Shropshire Council

Shrewsbury North West Relief Road

Transport Benefits Analysis Technical Note

70056211 – Transport Benefit Analysis Technical Note
December 2024

Confidential

Shropshire Council

NORTH WEST RELIEF ROAD

Transport Benefits Analysis Technical Note

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1 Introduction

1.1 Background

1.1.1. This technical note provides information on the transport benefits related to the economic appraisal undertaken as part of the Shrewsbury North West Relief Road (NWRR), hereby referred to as the ‘scheme’ for the purposes of this technical note.

1.1.2. This note provides detail around the breakdown and spatial distribution of benefits derived from Transport User Benefits Appraisal (TUBA), Cost and Benefit to Accidents-Light Touch (COBALT) and active modes, as well as details on the reliability and wider economic impact assessment which has been undertaken to inform the adjusted Benefit Cost Ratio (BCR) within the Economic Dimension.

1.2 Report Structure and Purpose

1.2.1. This note sets out information and evidence and the methodologies adopted pertaining to the economic assessment of transport related impacts of the scheme.

1.2.2. Following this introductory chapter, the remainder of this note is structured as follows:

- Chapter 2 – Economic Assessment Approach
- Chapter 3 – Level 1 Impacts
- Chapter 4 – Level 2 Impacts
- Chapter 5 – Common Analytical Scenarios

2 Economic Assessment Approach

2.1 Background

2.1.1. The typical impacts of a transport scheme are documented in the Department for Transport, Transport Analysis Guidance (TAG) and Value for Money (VfM) Framework. These outline the established monetised impacts of any transport proposal and are represented by the 'initial BCR' metric with those evolving monetised impacts reflected as part of the 'adjusted BCR' metric. To provide a comprehensive overview of the total impacts associated with the scheme, effects that cannot be easily monetised or where there is no widely accepted method for monetisation are considered as non-monetised impacts in the Economic Dimension.

2.1.2. Level 1 and Level 2 impacts that inform the initial and adjusted BCR for the scheme are outlined in Table 2-1 and form the basis for the VfM assessment. Level 3 impacts from the transport proposal are estimated qualitatively, based on a seven-point scale aligned with DfT guidance (Large, Moderate, Slight Beneficial and Adverse, plus Neutral). These impacts are considered together and do not feed into the initial or adjusted value for money metrics. As such, the qualitative assessment of non-monetised impacts are not included as part of this report.

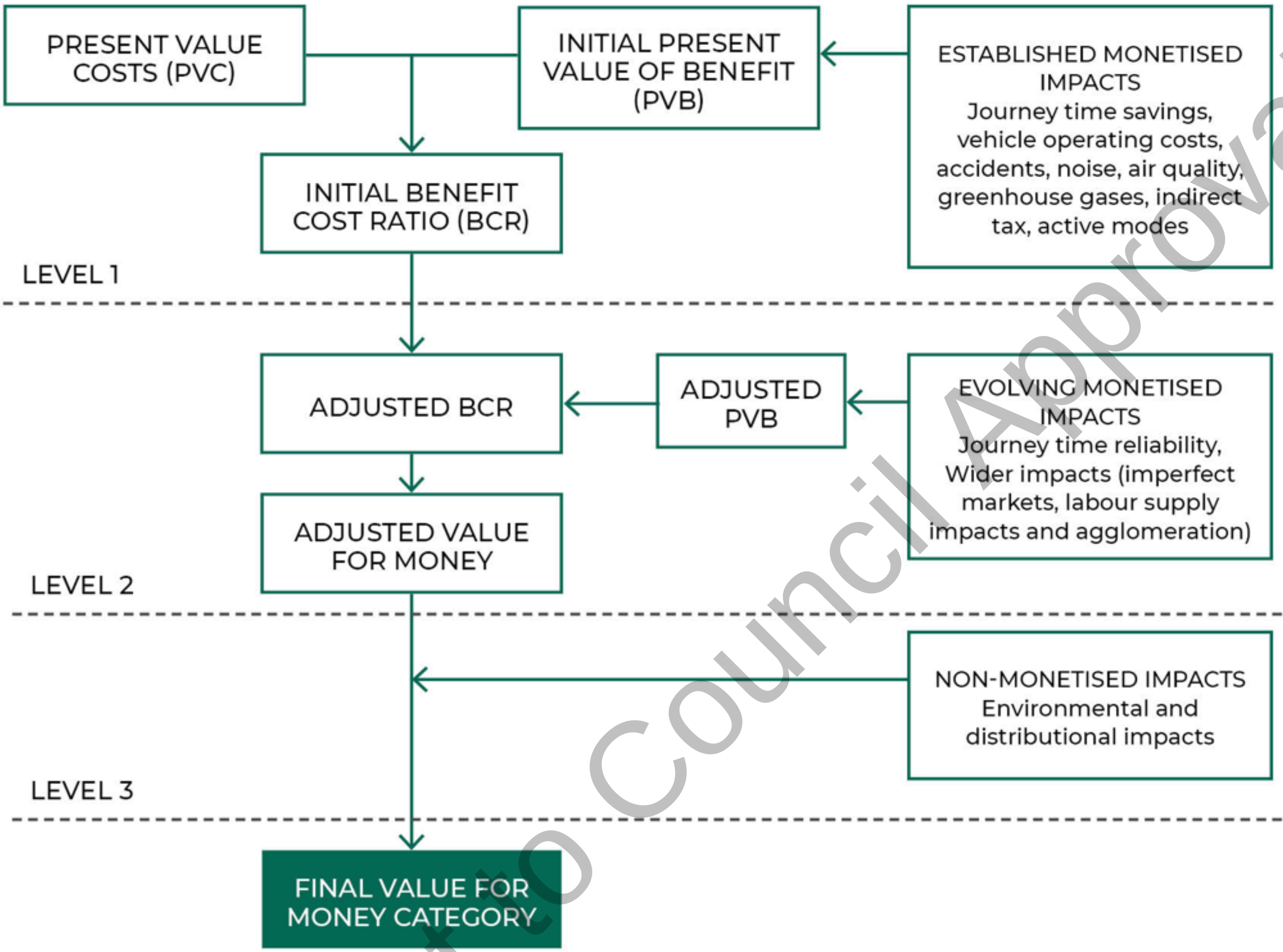
2.1.3. Given the uncertainty in the estimation of all impacts, it is important to undertake appropriate and proportionate sensitivity analysis at all stages of the VfM assessment. This involves the adjustment of input parameters and assumptions that underpin the Core scenario to estimate the impact of the transport proposal. Further detail on the use of sensitivity analysis in the context of NWRR is provided in Chapter 5 of this technical note.

