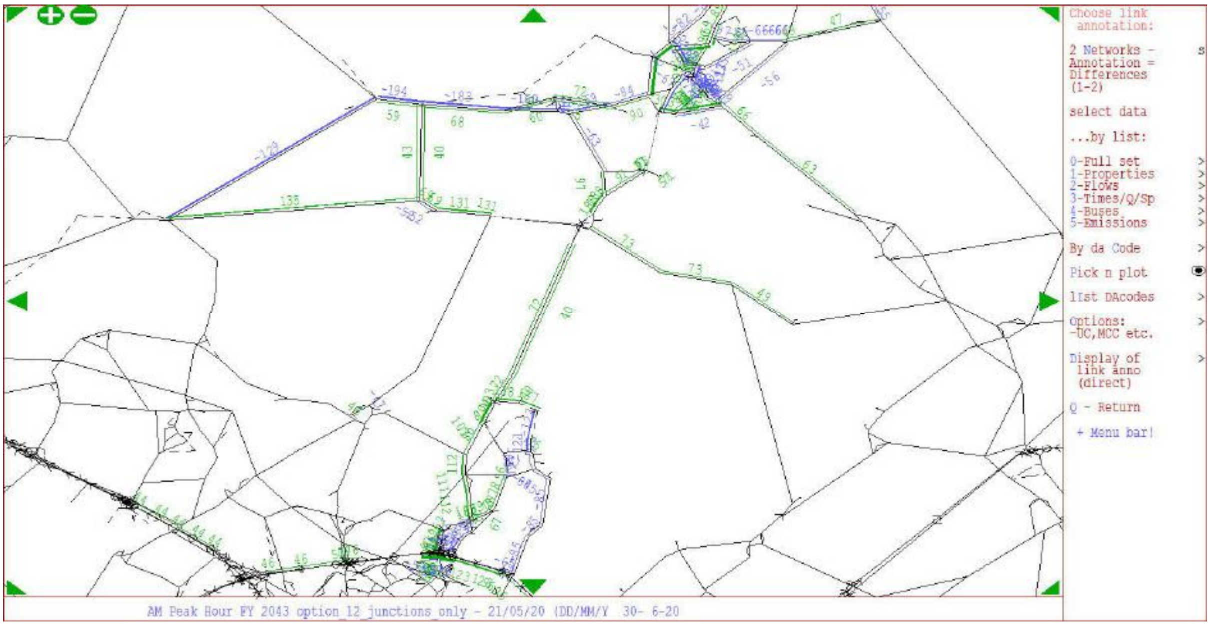
2028- IP



2028- PM


Choose link annotation:
2 Networks - Annotation = Differences (1-2)
select data
...by list:
0-Full set
1-Properties
2-Flows
3-Times/Q/Sp
4-Buses
5-Emissions
By da Code
Pick n plot
list DAcodes
Options: -UC,MCC etc.
Display of link anno (direct)
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_12_junctions_only - 21/05/20 (DD/MM/Y 30- 6-20

2043- AM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2 Networks - Annotation = Differences (1-2)
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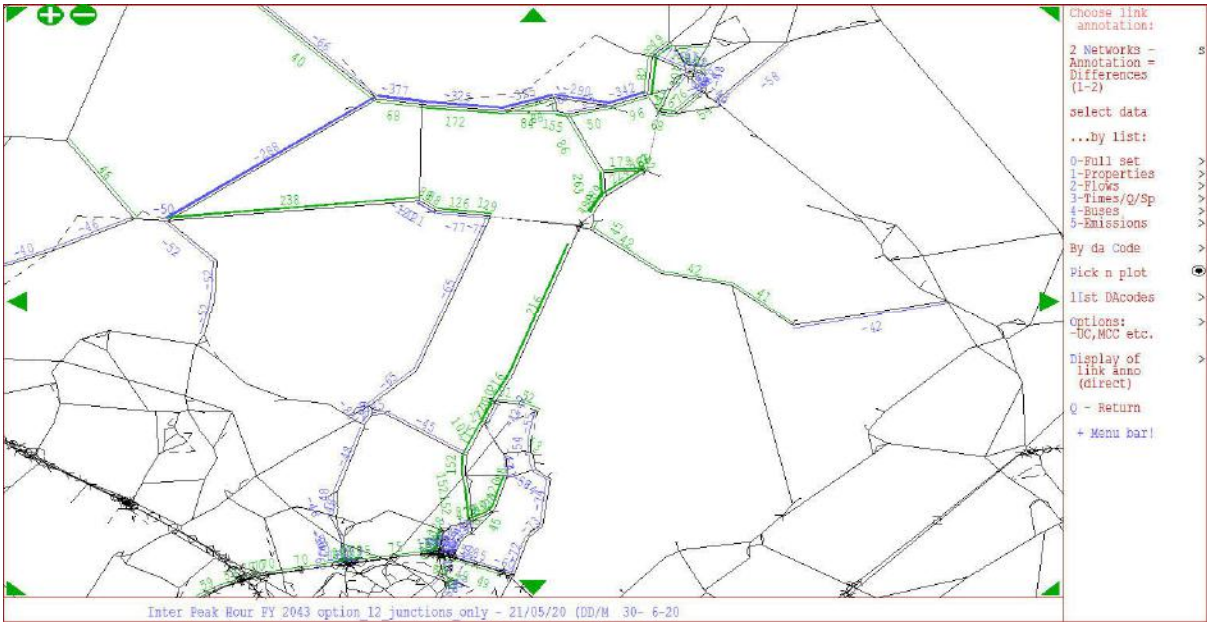
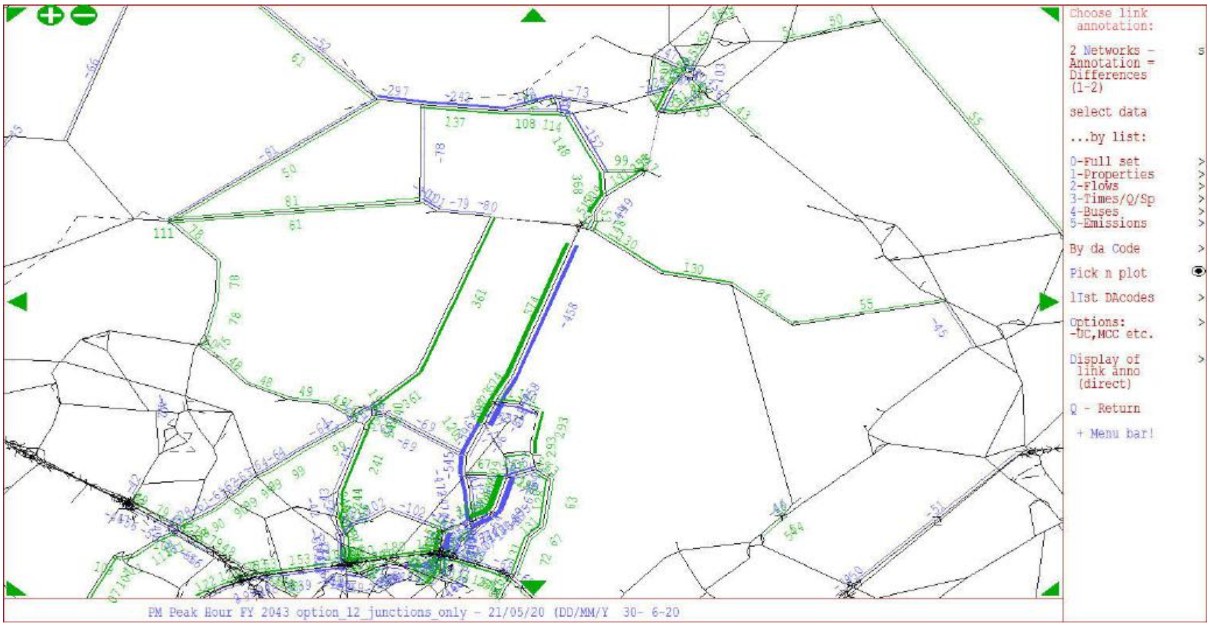
...by list:
0-Full set
1-Properties
2-Flows
3-Times/Q/Sp
4-Buses
5-Emissions
By da Code
Pick n plot
list DAcodes
Options: -UC,MCC etc.
Display of link anno (direct)
Q - Return
+ Menu bar!
AM Peak Hour FY 2043 option_12_junctions_only - 21/05/20 (DD/MM/Y 30- 6-20

2043- IP



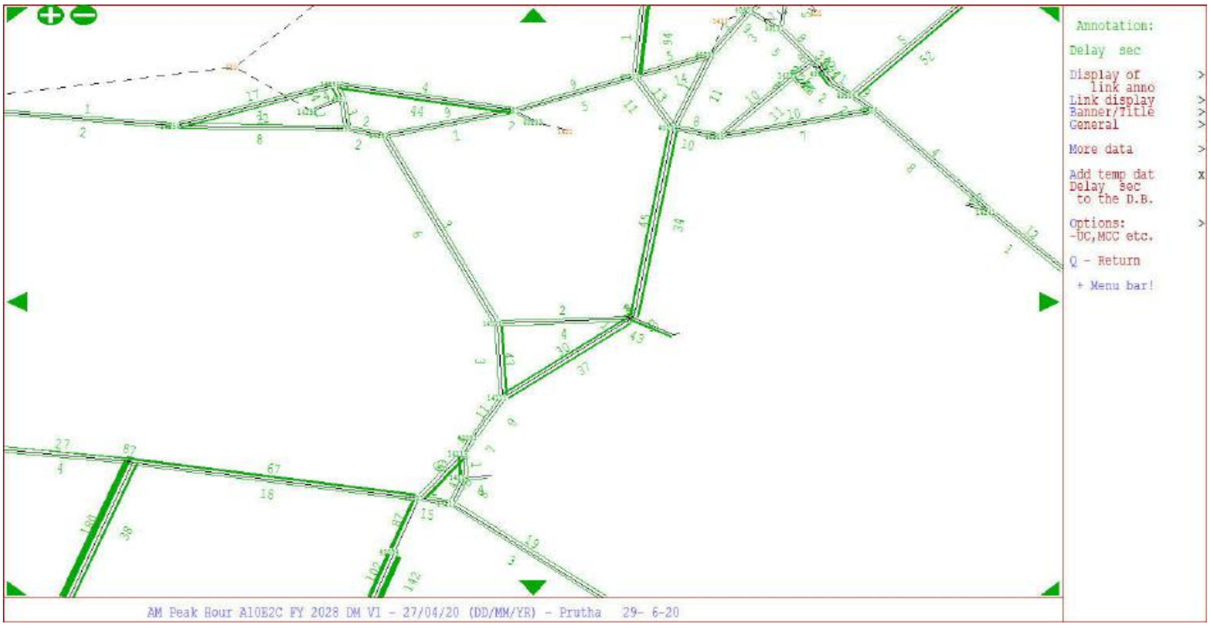
2043- PM



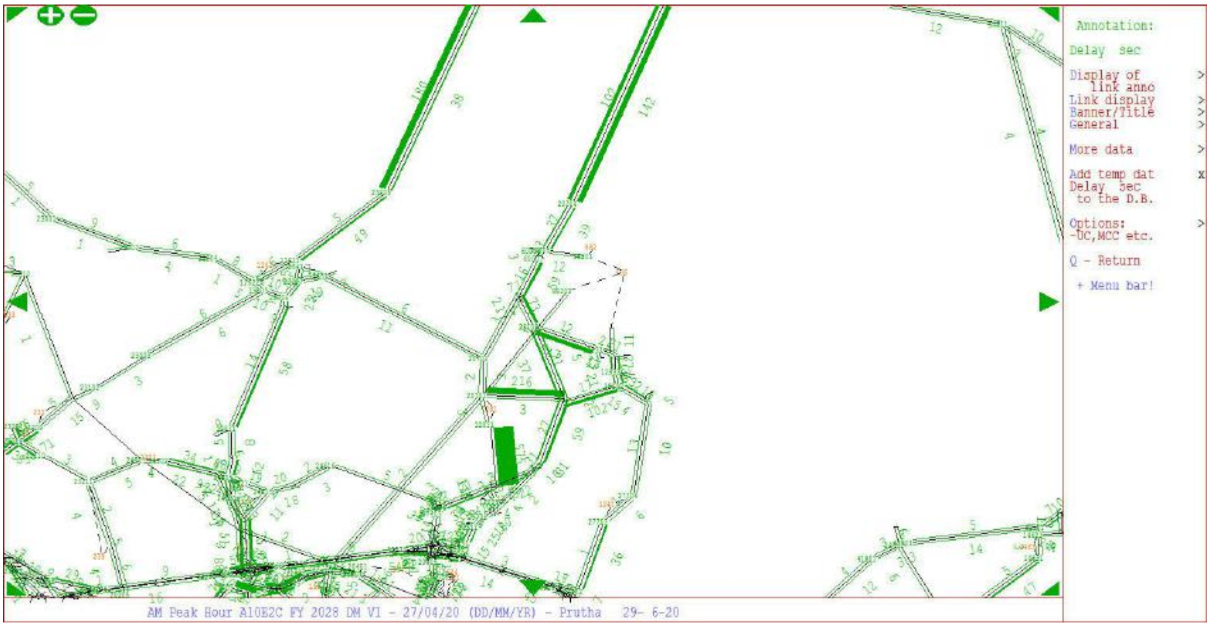
Appendix C. Delays

DM

2028- AM



Annotation:
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -DC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour A10E2C FY 2028 DM VI - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20



Annotation:
Delay sec
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Banner/Title
General
More data
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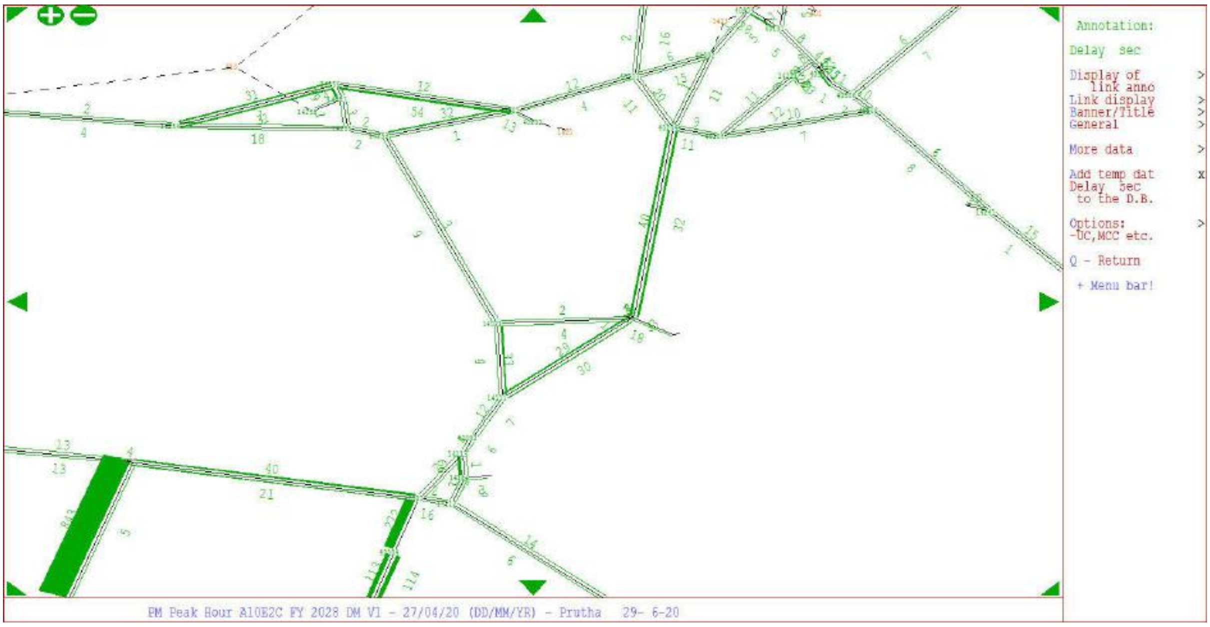
Options: -DC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour A10E2C FY 2028 DM VI - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20

2028- PM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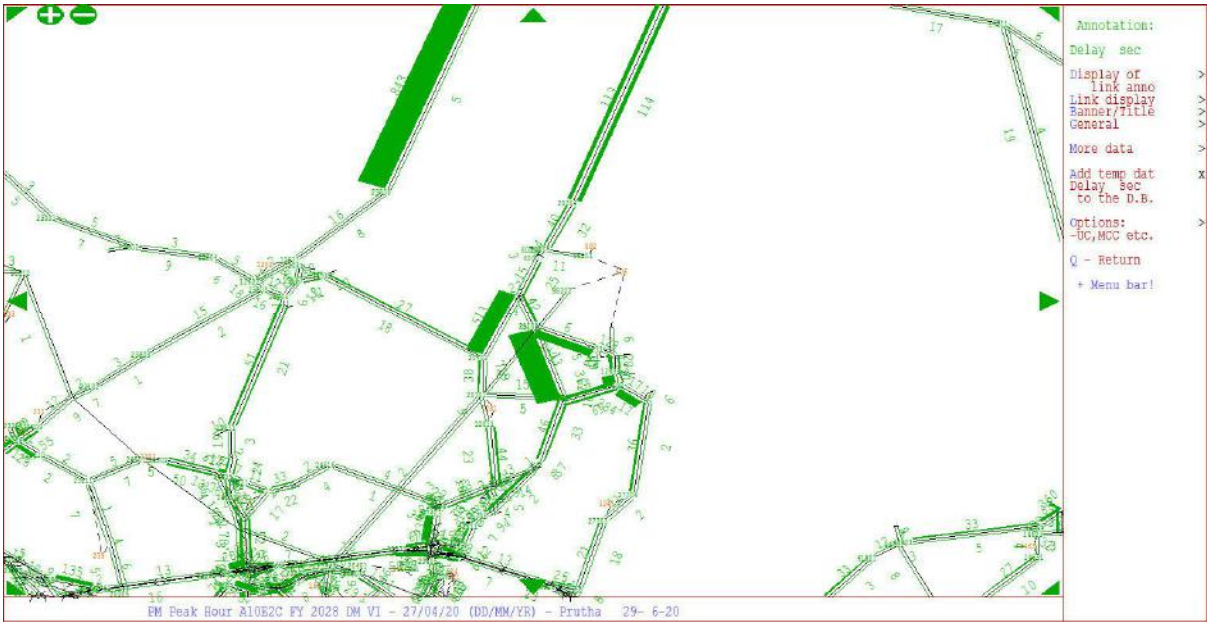
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour A10E2C FY 2028 DM VI - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20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Link display
Banner/Title
General
More data
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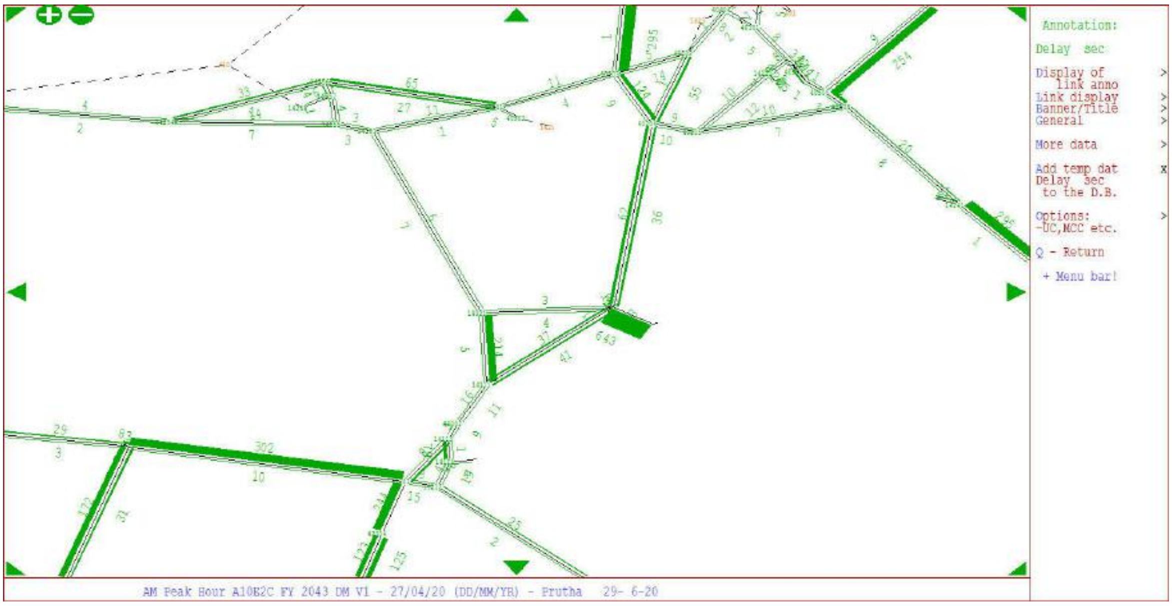
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour A10E2C FY 2028 DM VI - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20