Table 2-1 – Scheme impacts from the transport proposal

Established Monetised Impacts – Level 1	Evolving Monetised Impacts – Level 2	Non-Monetised Impacts – Level 3
Capital, maintenance & renewal costs Journey time savings Vehicle Operating Costs (VOCs) Accidents Noise, Air Quality and GHGs Indirect tax Active modes	Journey time reliability Wider economic impact	Townscape Historic environment Biodiversity Water environment

2.1.4. Figure 2-1 overleaf shows an overview of the economic appraisal process that has been followed to inform the VfM assessment.

Figure 2-1 – Economic appraisal process



2.1.5. The scheme is comprised of a single carriageway all-purpose 4.85km long road, providing the ‘missing’ link between the north and west of Shrewsbury. Elements of the scheme include a shared new footway / cycleway along the length of the scheme; a 584m long viaduct; a new at-grade four arm roundabout; replacement of an existing five-arm roundabout with two four-arm roundabouts in a ‘dumb-bell’ configuration; a bridge to carry the scheme over the railway line; and new infrastructure to maintain and create new links for non-motorised users.

2.1.6. Within the appraisal, benefits have been considered over an appraisal period from scheme opening in 2027. The appraisal period reflects the asset life of the infrastructure, so for the highway elements of the scheme this was assumed to be 60-years and for the active mode measures a shorter appraisal period of 40-years was used, based on guidance from DfT and Active Travel England (ATE) appropriate for dedicated, high-quality cycling and walking infrastructure.

2.1.7. A number of tools have been used to estimate the benefits associated with the scheme. All benefits within the appraisal are presented in the DfT's appraisal base year (2010) Present Values (PV) and in market prices in line with TAG Unit A1-1. Monetised impacts have been rebased to 2010 prices using Gross Domestic Product (GDP) Deflator forecasts from the TAG Data Book v1.23 (May 2024). Impacts have been converted to PV using social or health discount rates as set out in the TAG Data Book. Where required, impacts have been adjusted to market prices from the factor unit of account using the adjustment factor in the TAG Data Book.

3 Level 1 Impacts

3.1 Introduction

3.1.1. This chapter focuses on the following elements, reflecting the established monetised impacts of the scheme used to establish the initial BCR for the scheme.