2043- AM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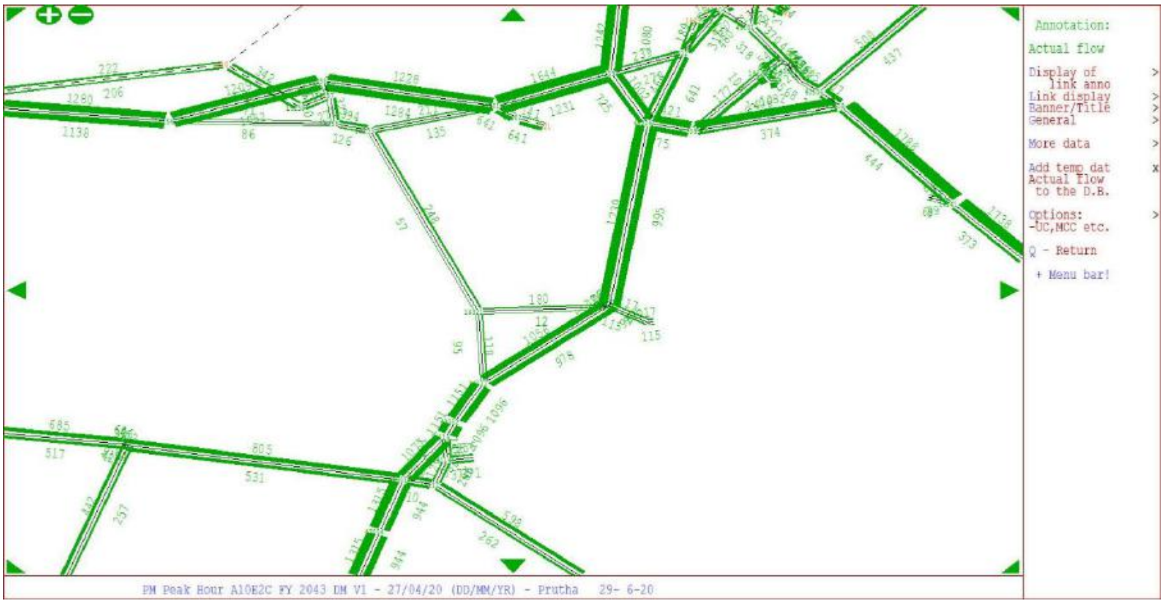
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20


Annotation:
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20

2043-PM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Actual flow
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Link display
Banner/Title
General
More data
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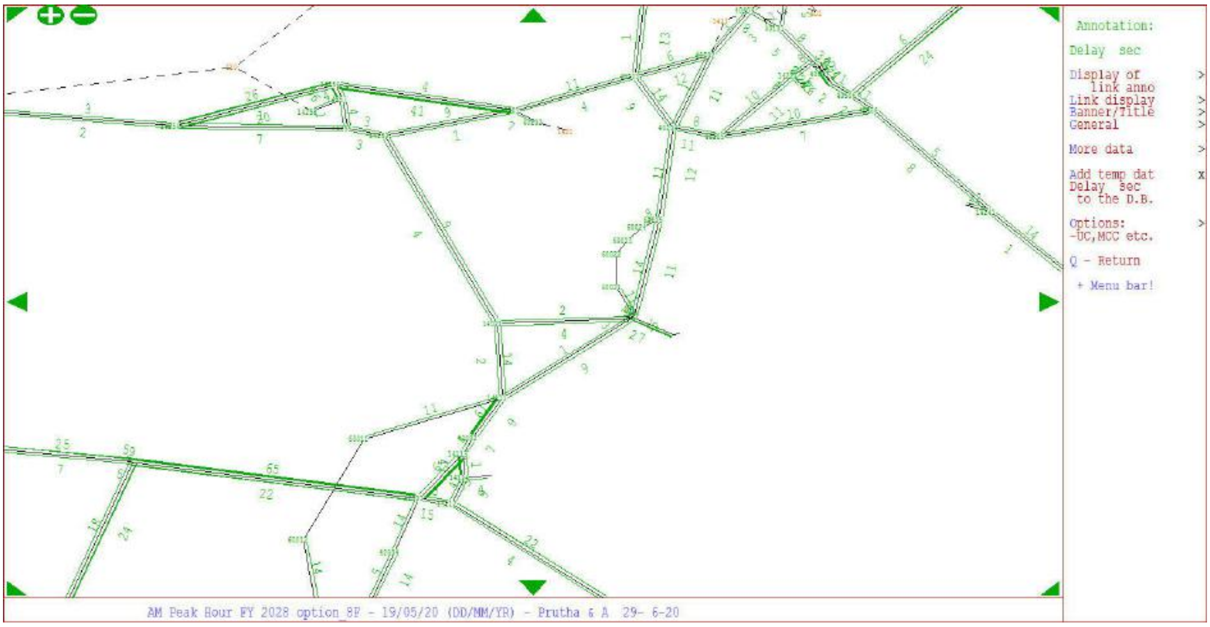
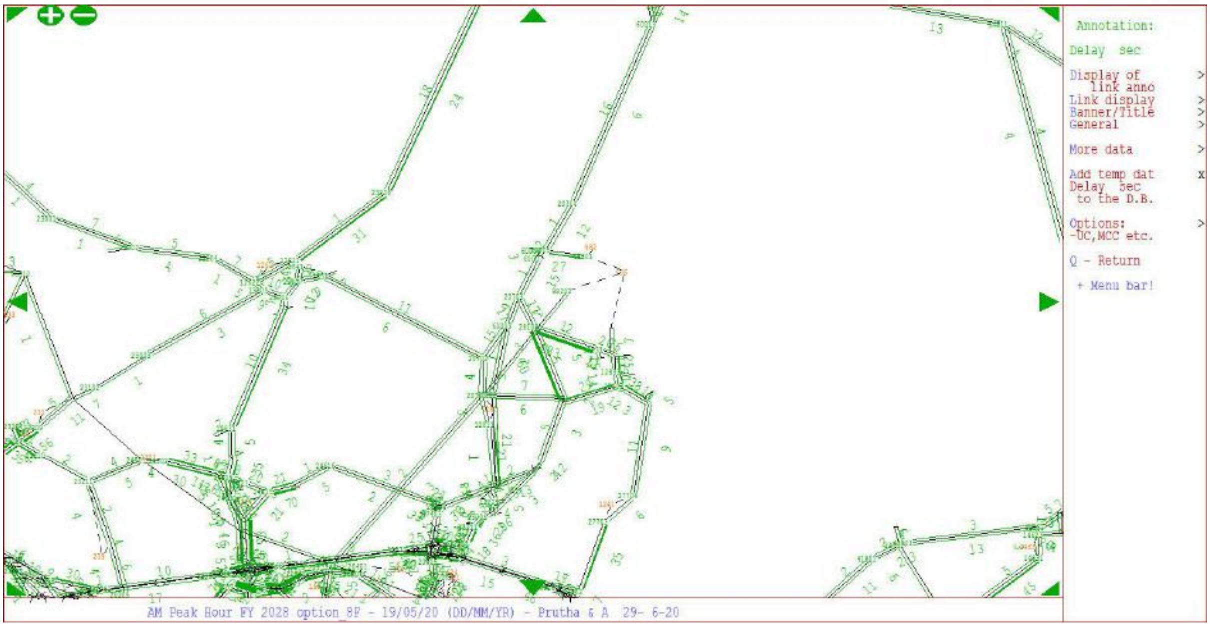
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20


Annotation:
Actual flow
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Actual flow to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour A10E2C FY 2043 DM V1 - 27/04/20 (DD/MM/YR) - Prutha 29- 6-20

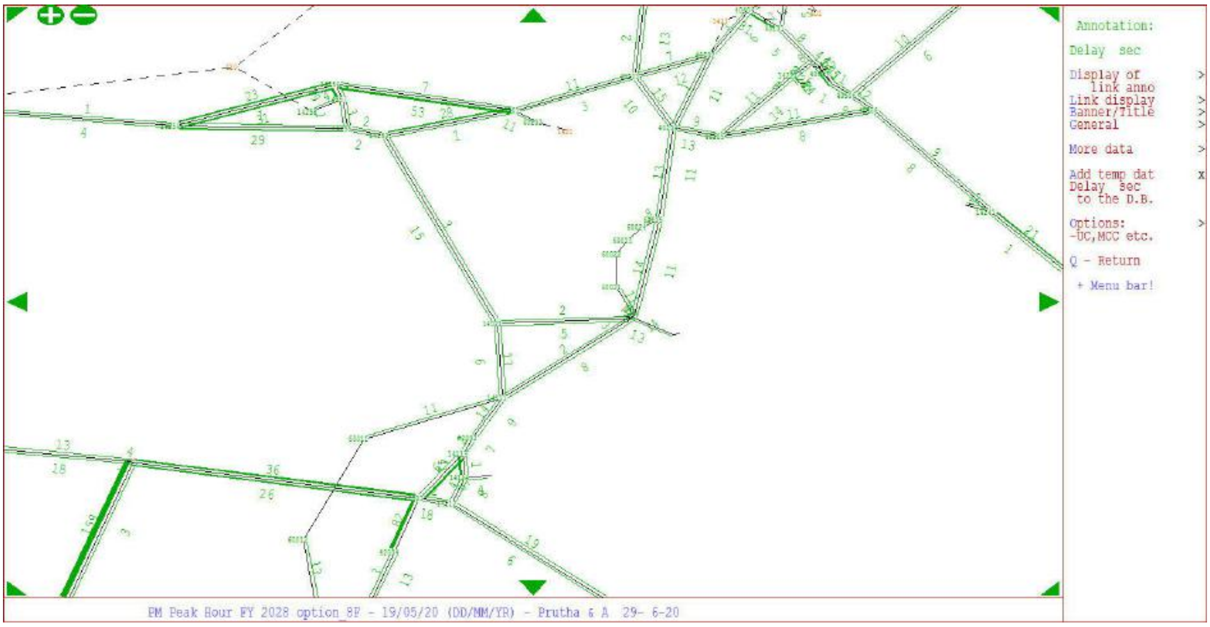
Option A

2028- AM





2028- PM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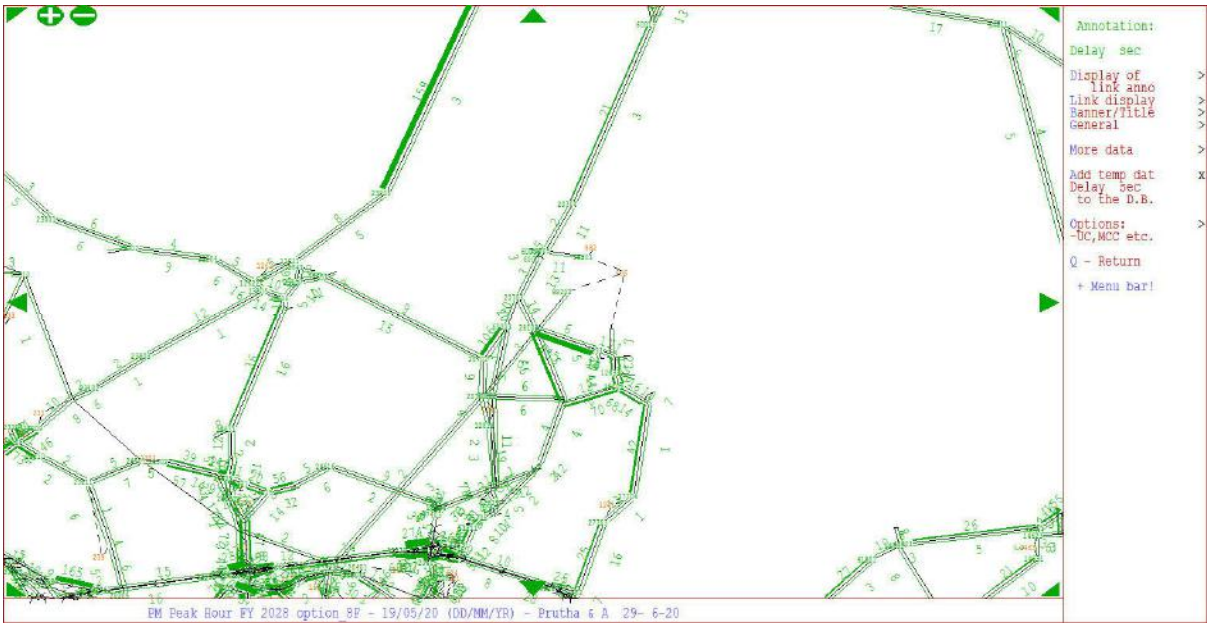
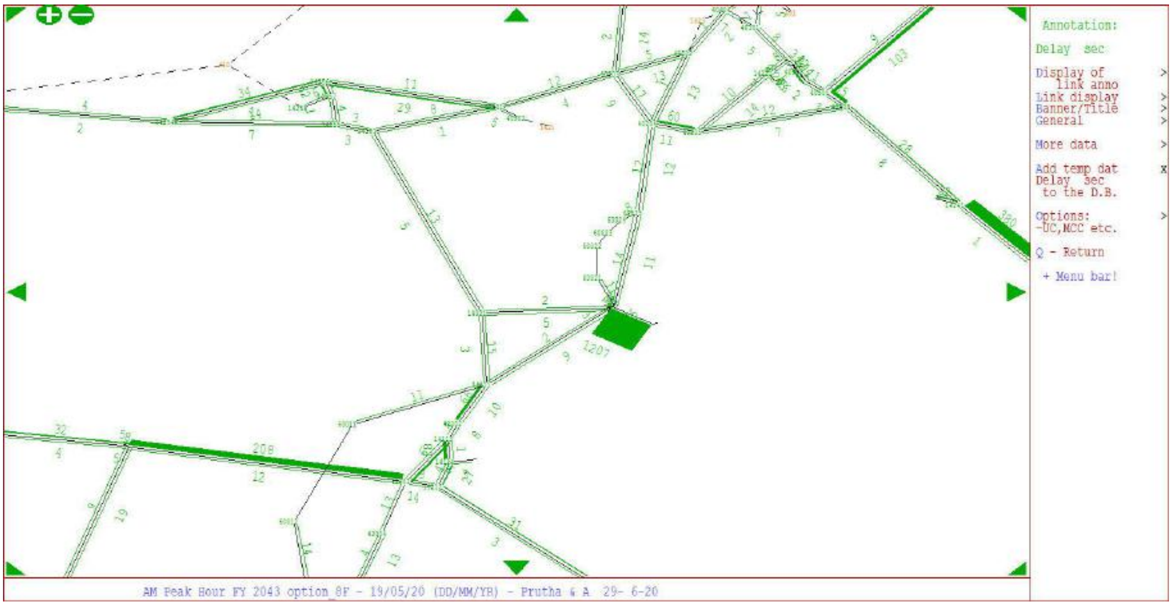
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_8F - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20


Annotation:
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_8F - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

2043- AM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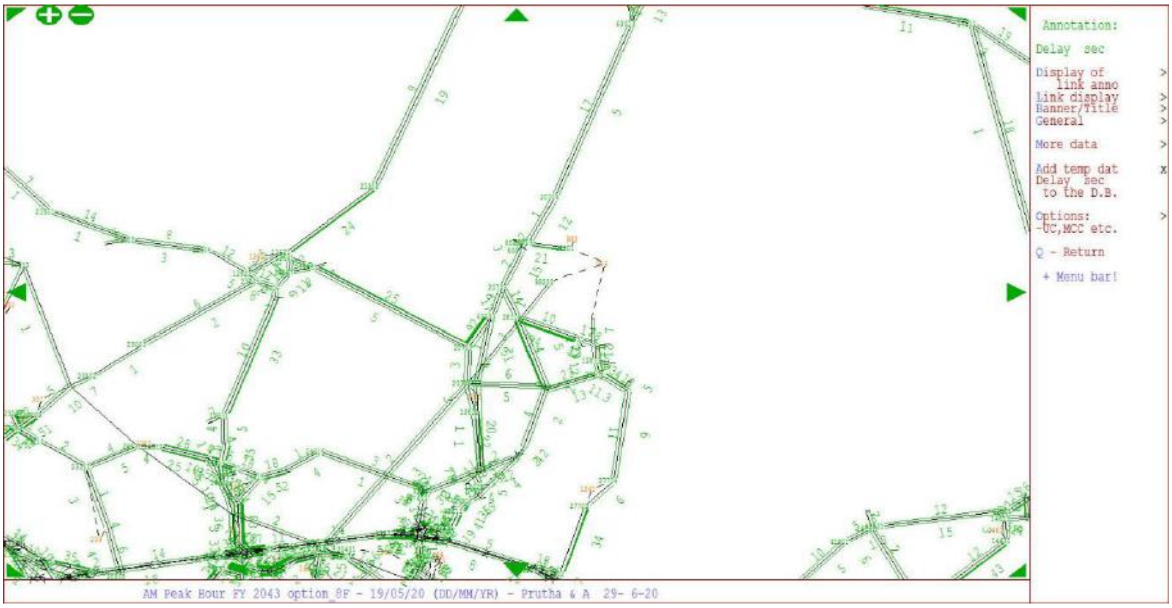
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour FY 2043 option_8F - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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General
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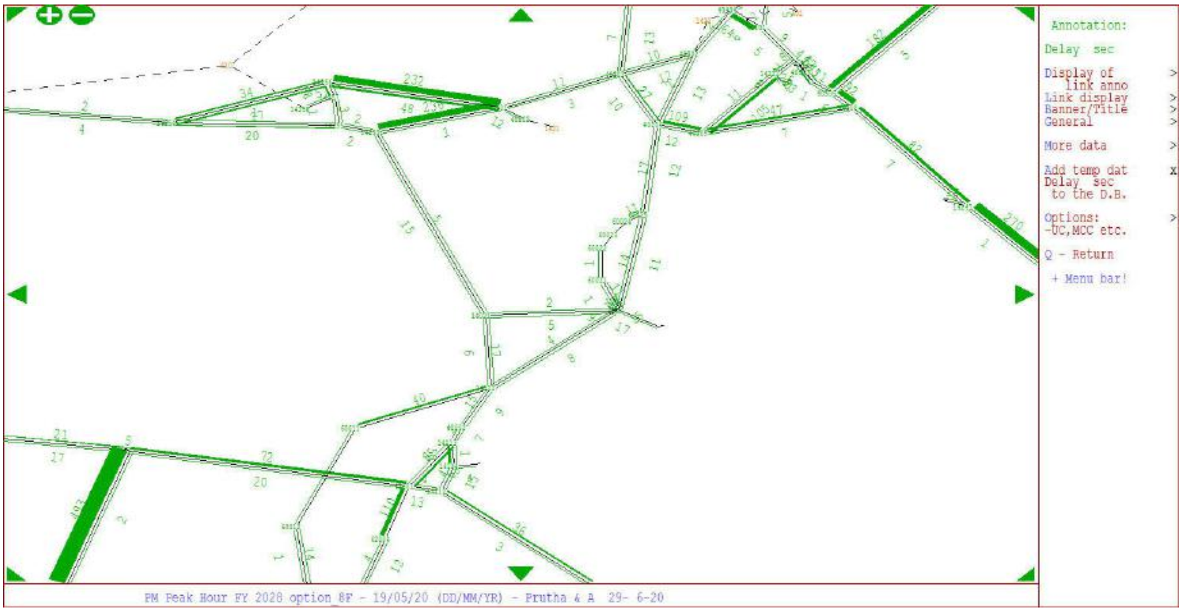
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour FY 2043 option_8F - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

2043- PM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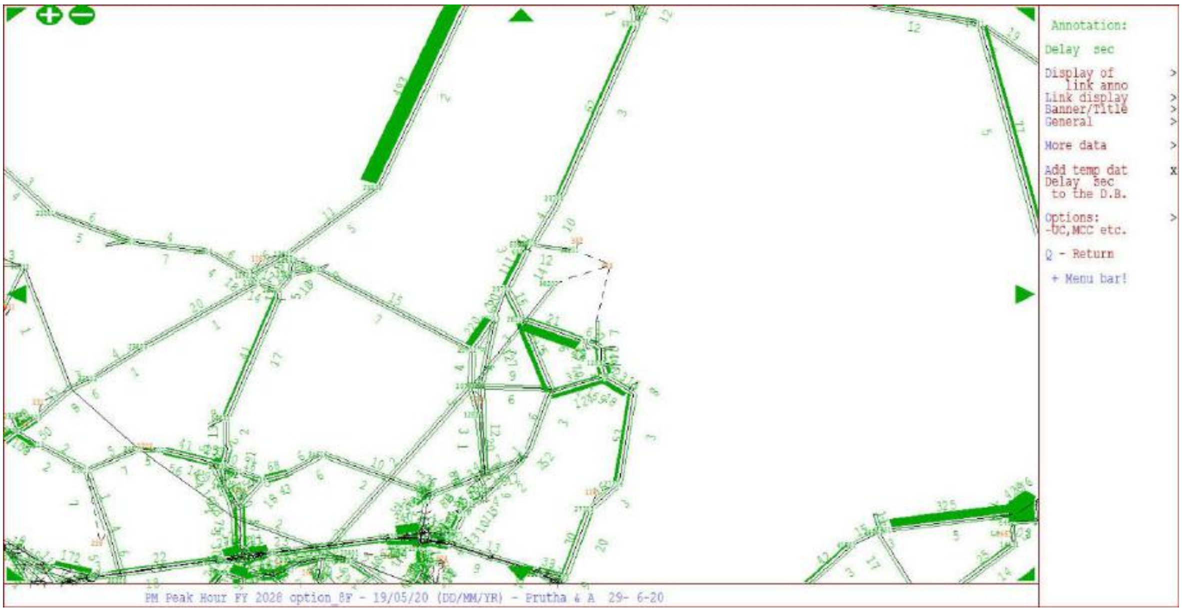
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_8F - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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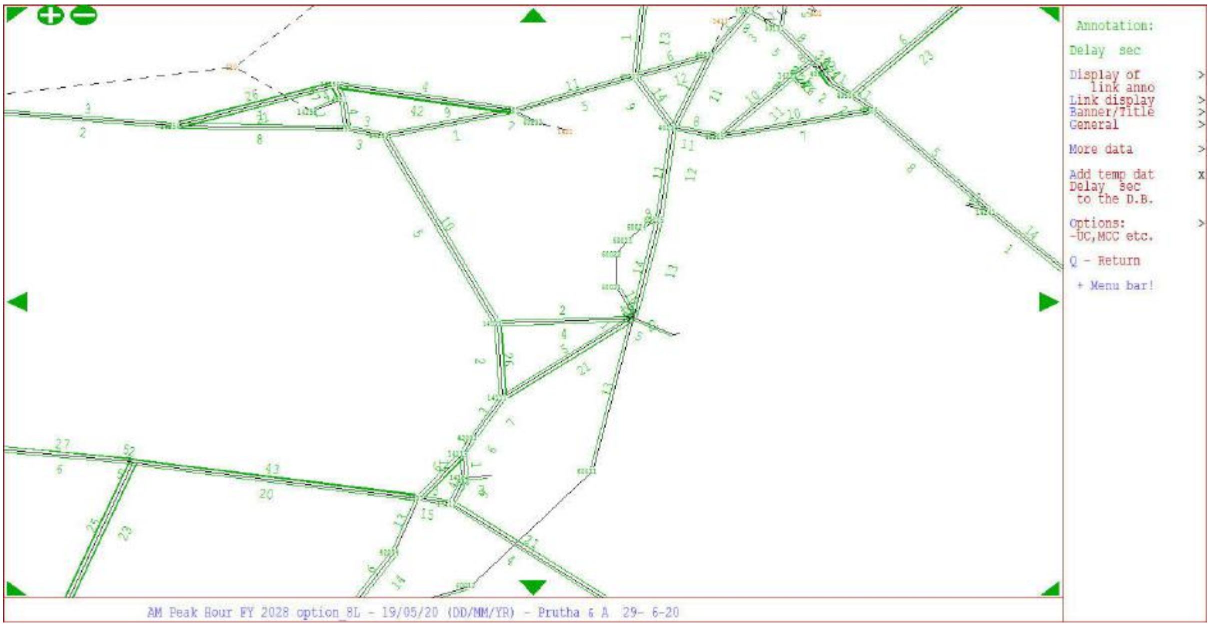
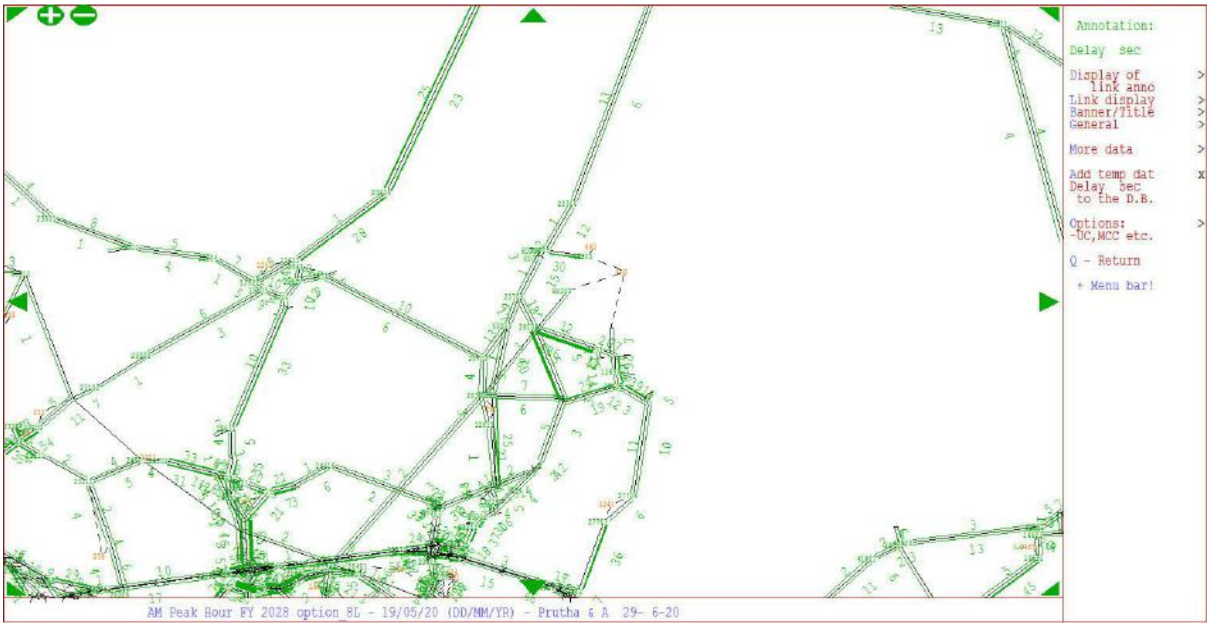
PM Peak Hour FY 2028 option_8F - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

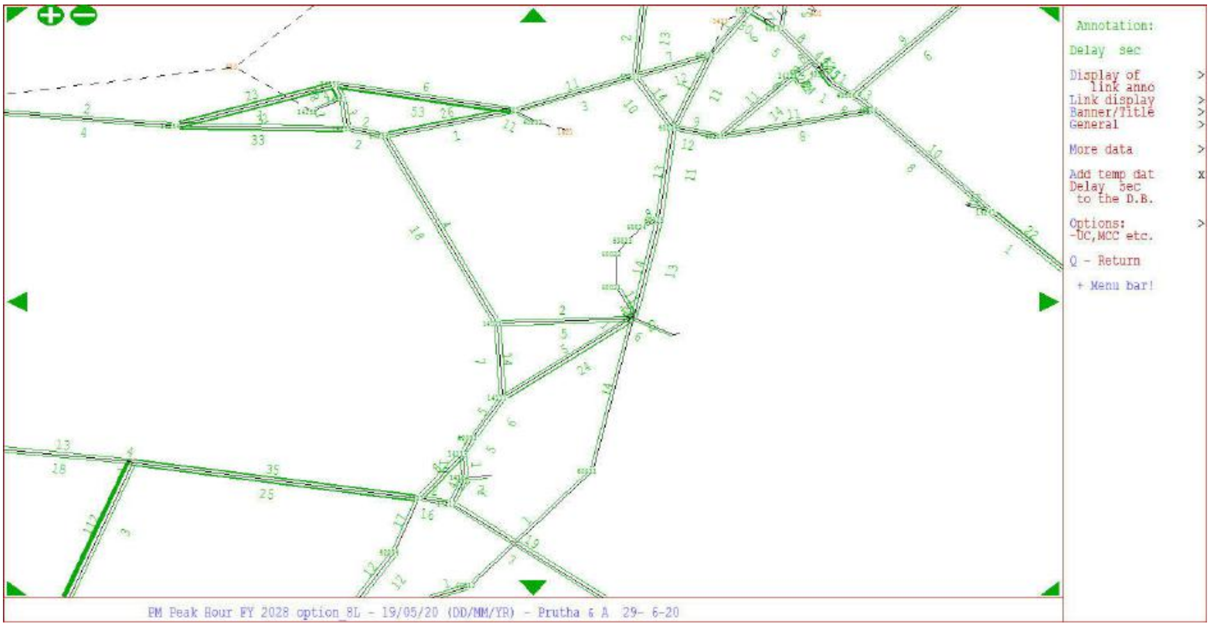
Option B

2028- AM





2028- PM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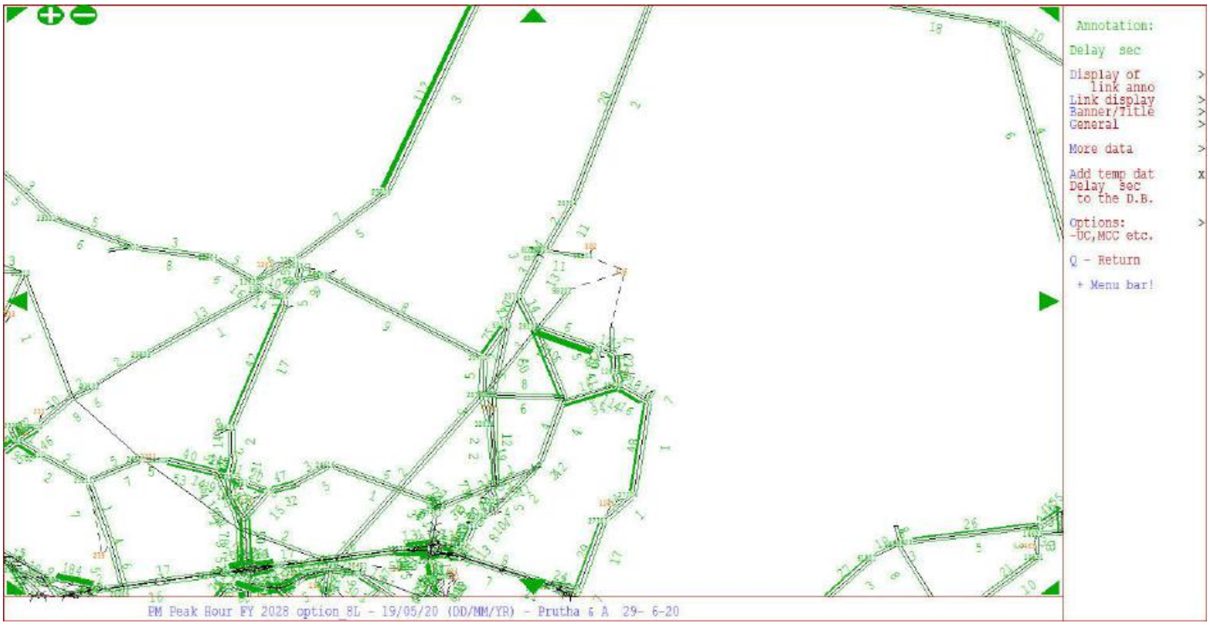
PM Peak Hour FY 2028 option_8L - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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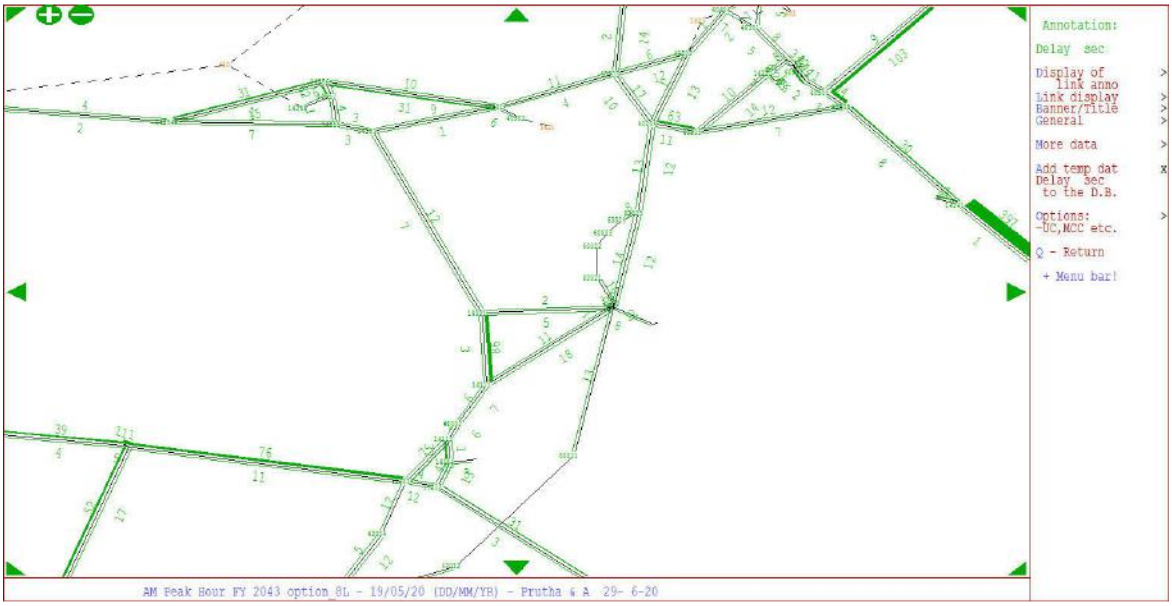
PM Peak Hour FY 2028 option_8L - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

2043- AM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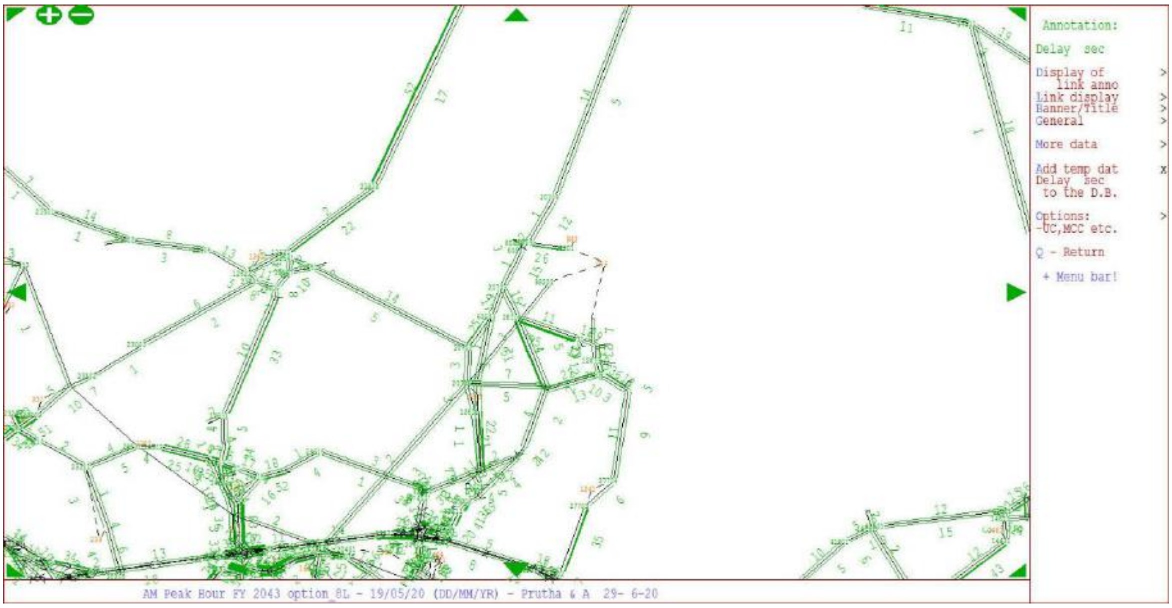
AM Peak Hour FY 2043 option_8L - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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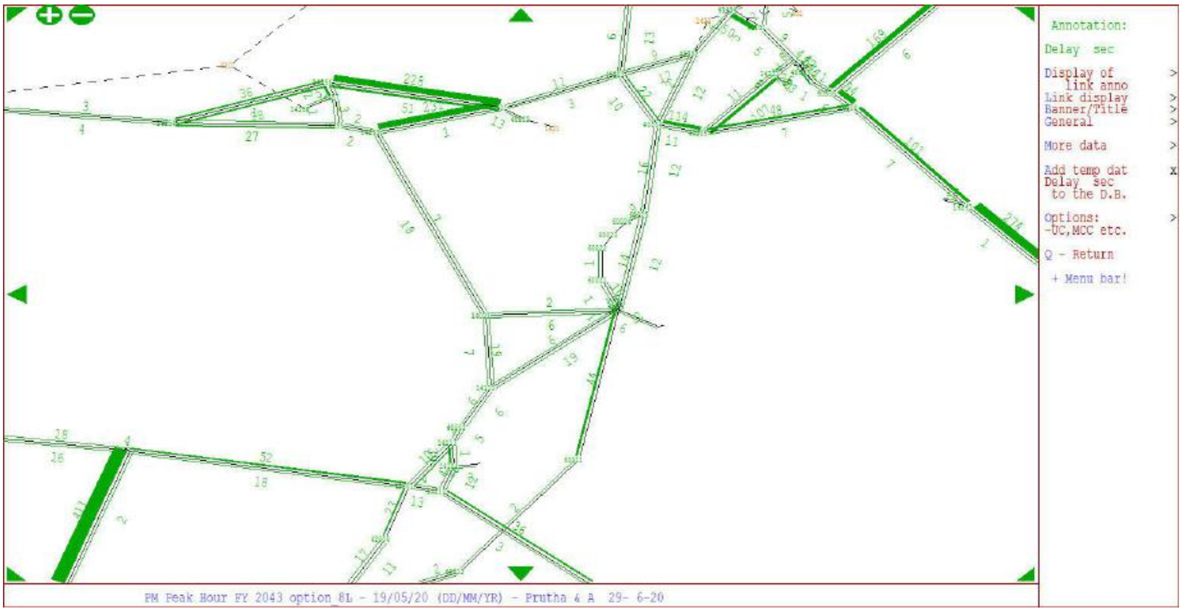
AM Peak Hour FY 2043 option_8L - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