- Transport User Benefits; derived from TUBA software
- Accident Benefits; utilising COBALT
- Active modes; derived from Active Mode Appraisal Toolkit (AMAT)

3.2 Transport User Benefits

Introduction

3.2.1. The Transport User Benefits consist of travel time and Vehicle Operating Cost (VOC) impacts as a result of the scheme. These have been assessed using DfT programme TUBA version 1.9.23 and the corresponding relevant economic parameters file version 1.9.23.0 based on TAG Data Book v1.23 (May 2024). The software carries out the appraisal of the following economic elements associated with the scheme's core and operation (maintenance and renewal) over the 60-year appraisal period (excluding those accrued during construction)[1]:

- Travel time savings
- Vehicle Operating Cost (VOC) savings
  - Fuel VOC
  - Non-fuel VOC
- Indirect tax revenues

3.2.2. The assessment has been undertaken in line with the guidance provided in TAG Unit A1.1 Cost Benefit Analysis (November 2023) and Unit A1.3 User and Provider Impacts (May 2022). Benefits are derived by comparing the impacts of the scheme in the with and without scheme scenario for forecast years 2027, 2042 and 2050 for core, and in line with the maintenance regime[2] for maintenance scenarios, using Shrewsbury transport modelling suite[3] (Shrewsbury Transport Model). TUBA software is used to convert journey time savings and any changes affecting VOCs from the strategic traffic model into a monetary value, in 2010 prices, present value terms.

[1] Traffic impacts during the scheme construction phase have been excluded from the Full Business Case (FBC) economic assessment, as the NWRR will primarily be constructed offline, and therefore, these impacts have not been assessed.
[2] Surface dressing (2039, 2059 and 2079), full resurfacing (2047) and full resurfacing with viaduct maintenance (2067)
[3] A SATURN highway assignment model combined with a Variable Demand Model in CUBE.

3.2.3. Benefits are disaggregated as employer's business, commuting and 'other' benefits. Business benefits are the benefits accrued by business travellers, including car (and van) occupants travelling on employee business. This group also includes HGV drivers.

3.2.4. Non-business travellers, namely those commuting and 'other', are travelling in their own time and are therefore classified as consumer users.

3.2.5. TUBA uses standard values of time in line with TAG Databook Table A1.3.1. For car business trips, it uses method 1 (continuous average value of time by distance band[4]), while for all other modes-purpose combinations, it applies method 3 (average value of time, all distances).

3.2.6. TUBA takes, as its principal input, zone to zone matrices of trip numbers, travel times and distances travelled.

Forecast Years, Scenarios and Appraisal Period

3.2.7. The scheme has been appraised for the forecast years of 2027 (opening year), 2042 (15 years after the scheme opening), and 2050 (second forecast year). The appraisal period is for 60 years (2027-2086), commencing in the opening year.

3.2.8. The benefits due to these changes are interpolated between each forecast year and extrapolated from the final forecast year to the last appraisal year (2086), to cover the 60-year appraisal period. The extrapolation of benefits from the last forecast year (2050) to the last appraisal year (2086) assumes no growth in the magnitude of impacts.

User Classes

3.2.9. The user classes modelled in the Shrewsbury Transport Model have been aggregated to match TUBA's user classes. Light Goods Vehicles (LGVs) are further split into personal, and freight based on the TAG Databook split, while Heavy Goods Vehicles (HGVs) are split into Other Goods Vehicles Category 1 and 2 (OGV1 and OGV2) based on local traffic counts. The user classes used for TUBA analysis are provided in Table 3-1.

[4] Based on willingness-to-pay for travel time savings (excluding professional and freight drivers)

Table 3-1 – TUBA user classes

TUBA User Class	Vehicle	Purpose	Person	Model User Class
1	Car	Business	All	1
2	Car	Commuting	All	2
3	Car	Other	All	3
4	LGV personal	All	All	4
5	LGV freight	All	All	4
6	OGV1	All	All	5
7	OGV2	All	All	5

Annualisation Factors

3.2.10. Within TUBA, annualisation factors were used to expand from modelled time periods to represent the full appraisal period across the whole year. The annualisation factors were recalculated for the FBC and were derived from the analysis of 2023 traffic flow data from various count sites around Shrewsbury, for which traffic flow data was available for all 12 months.

3.2.11. The modelled AM and PM peak hours were expanded using the relationships between the observed average three-hour period flows and the single peak hour flows, for the AM and PM peak. The modelled interpeak (IP) hour represents an average hour in the 6-hour interpeak period and, therefore, was expanded appropriately using a factor of 6.

3.2.12. To convert to annual factors, the daily factors were multiplied by 253, reflecting the 253 working days per calendar year, with the factors being shown below in Table 3-2.