2043- PM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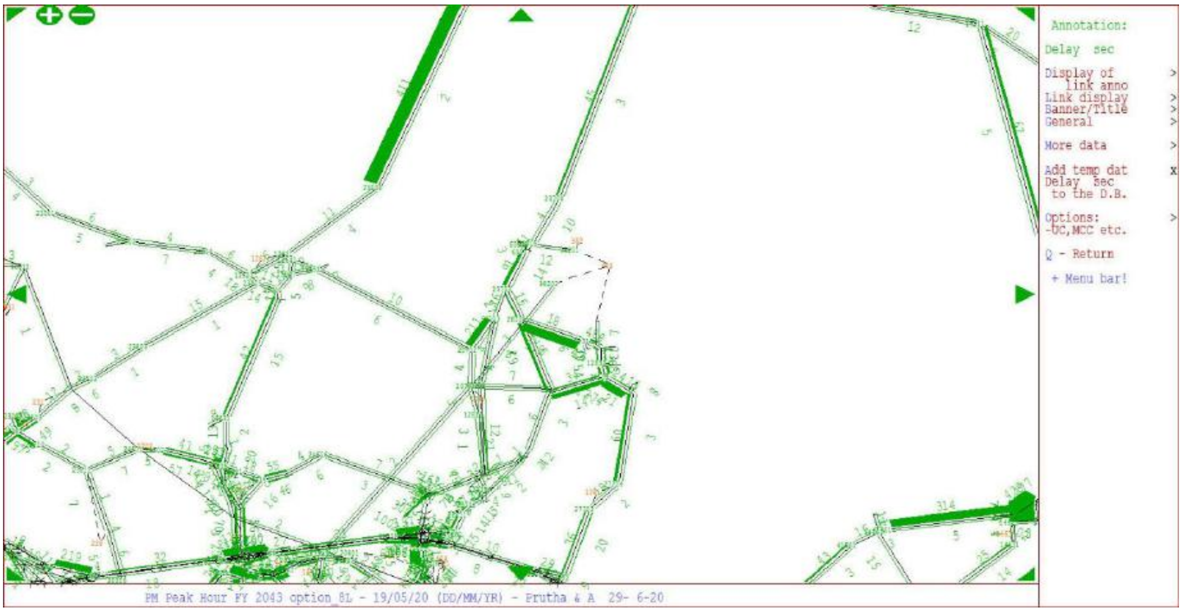
+ Menu bar!
PM Peak Hour FY 2043 option 8L - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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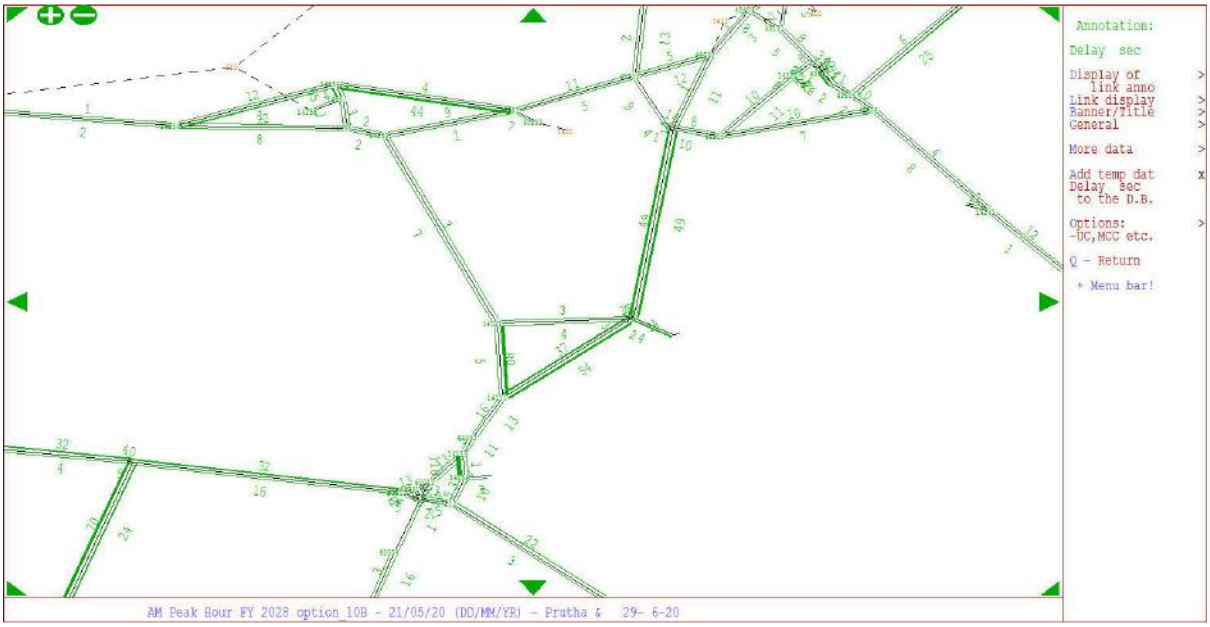
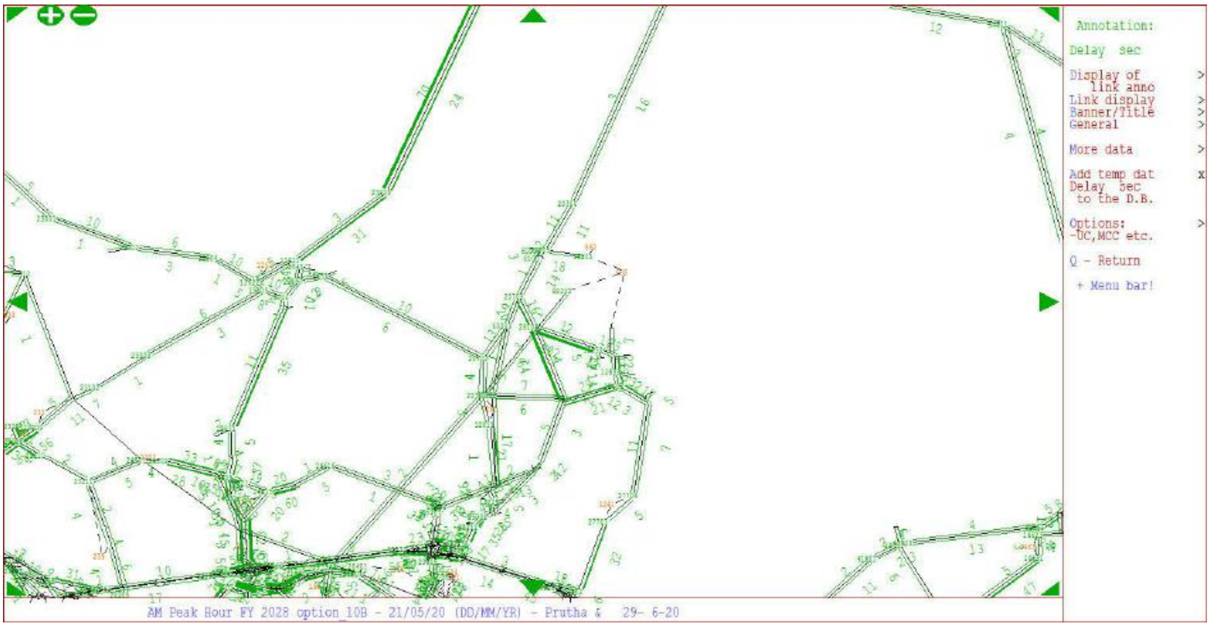
+ Menu bar!
PM Peak Hour FY 2043 option 8L - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

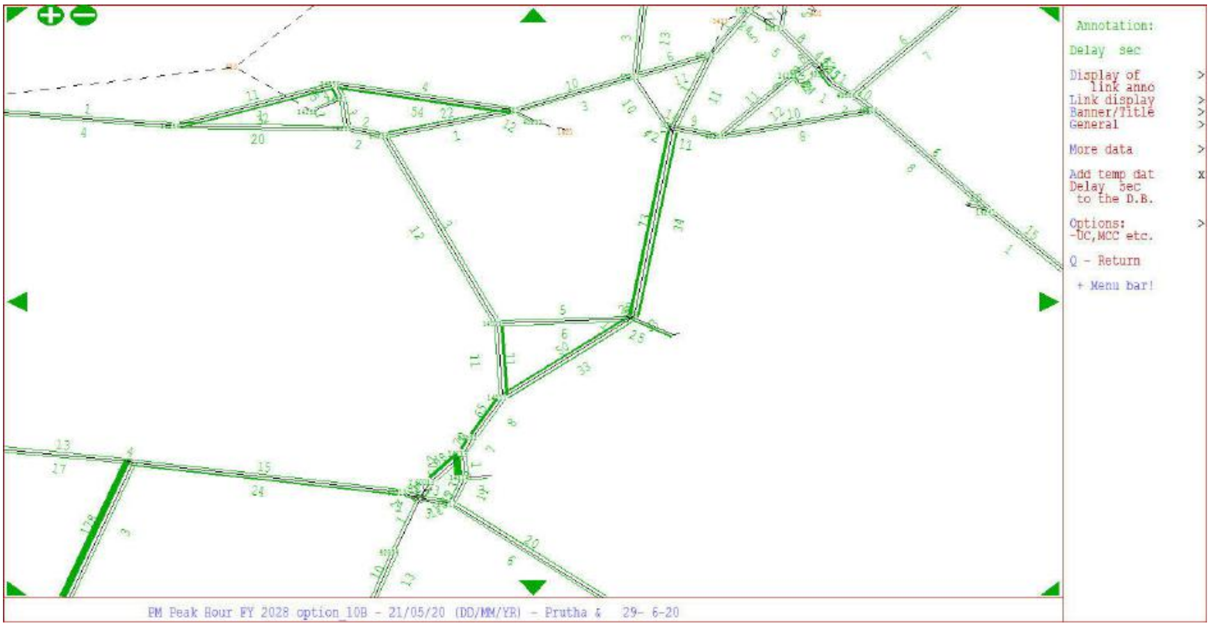
Option C

2028- AM





2028- PM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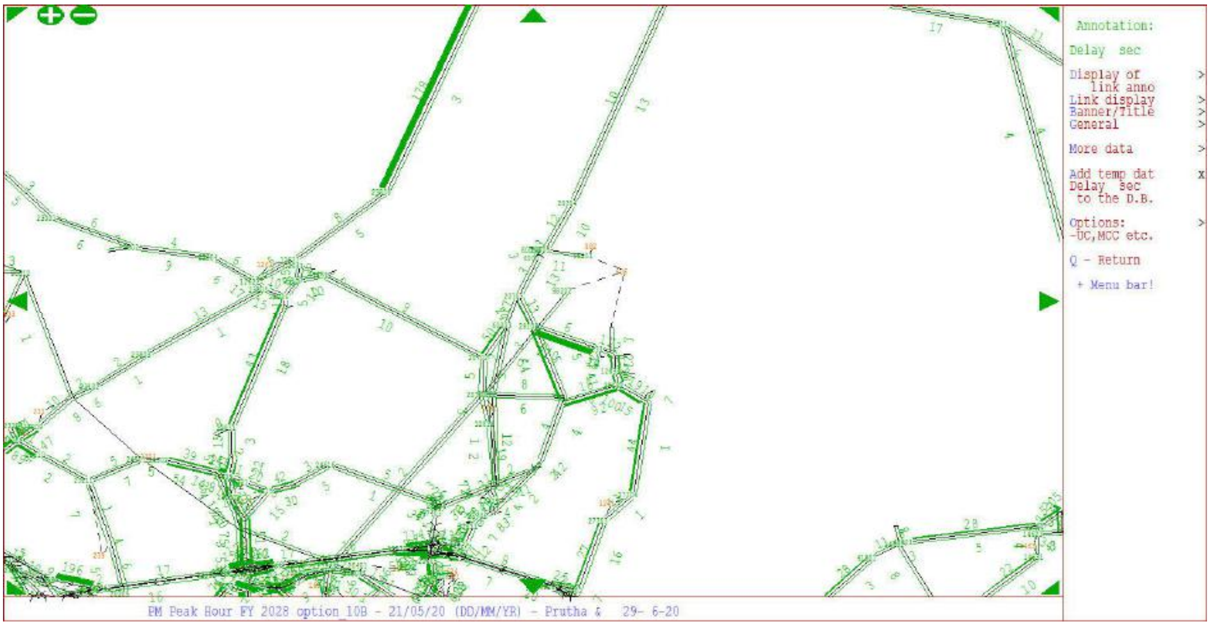
+ Menu bar!
PM Peak Hour FY 2028 option_10B - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20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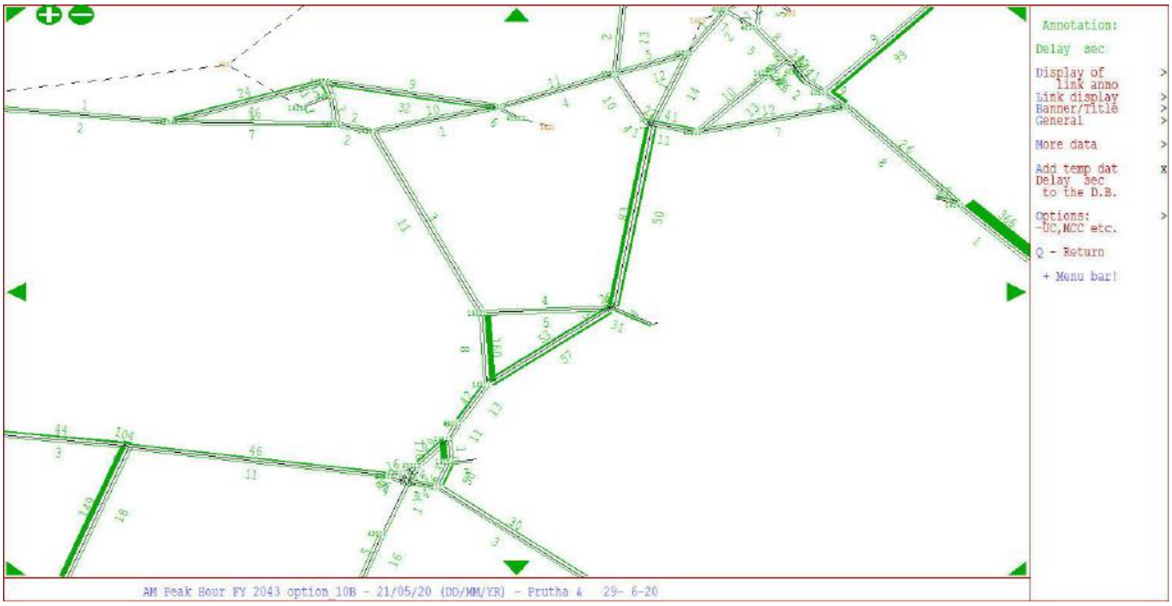
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_10B - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20

2043- AM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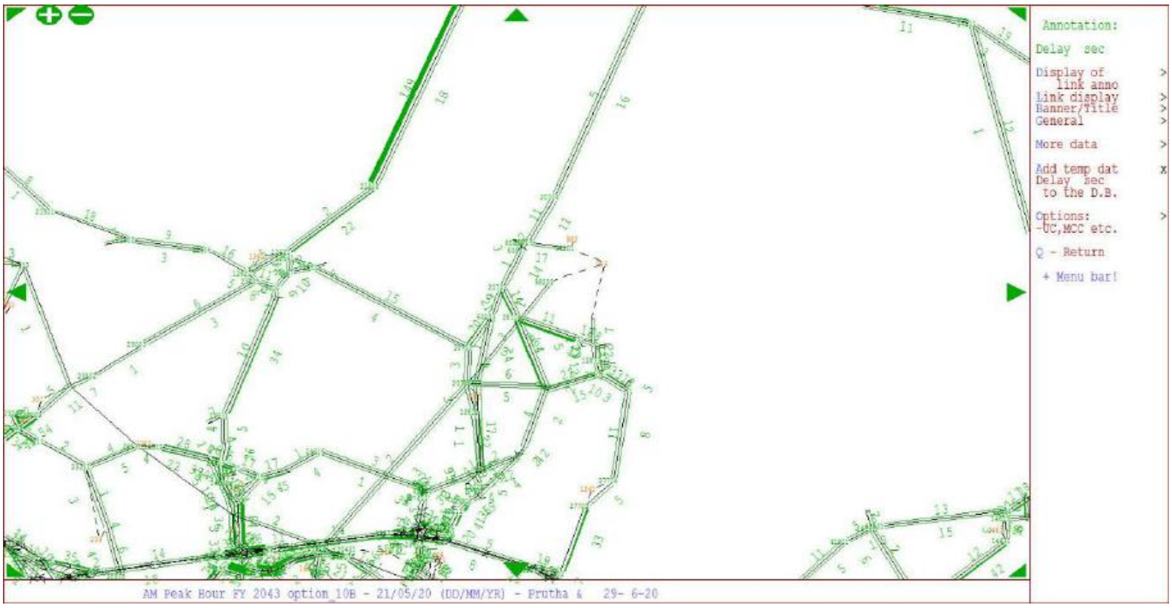
AM Peak Hour FY 2043 option_10B - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20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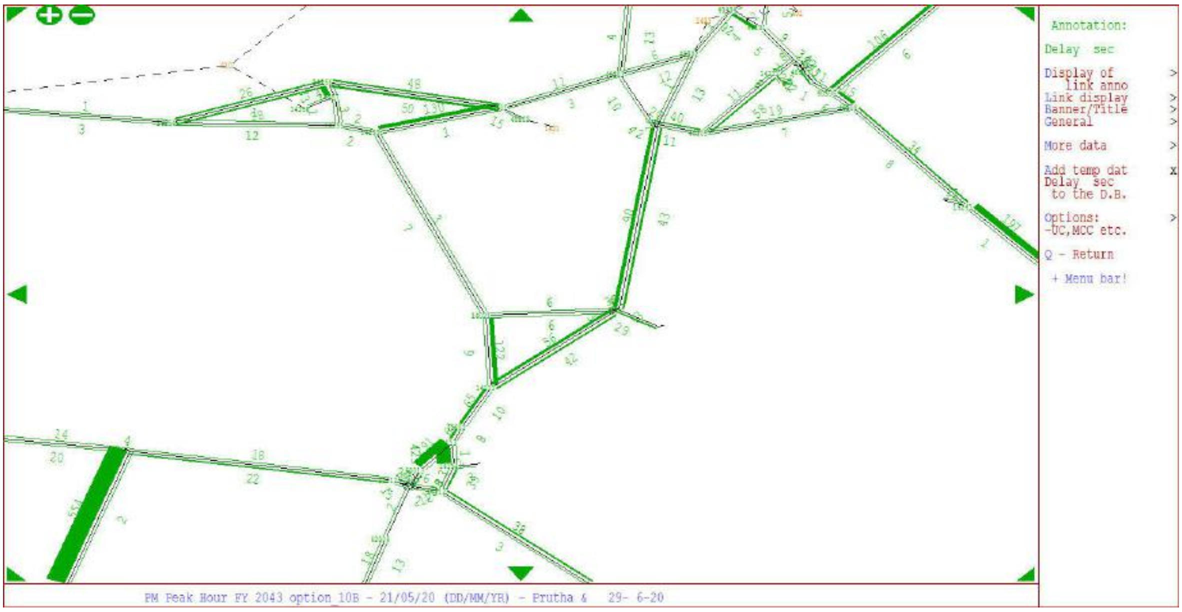
AM Peak Hour FY 2043 option_10B - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20