Table 3-2 – Annualisation factors

Time Period	Annualisation Factor
AM peak (07:00 – 10:00)	651
Interpeak (10:00 – 16:00)	1,550
PM peak (16:00 – 19:00)	667

3.2.13. Annualisation factors for the operation impacts assessment have been adjusted to account for the duration of each specific maintenance intervention.

3.2.14. It should be noted evenings and weekends have not been modelled, and as such the impacts during these times have not been captured.

Input Matrix Conversion and Units

3.2.15. The following steps are taken to convert the Shrewsbury Transport Model matrices to be used in TUBA:

- Convert the input trip matrices from Passenger Car Units (PCU) to vehicles.
- Split the model's single LGV user class into LGV personal and LGV freight user classes for TUBA using factors from TAG Unit A1 (section A1.3.4).
- Split the model's single OGV user class into OGV1 and OGV2 user classes for TUBA using locally collected traffic data to get the proportions of OGV1 and OGV2 traffic, considering the model's PCU factor of 2.4 for OGV.

3.2.16. The resultant factors applied to the trip matrices are shown in Table 3-3 overleaf.

Table 3-3 – Trip matrix factors

User Class	AM	IP	PM
1	1.00	1.00	1.00
2	1.00	1.00	1.00
3	1.00	1.00	1.00
4	0.12	0.12	0.12
5	0.88	0.88	0.88
6	0.18	0.18	0.18
7	0.23	0.23	0.23

Sectoral Analysis

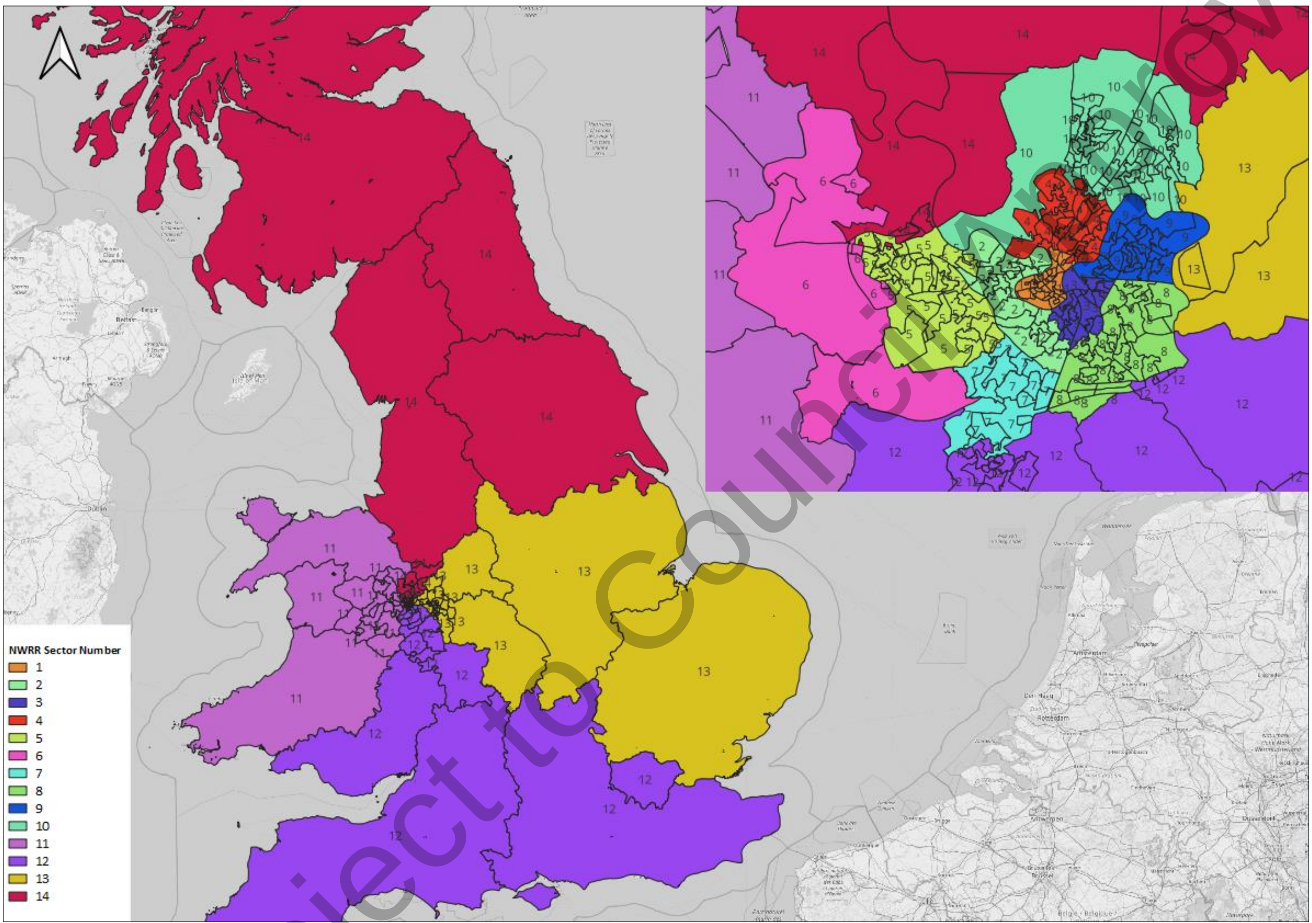
3.2.17. The NWRR has 413 zones between which trips are assigned on the local road network. In order to enable analysis of the geographical spread of benefits from the scheme derived in TUBA, the zones in the model have been assigned to 14 sectors, as described in Table 3-4, below and geographically illustrated in Figure 3-1 overleaf.