2043- PM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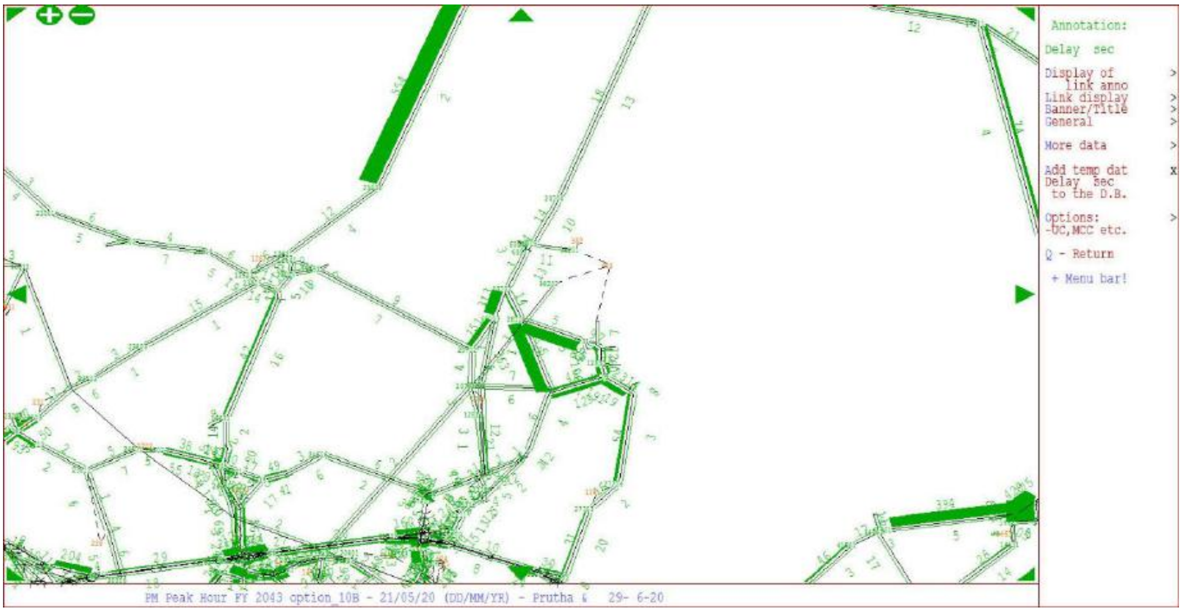
+ Menu bar!
PM Peak Hour FY 2043 option_10B - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20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Q - Return
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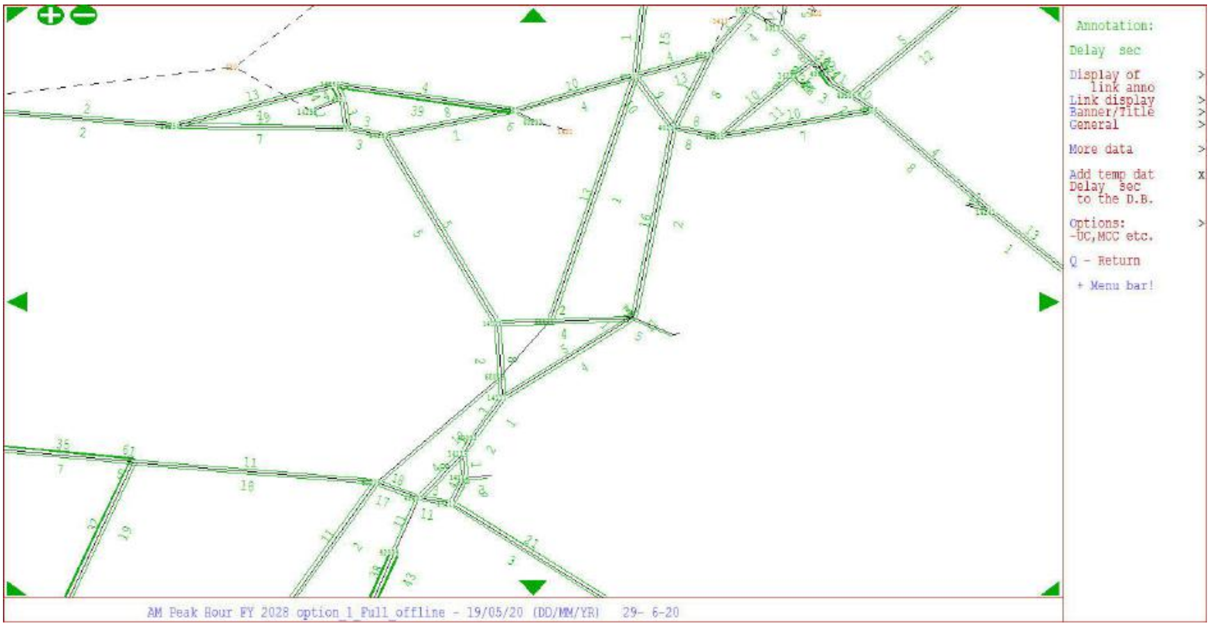
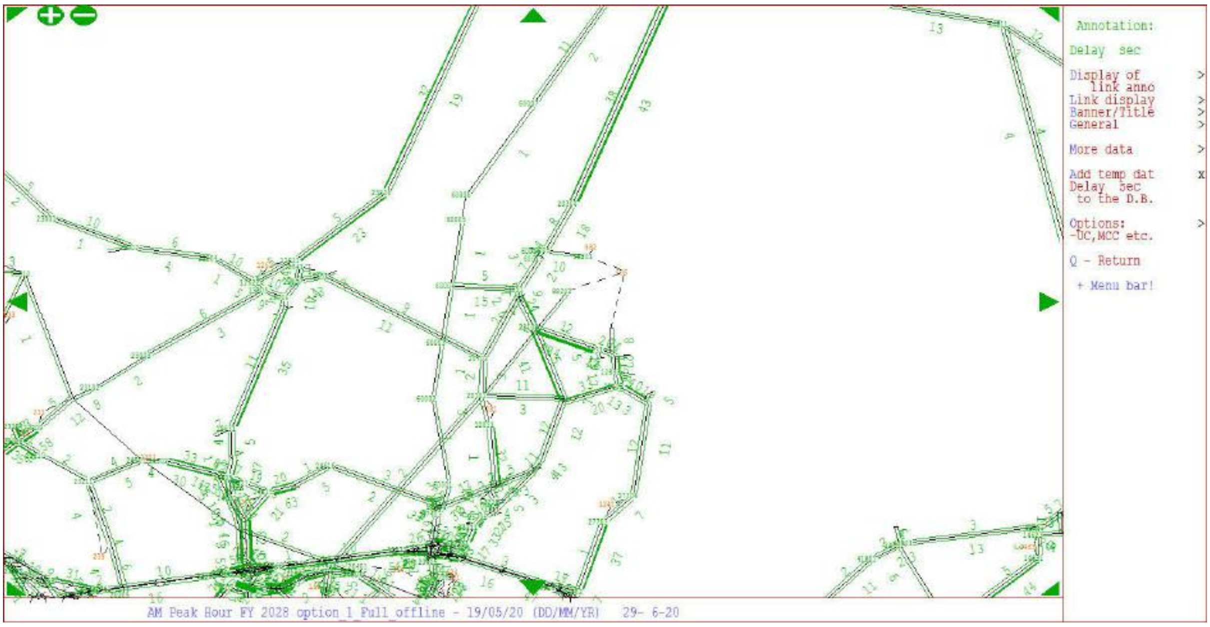
PM Peak Hour FY 2043 option_10B - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20

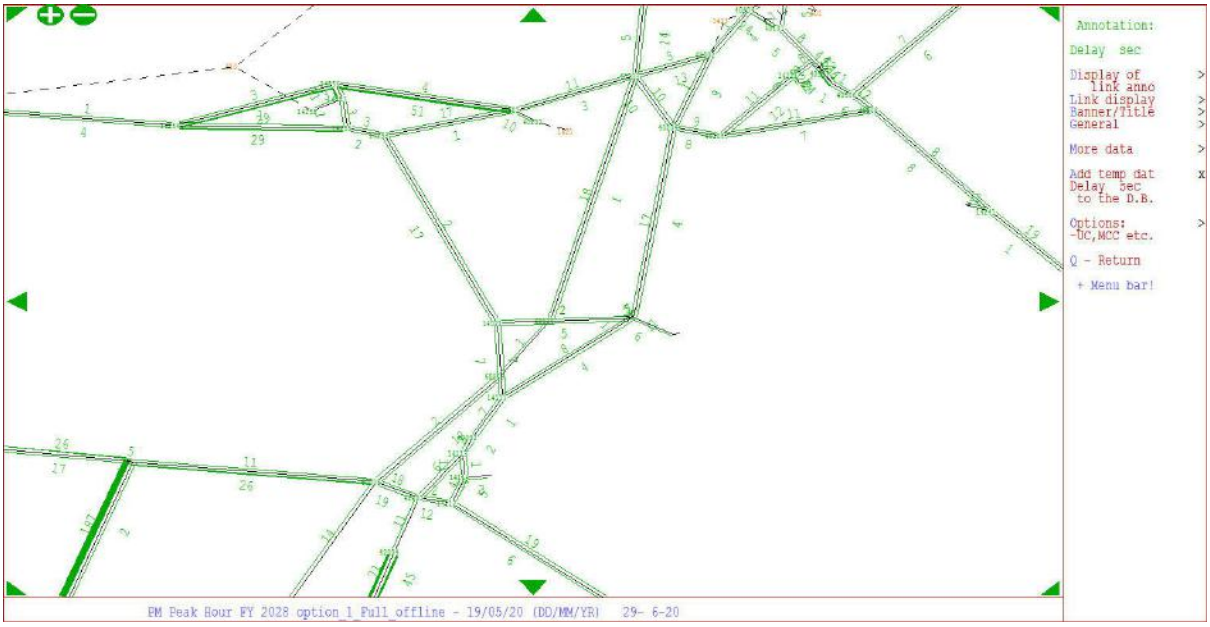
Option D

2028- AM





2028- PM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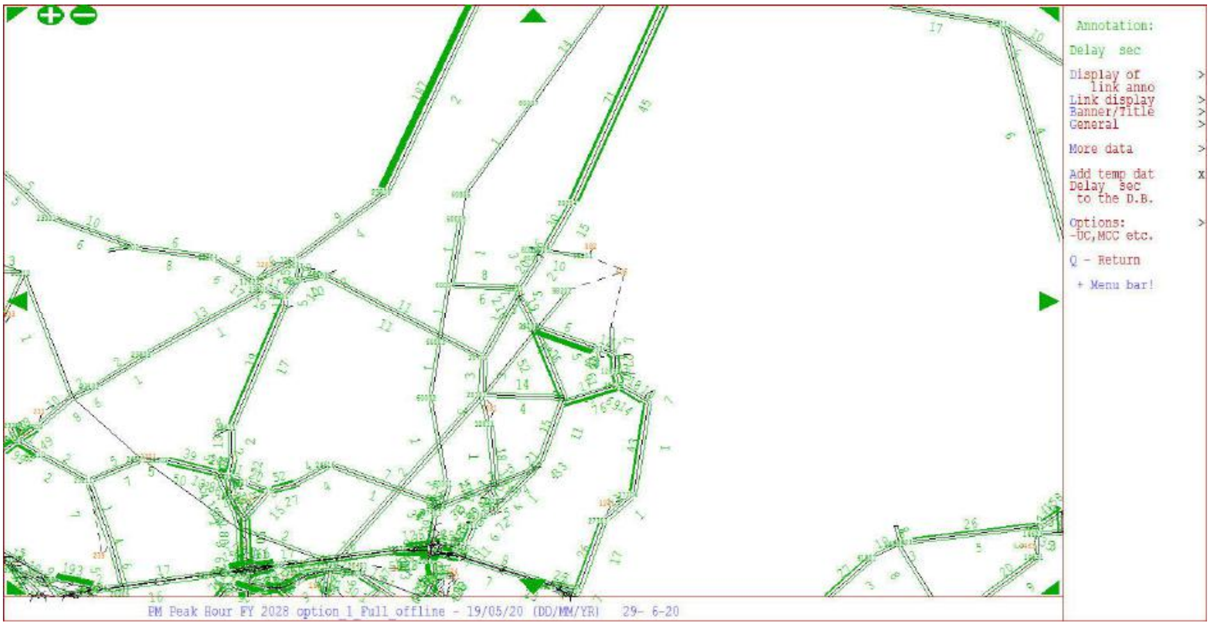
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_1_Full_offline - 19/05/20 (DD/MM/YR) 29- 6-20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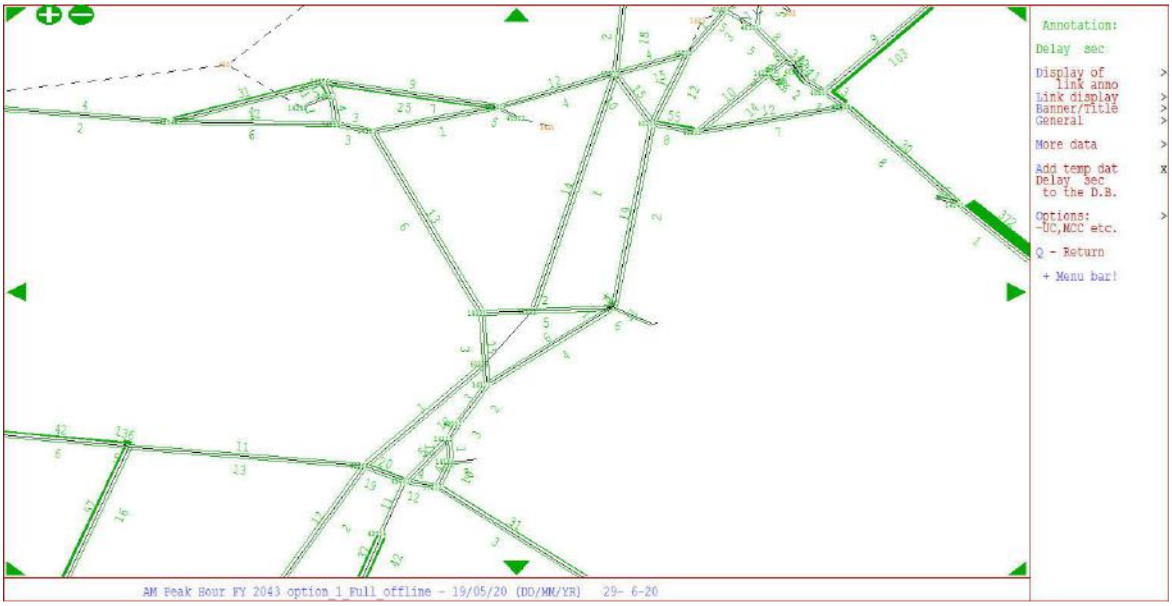
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_1_Full_offline - 19/05/20 (DD/MM/YR) 29- 6-20

2043- AM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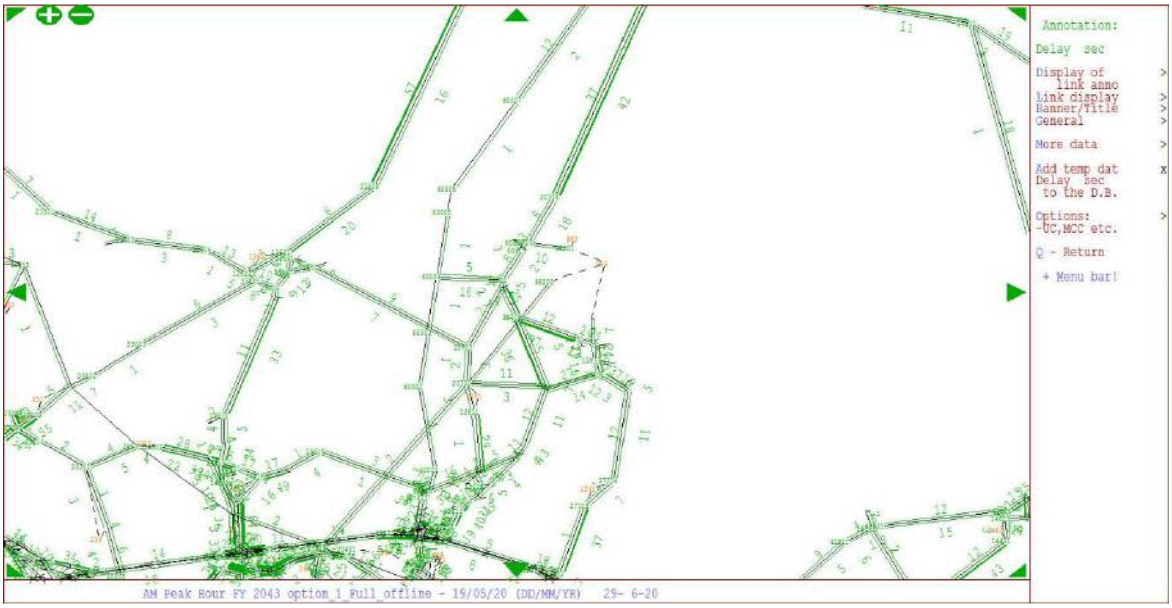
Q - Return
+ Menu bar!
AM Peak Hour FY 2043 option_1 Full_offline - 19/05/20 (DD/MM/YR) 29- 6-20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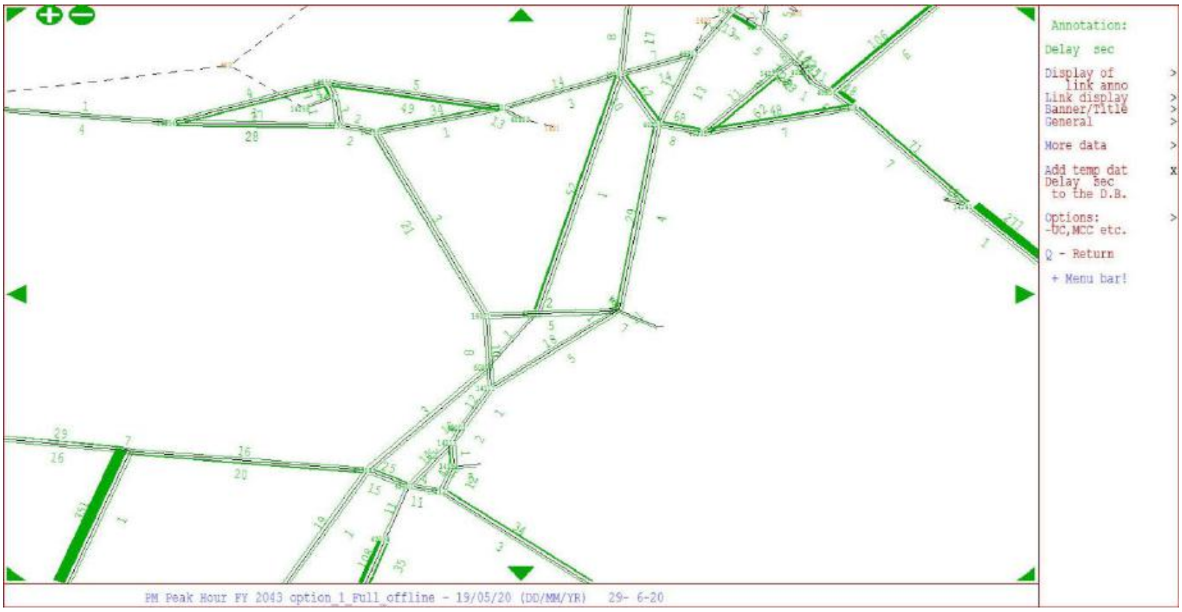
AM Peak Hour FY 2043 option_1 Full_offline - 19/05/20 (DD/MM/YR) 29- 6-20