Table 3-4 – Sectoring system

Sector ID	Sector Description	Sector ID	Sector Description
1	Shrewsbury Town Centre	8	Outer Shrewsbury (South-West)
2	Inner Shrewsbury (West)	9	Outer Shrewsbury (North- West)
3	Inner Shrewsbury (East)	10	Outer Shrewsbury (North)
4	Inner Shrewsbury (North)	11	Wales
5	Outer Shrewsbury (West)	12	Southern England

Sector ID	Sector Description	Sector ID	Sector Description
6	A5 West	13	Eastern England
7	Outer Shrewsbury (South)	14	Northern England & Scotland

Figure 3-1 – NWRR sectoring system



3.2.18. Sectoral level spatial analysis of user benefits across the full appraisal period was undertaken to ensure that the TUBA outputs were consistent across time periods and forecast years, and to verify that they were in line with logical expectations.

3.2.19. It is considered that sector benefits were reflective of where benefits in delay and journey time were occurring as a result of implementing the scheme. No masking has been applied to the TUBA run results.

TUBA Result Checks

3.2.20. All data used by TUBA is read in from external data files: the scheme, economics and matrix data files. Recognising that any errors in these files, or in the underlying transport model, can lead to incorrect results coming out of TUBA, the input model data was checked thoroughly, along with the outputs from TUBA.

3.2.21. The main output files from core TUBA were examined, focusing on the list of errors and warnings, user benefits and changes in revenues by mode, sub-mode, person types, purpose and time period. It was confirmed that:

- The scale of benefits is consistent with the scale of the scheme
- There are VOC benefits, in total non-fuel benefit that surpass the fuel disbenefits
- The road user benefits to consumers were of a similar order of magnitude to the benefits to other users and higher than the benefits to business

3.2.22. TUBA undertakes a check on the inputs provided and identifies any large cost or matrix changes between the Do Minimum (DM) and Do Something (DS) scenarios. These have been investigated thoroughly to identify and correct any erroneous results. It should be noted that warnings of this sort are not necessarily an indicator of an error in the modelling, however the TUBA warnings/errors can be used to feed back to the assignment model to investigate potential problems with the traffic models.

3.2.23. The warnings have been analysed at both a zonal and sectoral level. A summary of the warnings by sector is provided in Appendix A.

Results- Core

3.2.24. The Transport Economic Efficiency (TEE) benefits are derived from travel time and VOC benefits as a result of the scheme.

3.2.25. The full TEE Tables are included in Appendix N of the Full Business Case (FBC) and are summarised in Table 3-5 overleaf. The figures in this table exclude wider public finances.

Table 3-5 – Transport Economic Efficiency (TEE) benefits

£'000s, 2010 PV over Appraisal Period		Benefit
Consumer – commuting user benefits	Travel time	56,285
	Vehicle operating costs	1,155
	Subtotal	57,440
Consumer – other user benefits	Travel time	90,719
	Vehicle operating costs	2,172
	Subtotal	92,891
Business benefits	Travel time	59,750
	Vehicle operating costs	6,836
	Subtotal	66,586
Private sector	Investment costs	-

£'000s, 2010 PV over Appraisal Period		Benefit
	Subtotal	-
Net business impact		66,586
Total TEE benefit		216,918

3.2.26. These TUBA TEE benefits differ from the final set of TEE benefits submitted as part of the FBC, as they exclude TEE impacts associated with the operation delays and Active Mode Appraisal described below.

Benefits by Mode

3.2.27. The benefits have been calculated across different User Classes with journey time benefits accounting for more than 95% of the total user benefit.

3.2.28. Travel by car accounts for the largest proportion of benefits across the user classes.

3.2.29. Benefits have been presented as 'User Benefits', which are without taking the indirect tax revenue into consideration and adding the indirect tax revenue gives the 'Total Benefits'. Table 3-6 overleaf presents the benefits by user class below.

Table 3-6 – Transport user benefit by mode

£'000s, 2010 PV over Appraisal Period	Time	Fuel VOC	Non-Fuel VOC	Indirect Tax	Total Benefit	User Benefit	% User Benefit
Car	176,636	6,190	374	-775	182,426	183,201	**84%**
LGV personal	1,400	30	48	-8	1,470	1,478	**1%**
LGV freight	23,916	230	875	-65	24,957	25,022	**12%**
OGV1	2,113	266	389	-132	2,635	2,767	**1%**
OGV2	2,689	804	956	-400	4,050	4,450	**2%**
Total	**206,754**	**7,521**	**2,643**	**-1,380**	**215,538**	**216,918**	**100%**

Benefits by Trip Purpose

3.2.30. Across all purposes of transport, other trips have the highest benefits accounting 43%, followed by business and commuting purposes by 31% and 26% of the total user benefit respectively. Table 3-7 presents the benefits by trip purpose.

Table 3-7 – Transport user benefits by trip purpose

£'000s, 2010 PV over Appraisal Period	Time	Fuel VOC	Non-Fuel VOC	Indirect Tax	Total Benefit	User Benefit	% User Benefit
Business	59,750	2,051	4,785	-926	65,660	66,586	**31%**
Commute	56,285	2,137	-982	-36	57,405	57,440	**26%**
Other	90,719	3,333	-1,161	-418	92,473	92,891	**43%**
Total	**206,754**	**7,521**	**2,643**	**-1,380**	**215,538**	**216,918**	**100%**

Benefits by Time Period

3.2.31. The benefits have been calculated across the different time periods, with the IP period accounting for the highest benefits of 37% from the total user benefit, and the AM and PM accounting for 33% and 30%, respectively.

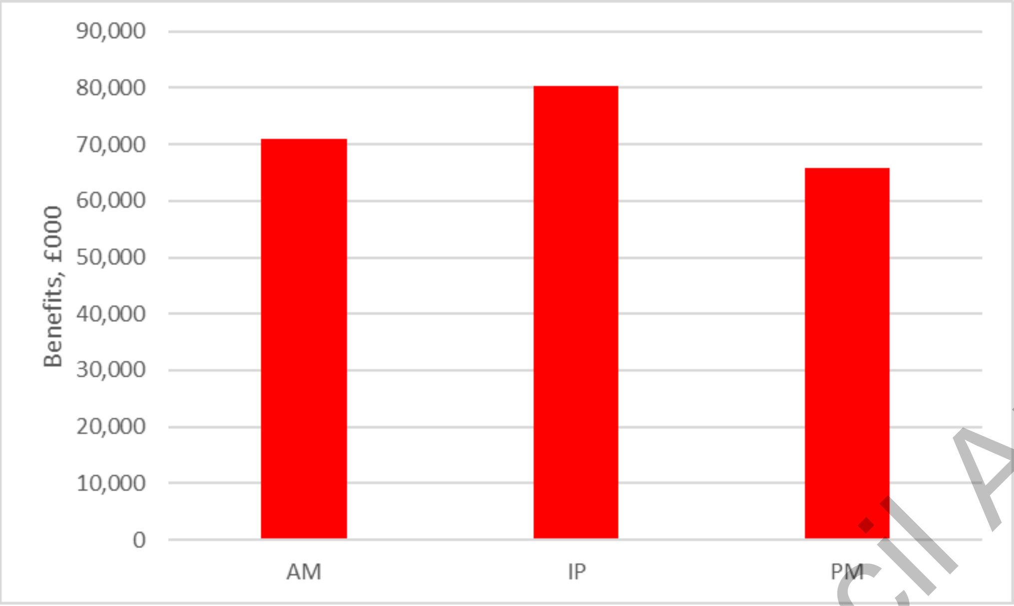
3.2.32. Table 3-8 overleaf presents the benefits by time period.