2043- PM



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Q - Return
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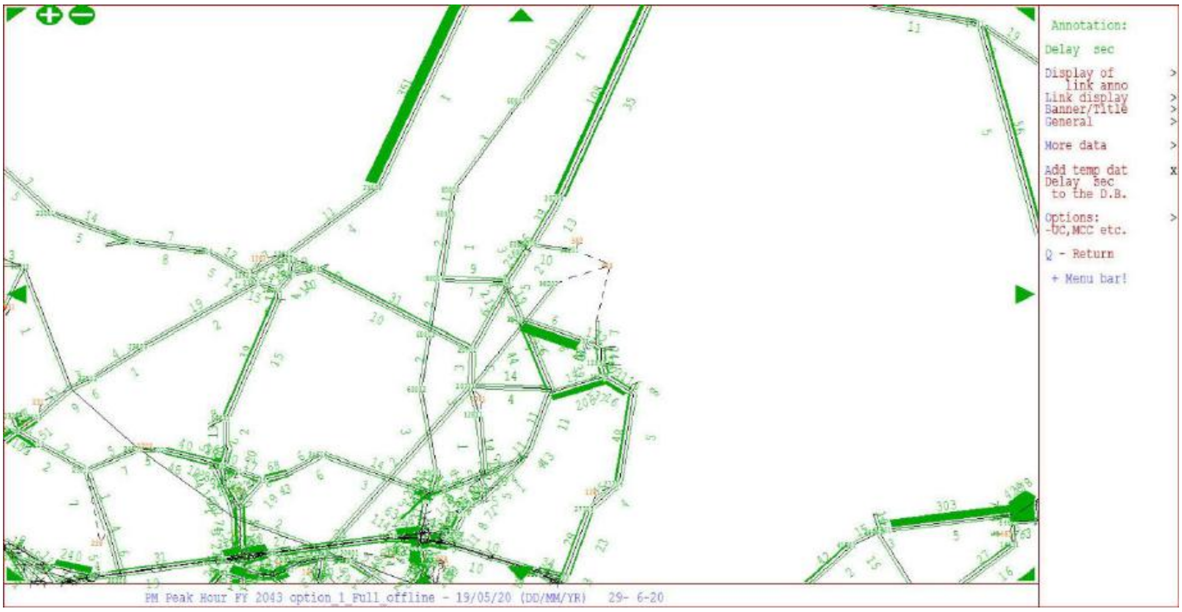
PM Peak Hour FY 2043 option_1_Full_offline - 19/05/20 (DD/MM/YR) 29- 6-20



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Q - Return
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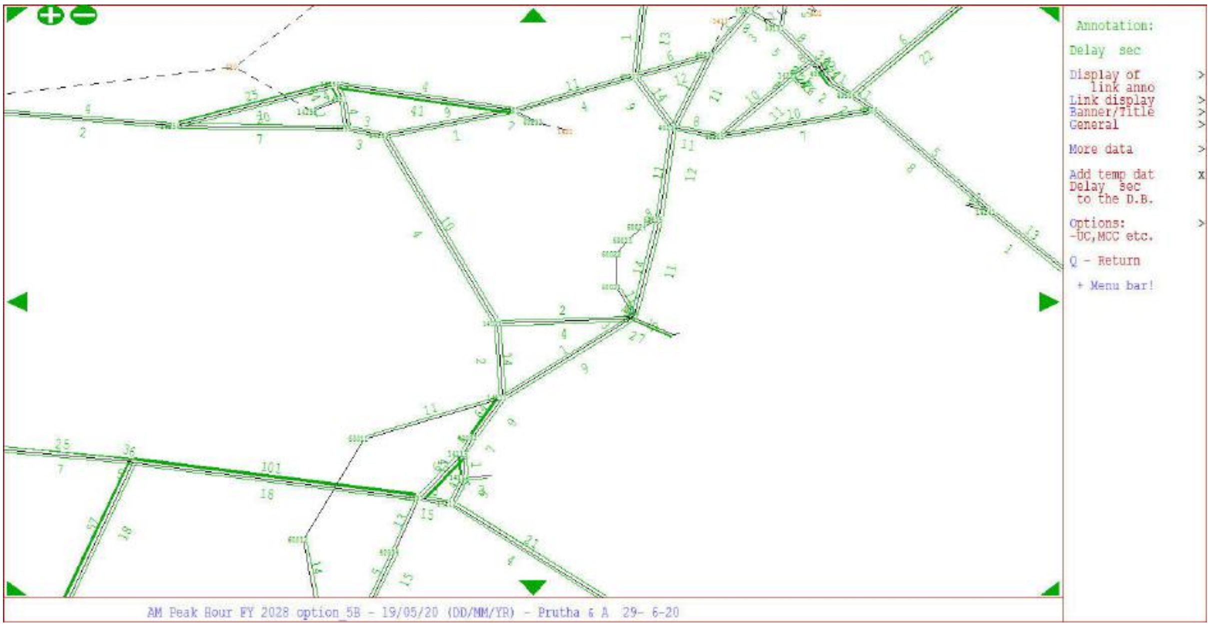
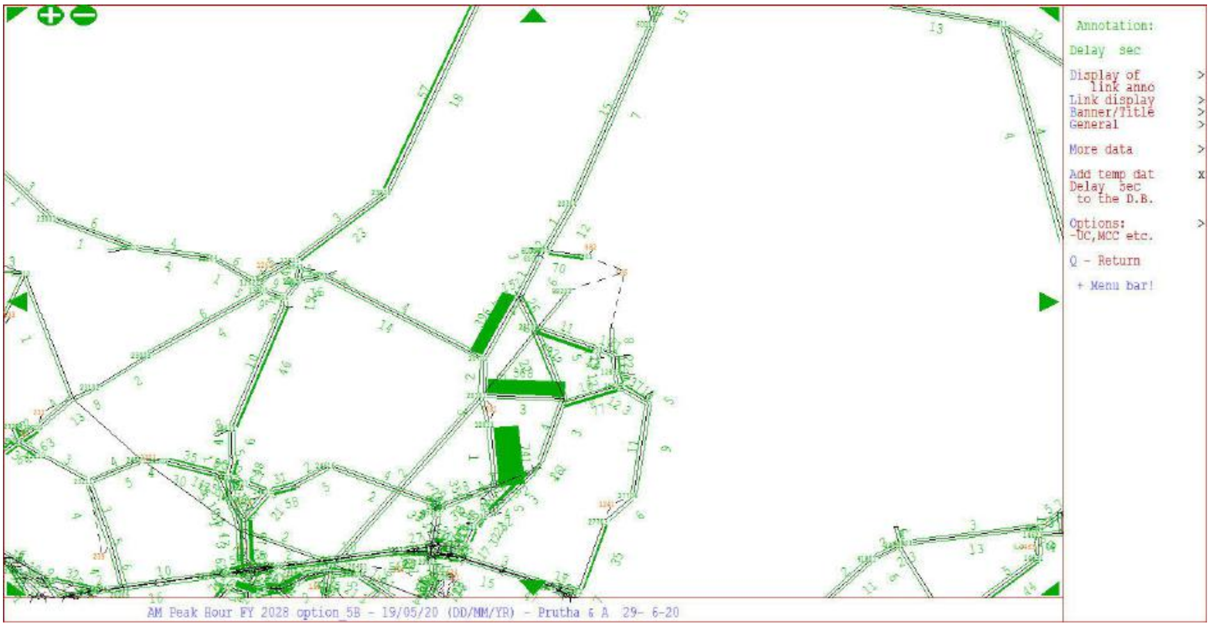
PM Peak Hour FY 2043 option_1_Full_offline - 19/05/20 (DD/MM/YR) 29- 6-20

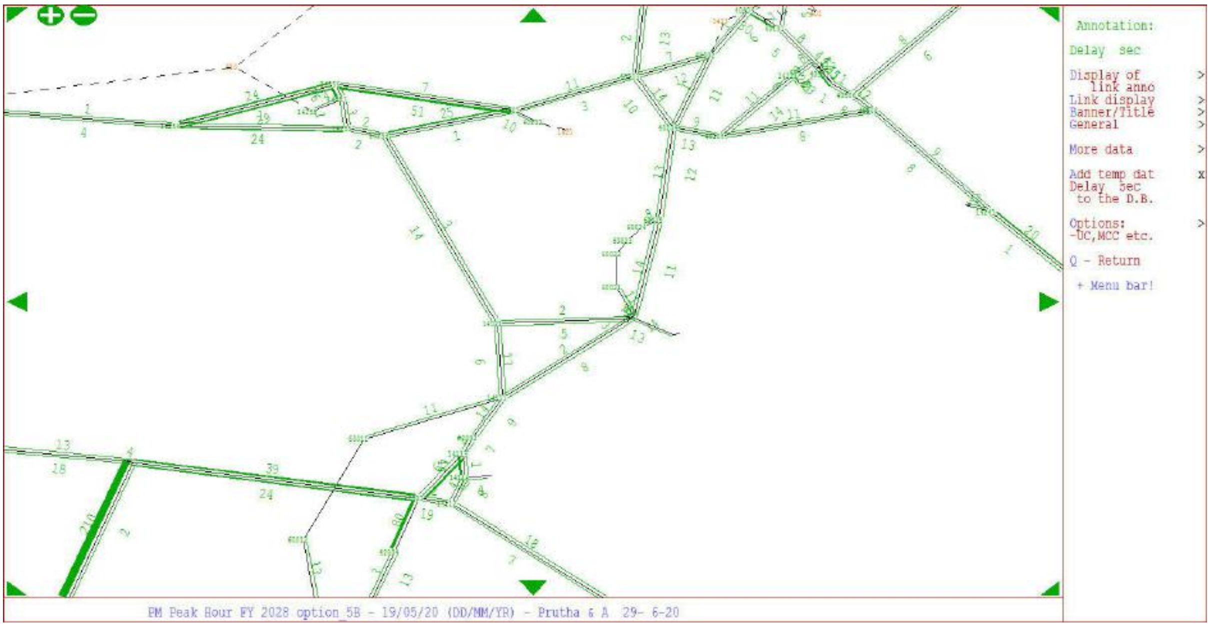
Option E

2028- AM





2028- PM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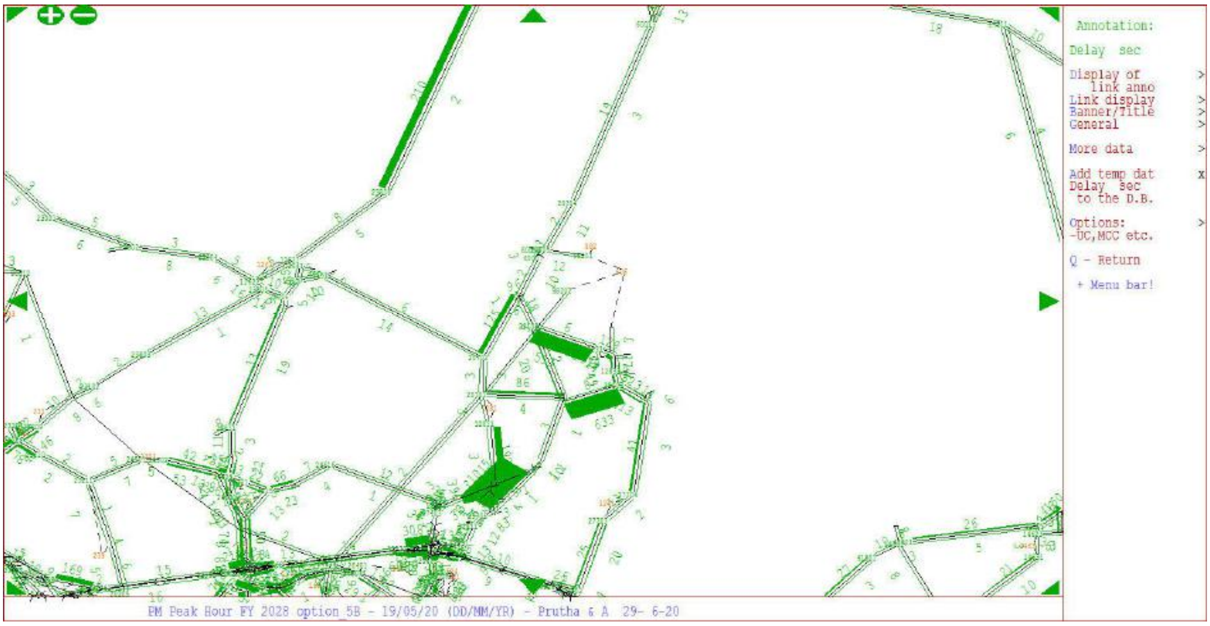
PM Peak Hour FY 2028 option_5B - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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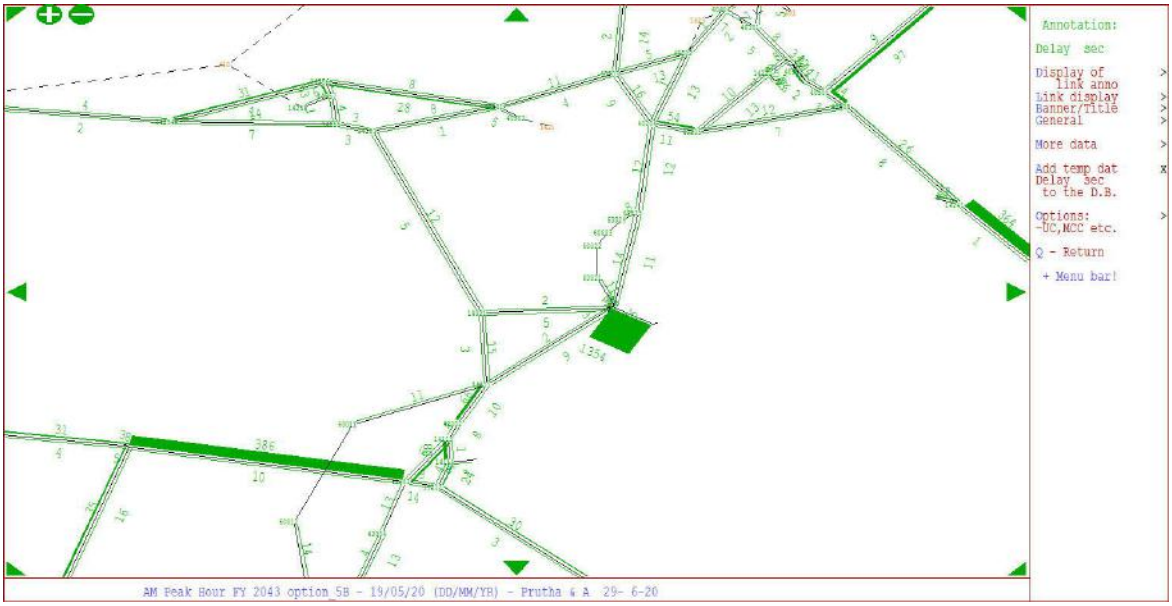
PM Peak Hour FY 2028 option_5B - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

2043- AM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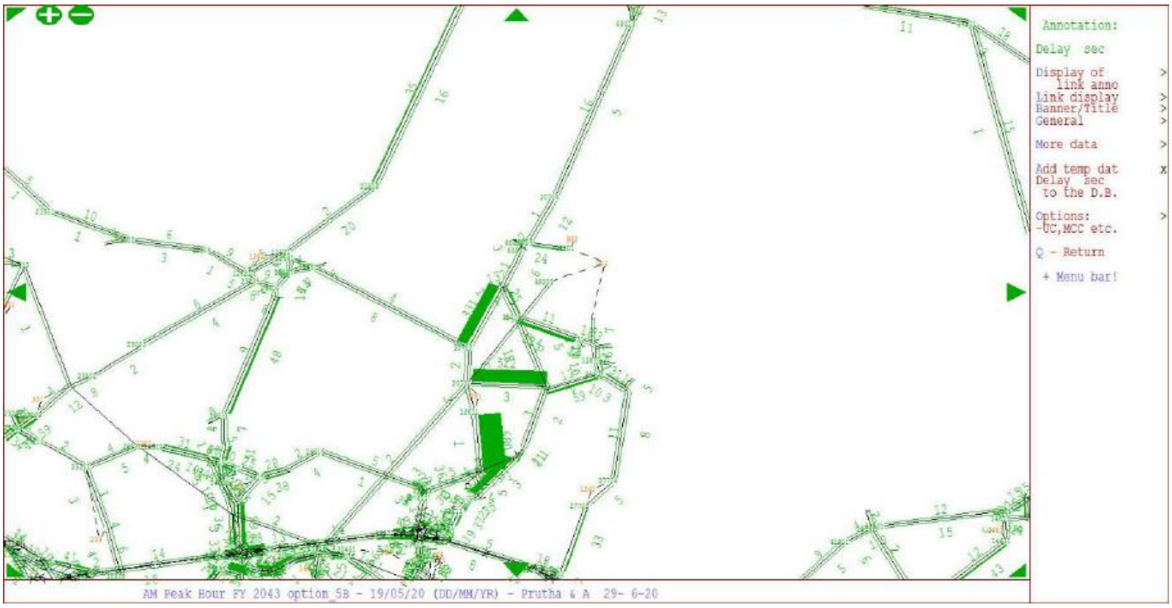
AM Peak Hour FY 2043 option_5B - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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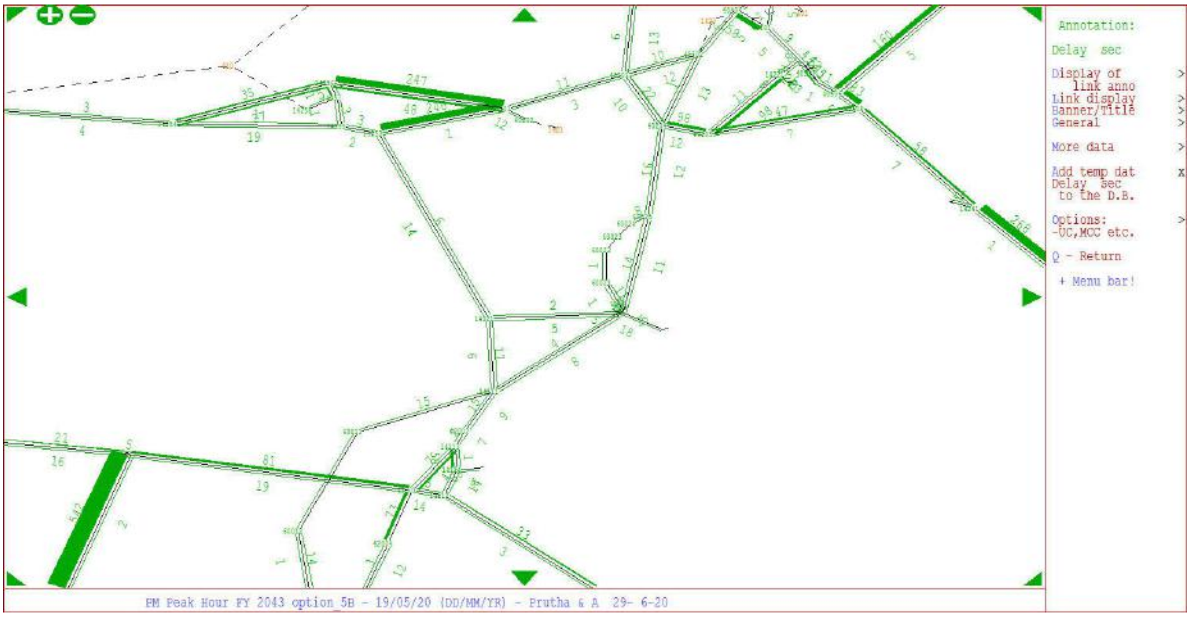
AM Peak Hour FY 2043 option_5B - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