Table 3-8 – Transport user benefits by time period

£'000s, 2010 PV over Appraisal Period	Time	Fuel VOC	Non-Fuel VOC	Indirect Tax	Total Benefit	User Benefit	% User Benefit
AM	67,415	2,648	791	-449	70,406	70,854	**33%**
IP	75,729	2,947	1,585	-706	79,555	80,261	**37%**
PM	63,610	1,926	266	-226	65,577	65,803	**30%**
Total	**206,754**	**7,521**	**2,643**	**-1,380**	**215,538**	**216,918**	**100%**

3.2.33. The total user benefits by time period are shown in Figure 3-2.

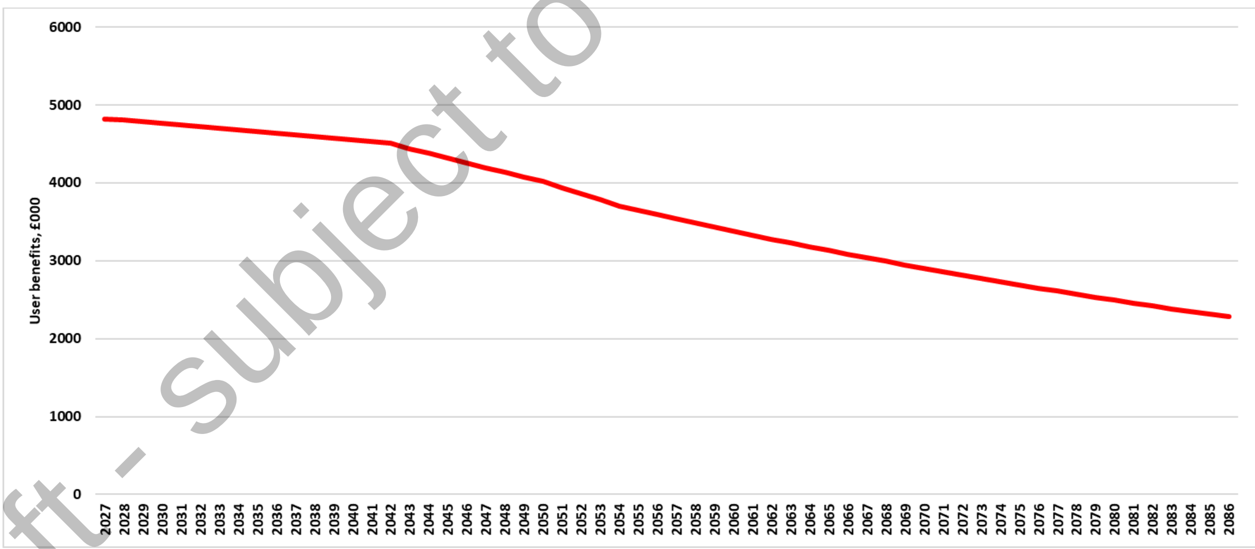
Figure 3-2 – Transport user benefits by time period



User Benefit Profile over the Appraisal Period

3.2.34. The benefits over the 60-year appraisal period are shown in Figure 3-3 overleaf. The highest user benefits are in the opening year and benefits gradually decrease for the rest of the appraisal period.

Figure 3-3 – User benefit profile



Sector Benefits

3.2.35. An analysis of the benefits by sector was undertaken to understand the geographical location of the benefits and to verify that the benefits occur where they would be expected.

3.2.36. The total user benefits by origin and destination and the proportion of the total user benefit by sector has been summarised in Table 3-9 overleaf. The highest user benefits for both origin and destination are obtained in Outer Shrewsbury (North) and Outer Shrewsbury (West) sectors, located to the north and west of the scheme, as would be expected.

Table 3-9 – Sector benefits

Sector Name	Sector ID	Total User Benefits (£)		Proportion of Total User Benefits	
		Origin	Destination	Origin	Destination
Shrewsbury Town Centre	1	9,193,811	11,722,217	4.24%	5.40%
Inner Shrewsbury (West)	2	5,281,557	10,948,107	2.43%	5.05%
Inner Shrewsbury (East)	3	3,014,180	5,759,851	1.39%	2.66%
Inner Shrewsbury (North)	4	13,187,335	7,619,179	6.08%	3.51%
Outer Shrewsbury (West)	5	32,585,685	34,484,901	15.02%	15.90%
A5 West	6	5,933,168	5,242,639	2.74%	2.42%
Outer Shrewsbury (South)	7	5,332,850	7,879,362	2.46%	3.63%
Outer Shrewsbury (South-West)	8	4,547,421	8,784,115	2.10%	4.05%
Outer Shrewsbury (North-West)	9	2,272,668	4,727,003	1.05%	2.18%
Outer Shrewsbury (North)	10	54,750,300	41,964,351	25.24%	19.35%
Wales	11	28,333,453	23,048,084	13.06%	10.63%
Southern England	12	10,636,916	12,893,971	4.90%	5.94%
Eastern England	13	12,975,945	21,625,772	5.98%	9.97%
Northern England & Scotland	14	28,872,748	20,218,485	13.31%	9.32%
Total		**216,918,037**	**216,918,037**	**100.00%**	**100.00%**

Results- Operation

3.2.37. The scheme has also been appraised for the estimated operation scenario, which includes planned interventions such as surface dressing in 2039, 2059 and 2079, full resurfacing in 2047, and full resurfacing with viaduct maintenance in 2067.