2043- PM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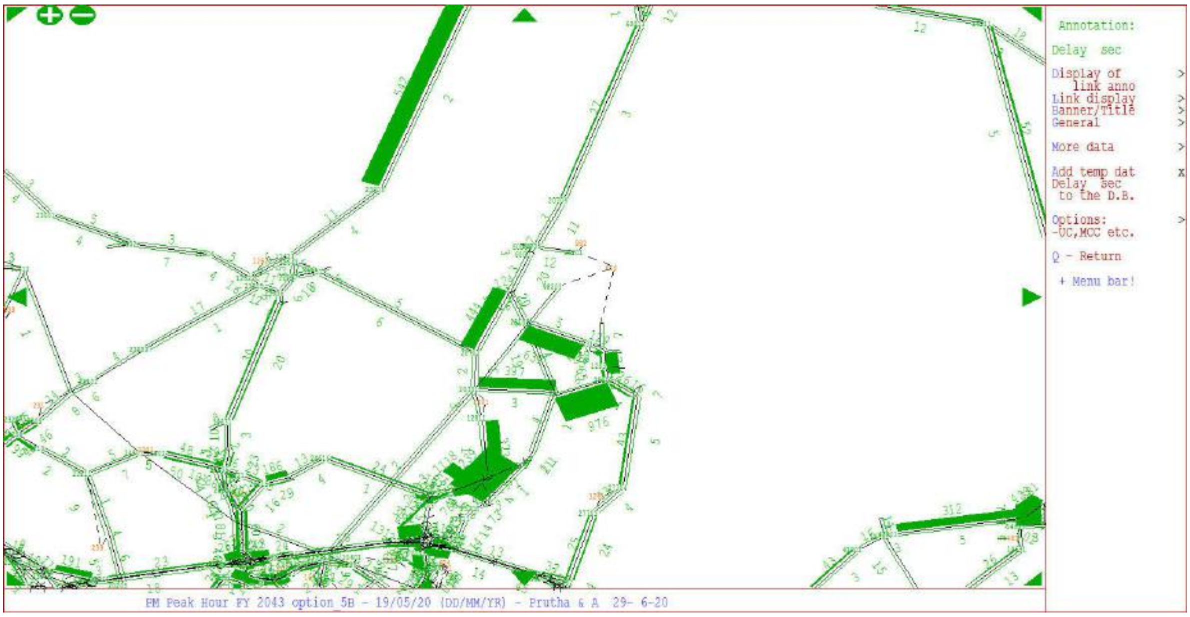
PM Peak Hour FY 2043 option_5B - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20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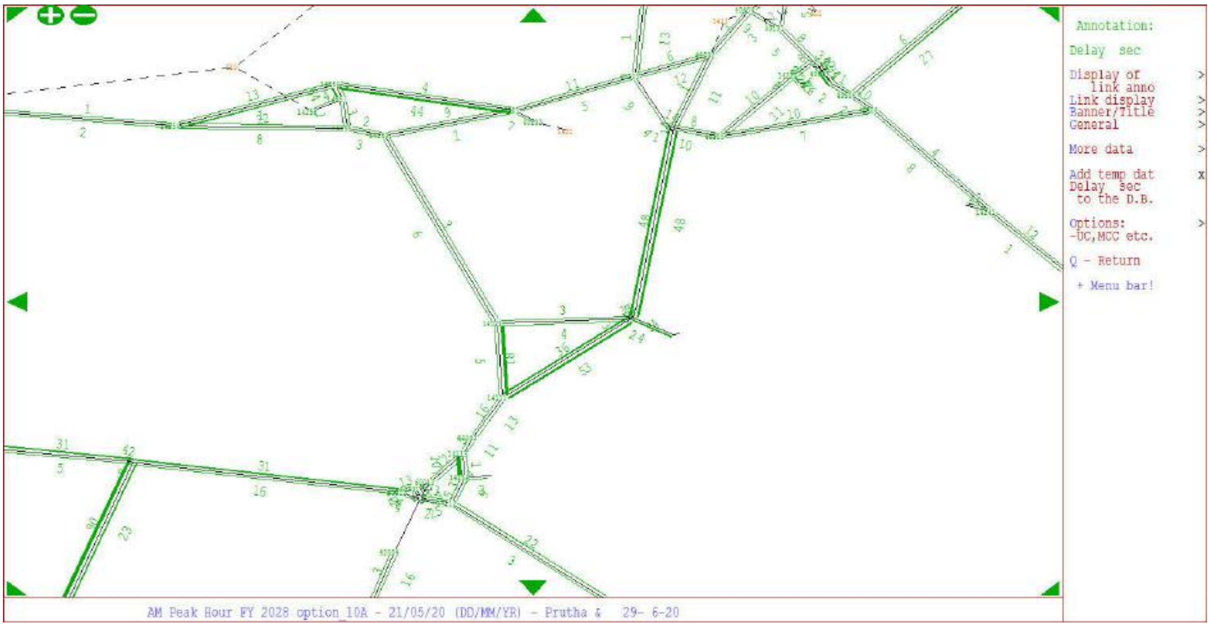
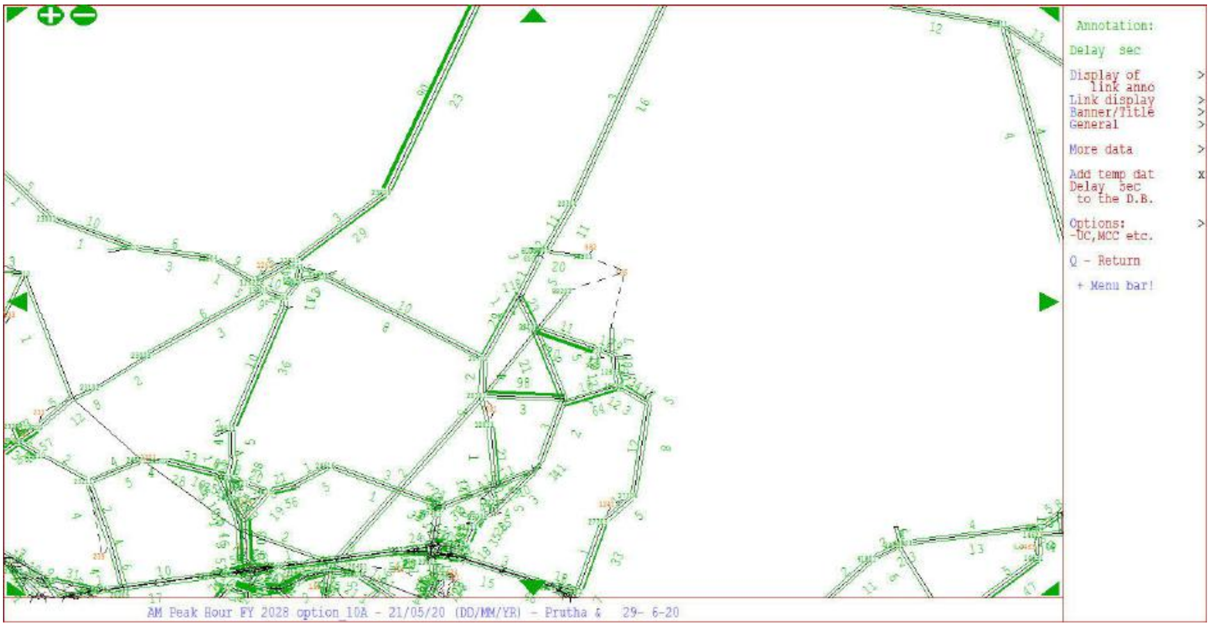
PM Peak Hour FY 2043 option_5B - 19/05/20 (DD/MM/YR) - Prutha & A 29- 6-20

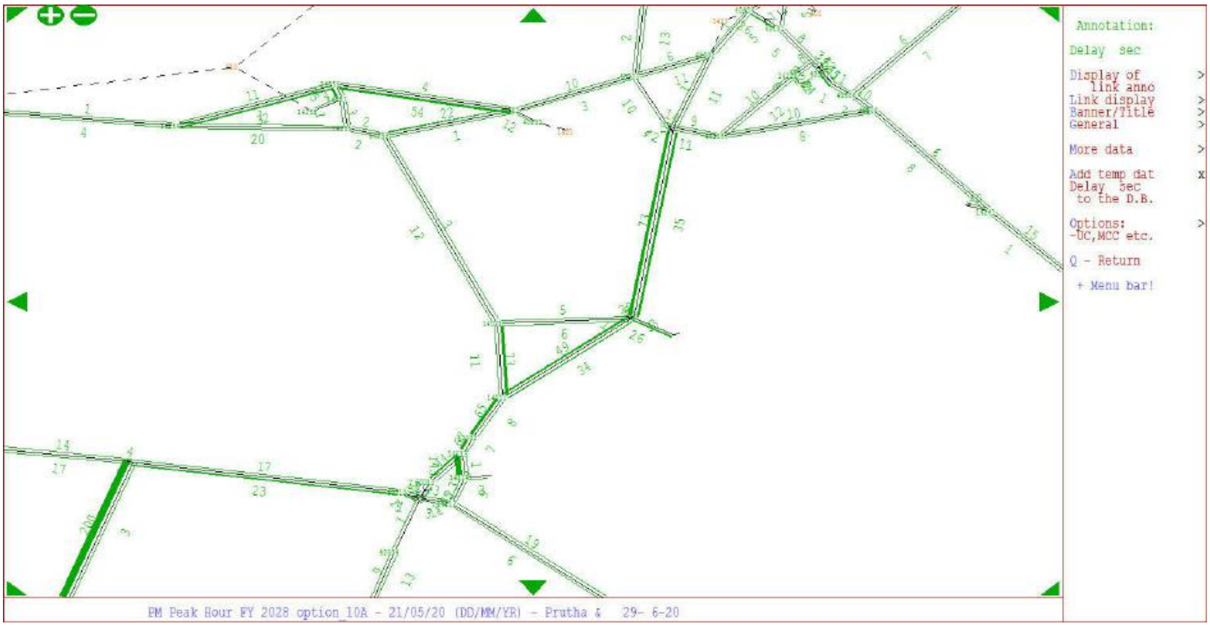
Option F

2028- AM





2028- PM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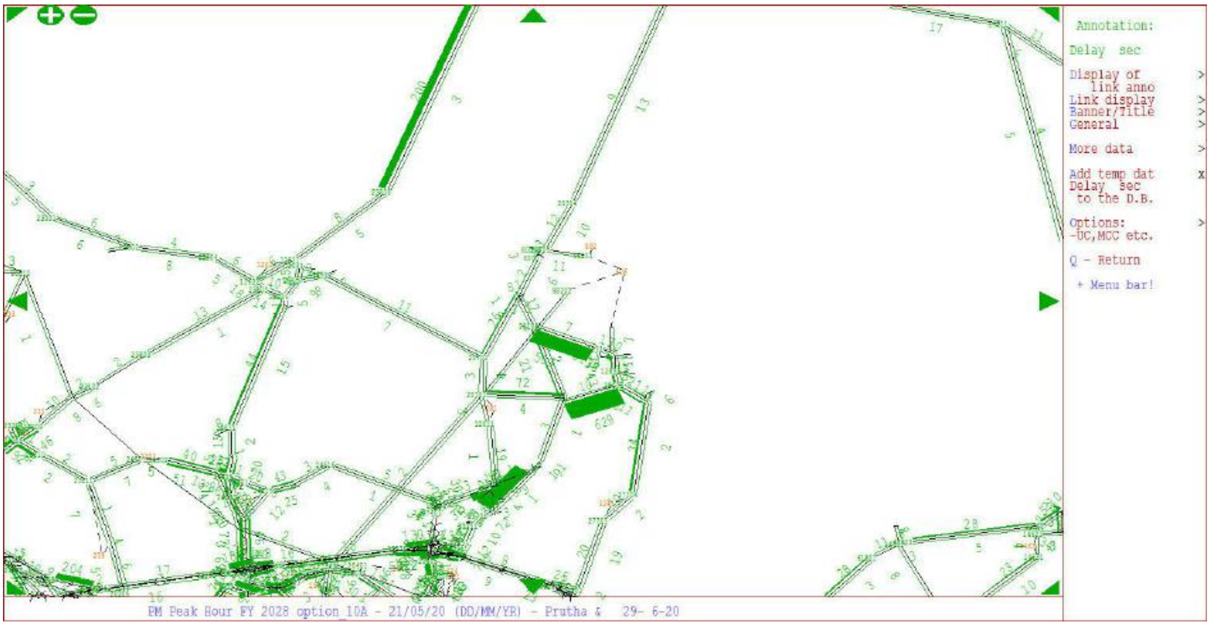
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_10A - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20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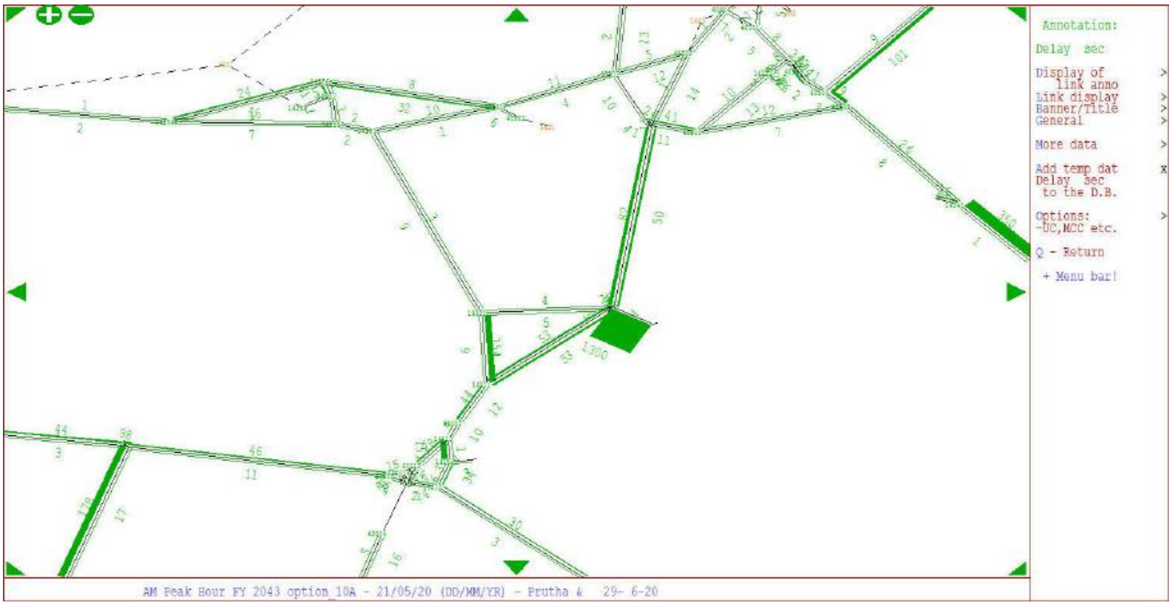
PM Peak Hour FY 2028 option_10A - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20

2043- AM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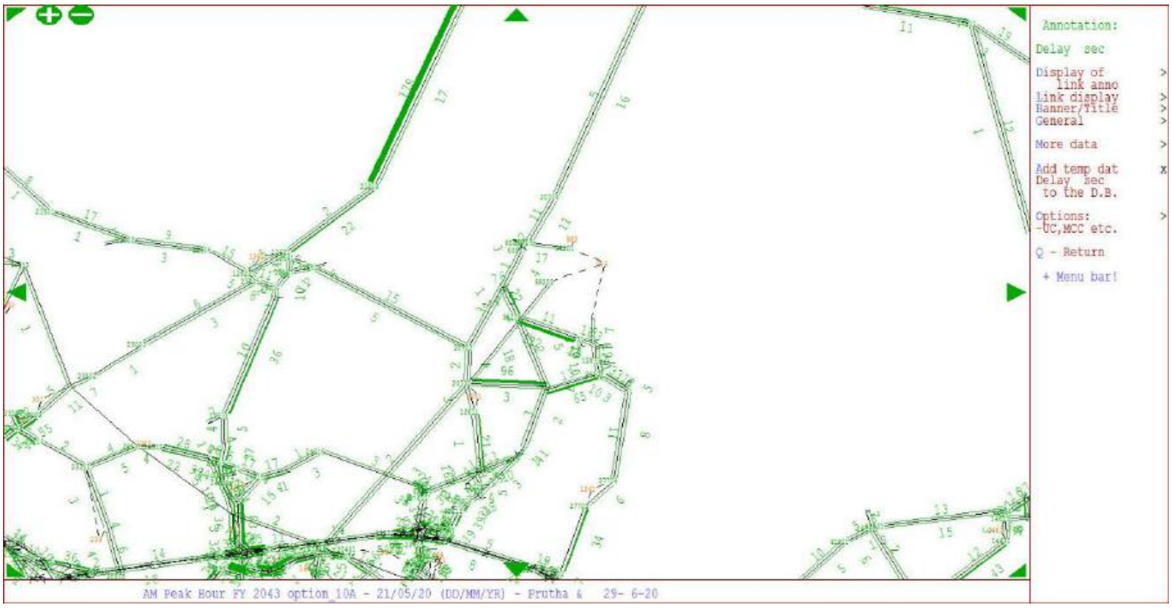
AM Peak Hour FY 2043 option_10A - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20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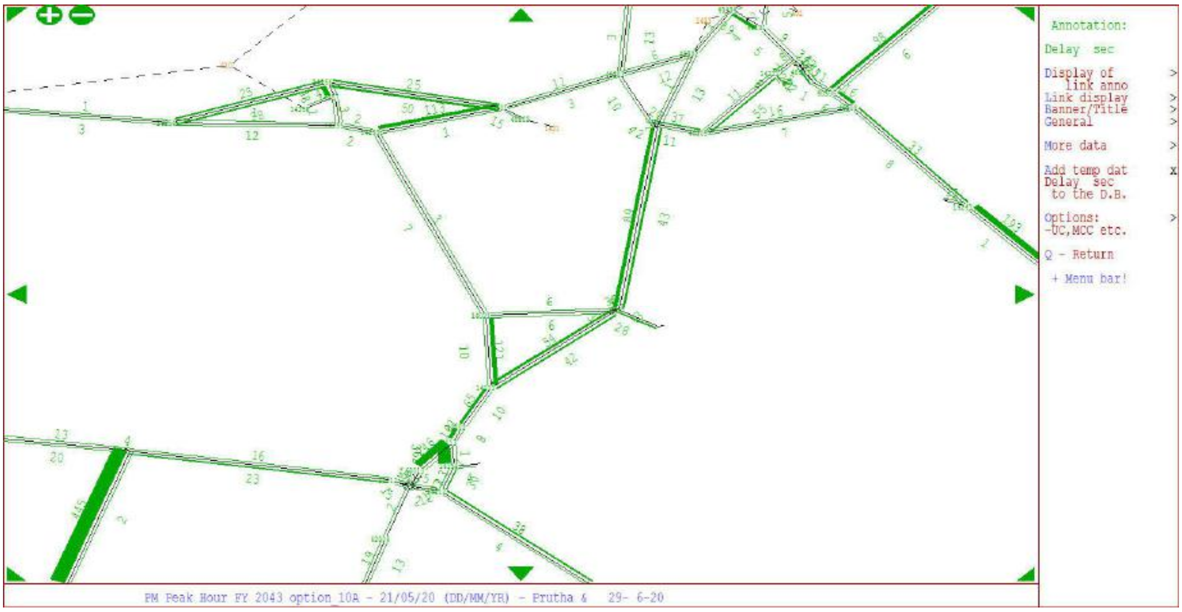
AM Peak Hour FY 2043 option_10A - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20

2043- PM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Q - Return
+ Menu bar!
PM Peak Hour FY 2043 option_10A - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20


Annotation:
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More data
Add temp dat Delay sec to the D.B.
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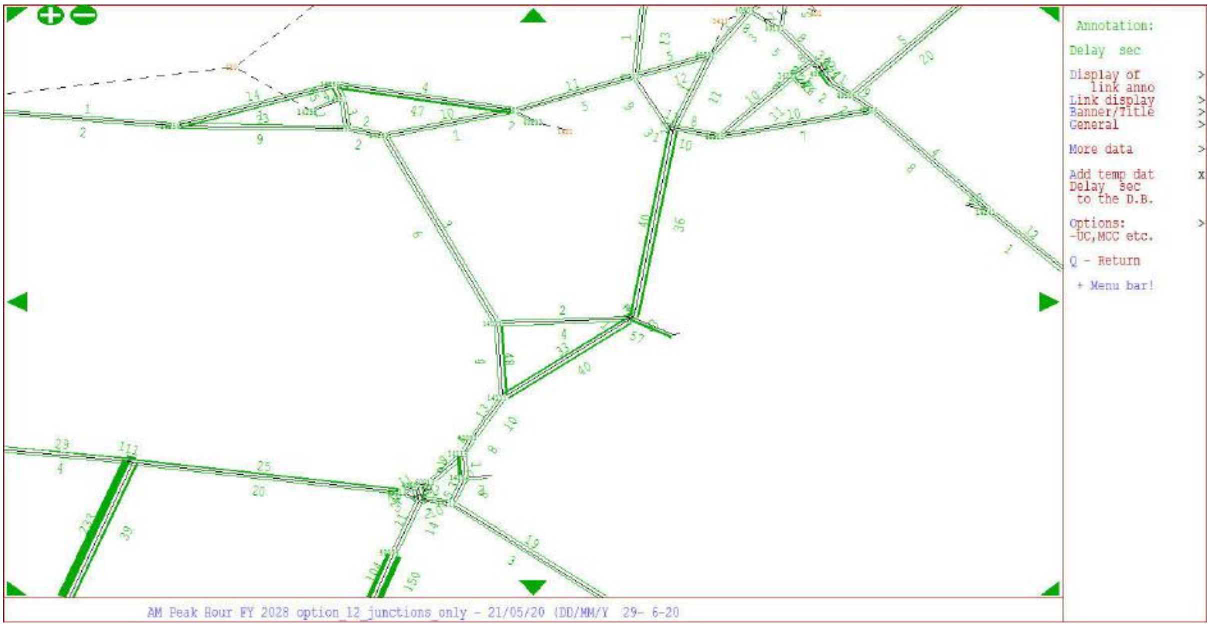
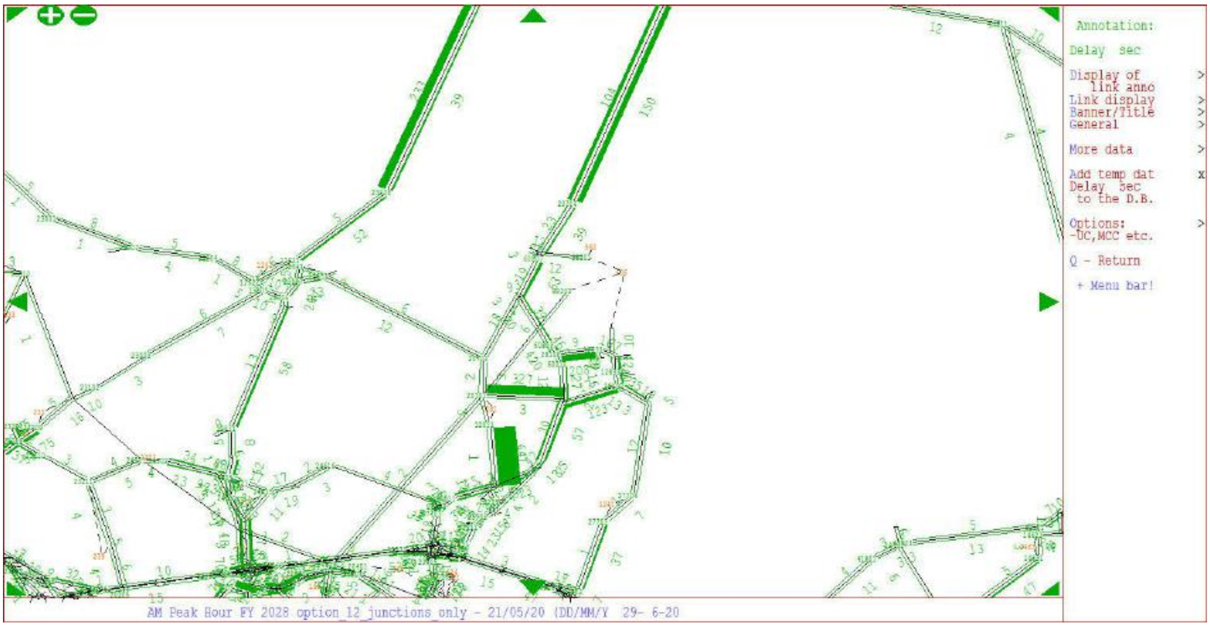
PM Peak Hour FY 2043 option_10A - 21/05/20 (DD/MM/YR) - Prutha & 29- 6-20

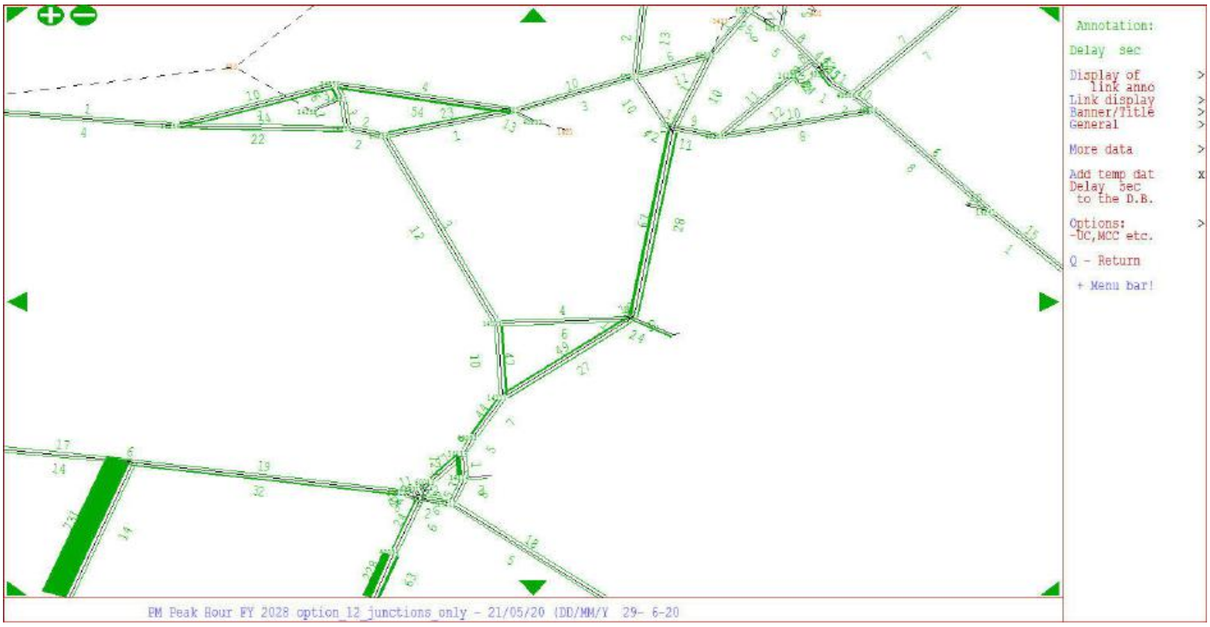
Option G

2028- AM





2028- PM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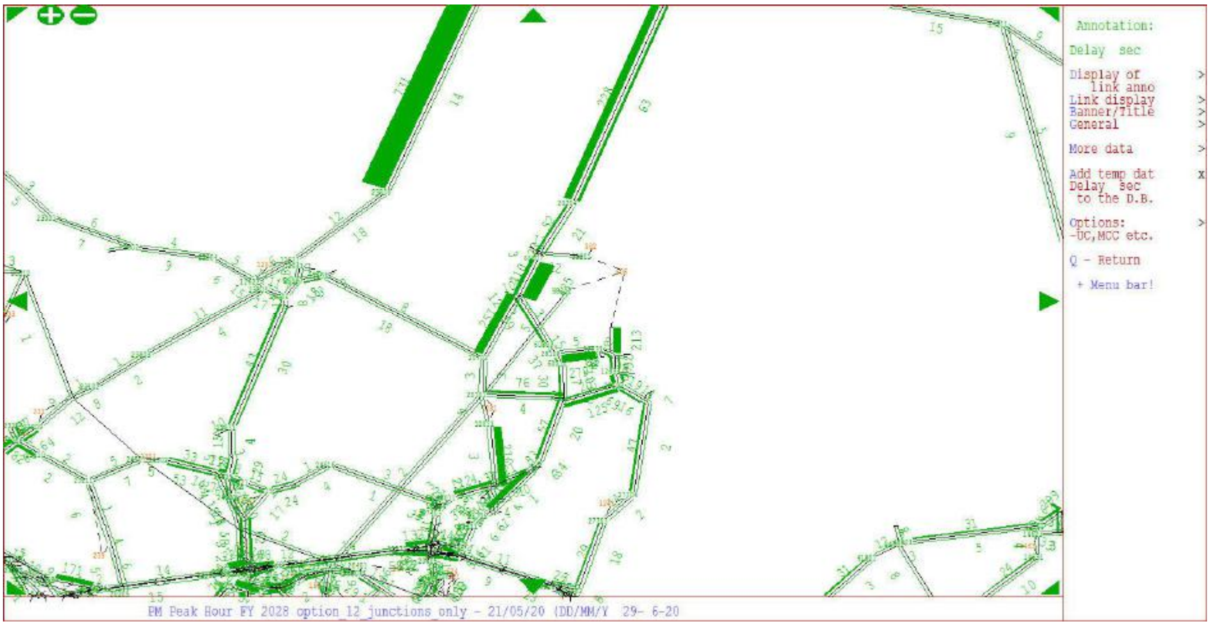
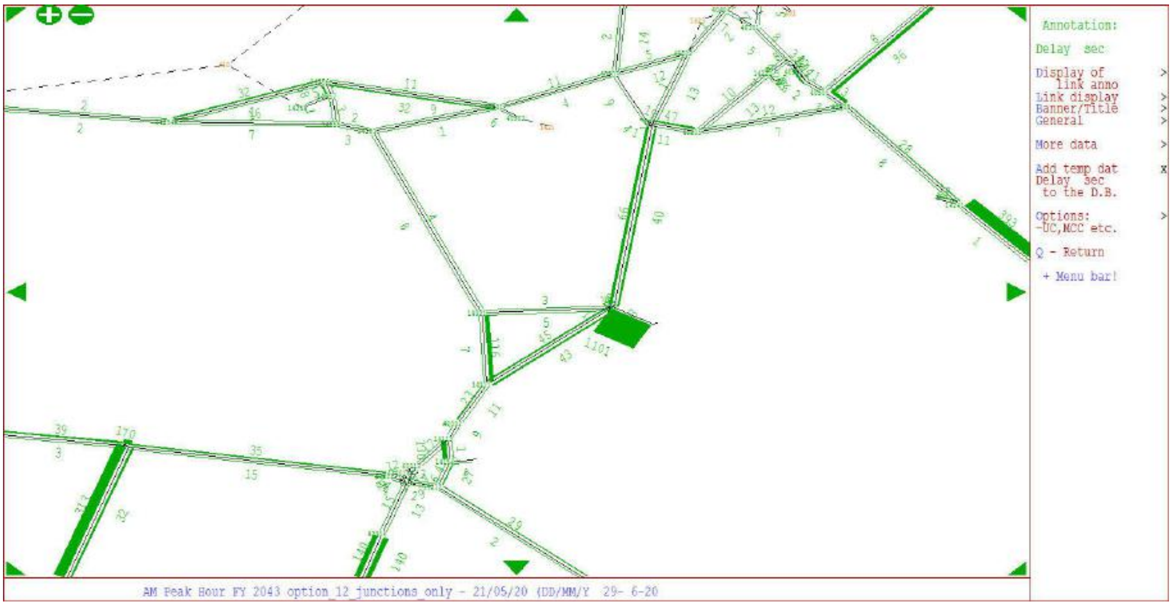
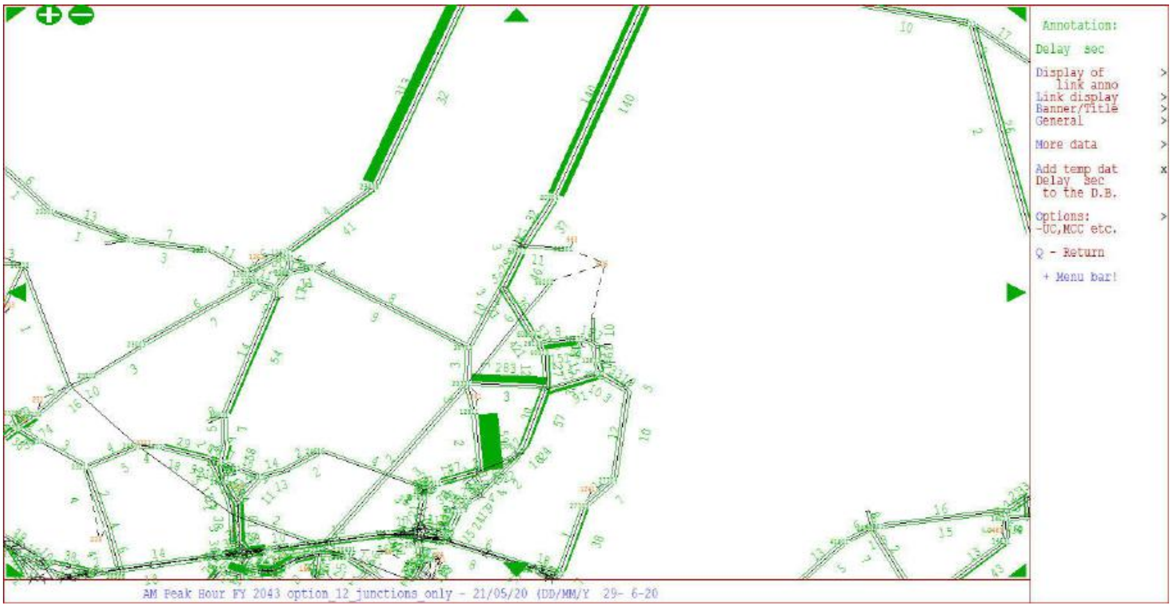
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_12_junctions_only - 21/05/20 (DD/MM/Y 29- 6-20


Annotation:
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
PM Peak Hour FY 2028 option_12_junctions_only - 21/05/20 (DD/MM/Y 29- 6-20

2043- AM


Annotation:
Delay sec
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour FY 2043 option_12_junctions_only - 21/05/20 (DD/MM/Y 29- 6-20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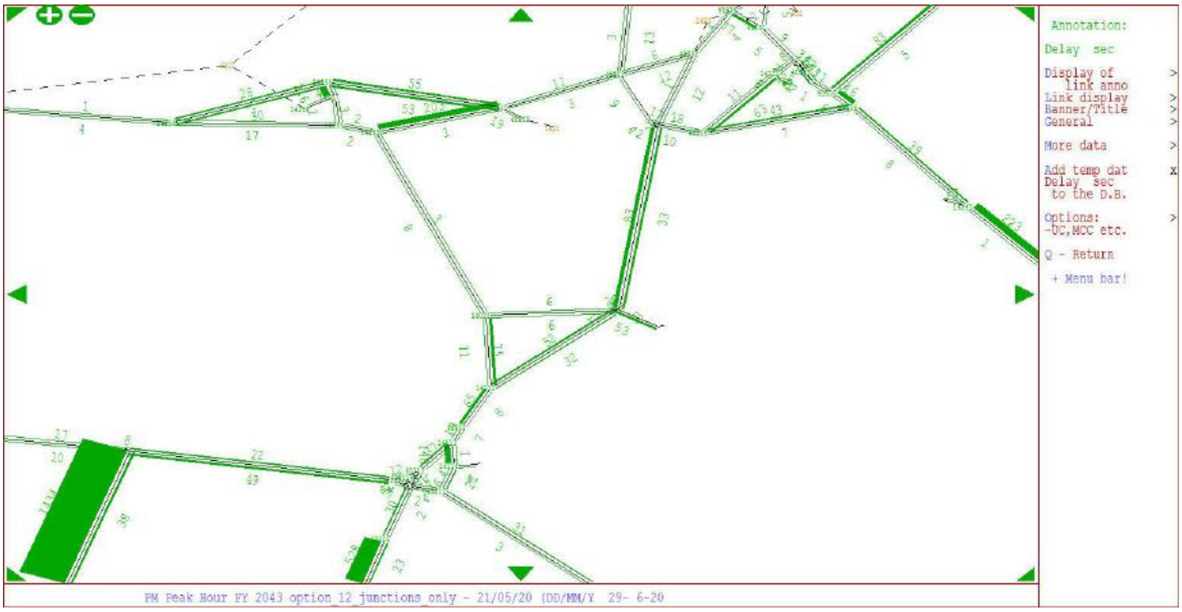
Display of link anno
Link display
Banner/Title
General
More data
Add temp dat Delay sec to the D.B.
Options: -UC,MCC etc.
Q - Return
+ Menu bar!
AM Peak Hour FY 2043 option_12_junctions_only - 21/05/20 (DD/MM/Y 29- 6-20

2043- PM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Delay sec
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More data
Add temp dat Delay sec to the D.B.
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PM Peak Hour FY 2043 option_12_junctions_only - 21/05/20 (DD/MM/Y 29- 6-20


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