3.2.38. Further details regarding routine annual maintenance and capital renewal over the 60-year period will require the following:

- Routine annual maintenance - including signage and bollard cleaning and landscaping

- Capital renewal - including works to pavements, structures, footpaths, kerbing, drainage, road markings and fencing

3.2.39. Routine annual maintenance is expected to be undertaken with minimal disruption to traffic and so its disbenefits have not been considered in this assessment.

3.2.40. Capital renewal works will occur less frequently and not all the capital renewal works are expected to cause significant impact to traffic. However, the pavement and structural renewals are expected to involve significant disruption.

3.2.41. The following works regime has been assumed for the pavement and structural renewal works, based on previous experience within the Council:

- Years 12, 32 and 52 after opening – Surface dressing of the pavement requiring a 1-week full closure of the affected road section in both directions, followed by 20mph running for 2 further weeks, in both directions on the affected road section.
- Year 20 – Full pavement resurfacing requiring a 3-week closure of the affected road section in both directions.
- Year 40 – Full pavement resurfacing and a structural intervention requiring a 6-to-8-week closure of the affected road section in both directions.

3.2.42. When undertaking these pavement and structural renewal works it has been assumed that the NWRR will be split into two sections, Holyhead Road to Berwick Road and Berwick Road to Ellesmere Roundabout, with one section remaining open whilst the other affected road section is being renewed.

3.2.43. To assess the impact of these works, future year models have been built for each of the five years above and, as with scheme benefits, the disbenefits to road users of these pavement and structural renewal works were forecast using the TUBA software.

3.2.44. Operation impacts of the scheme by user class are presented in Table 3-10 overleaf.

Table 3-10 – Transport user benefit by mode

£'000s, 2010 PV over Appraisal Period	Total Benefit	User Benefit	% User Benefit
Car	-1,945	-1,964	**85%**
LGV personal	-15	-15	**1%**
LGV freight	-253	-254	**11%**
OGV1	-26	-26	**1%**
OGV2	-38	-41	**2%**
Total	**-2,277**	**-2,300**	**100%**

3.3 Accident Benefits

Introduction

3.3.1. The accident appraisal has been undertaken using the DfT's COBALT program (v2.7) and COB27_COBALT Parameters File - TAG Databook v1.23.

3.3.2. The accident impact assessment has been performed using the method set out in the COBALT Manual[5]. It is used to forecast changes in the number of accidents and casualties to estimate the monetary value of these impacts.

3.3.3. The accident assessment is based on a comparison of accident costs and number of accidents and casualties in the 'with-scheme' and 'without-scheme' modelled network scenario.

3.3.4. COBALT calculates the accident cost, number of accidents and number of casualties using link and junction characteristics, accident rates, cost per accident and forecast traffic volumes. For this assessment, a combined link and junction approach is used to calculate the accident impacts.

3.3.5. The COBALT software estimates the number of accidents by summing the product of accident rates and forecast annual flows for each link using the relationships built into the COBALT software. Standard valuations for fatal, serious and slight accidents were applied within the program to calculate the cost of accidents in both 'without' and 'with' scheme scenarios and the difference between them. These savings (or costs) were then annualised and extrapolated over the 60-year appraisal period and discounted to produce a 2010 present value of accident benefits in 2010 prices.

Forecast Years, Scenarios and Appraisal period

3.3.6. The forecast years for the scheme used for the accident assessment are the same as the forecast models built for the NWRR scheme, which are:

- 2027 – opening year
- 2042 – (15 years after the scheme opening)
- 2050- (second forecast year)

3.3.7. The scenarios for which the accident assessment has been undertaken are:

- **Do Minimum (DM):** Without the scheme
- **Do Something (DS):** With the scheme

3.3.8. The appraisal period used for the assessment is 2027 to 2086, in line with the standard 60-year appraisal period used for the economic assessment of long-life transport assets.

Methodology

3.3.9. The methodology for the accident assessment comprises of:

[5] https://www.gov.uk/government/publications/cobalt-software-and-user-manuals

- Selection of the accident study area
- Calculation of the observed (local) accident rates
- Preparation of the COBALT Input file

Study Area

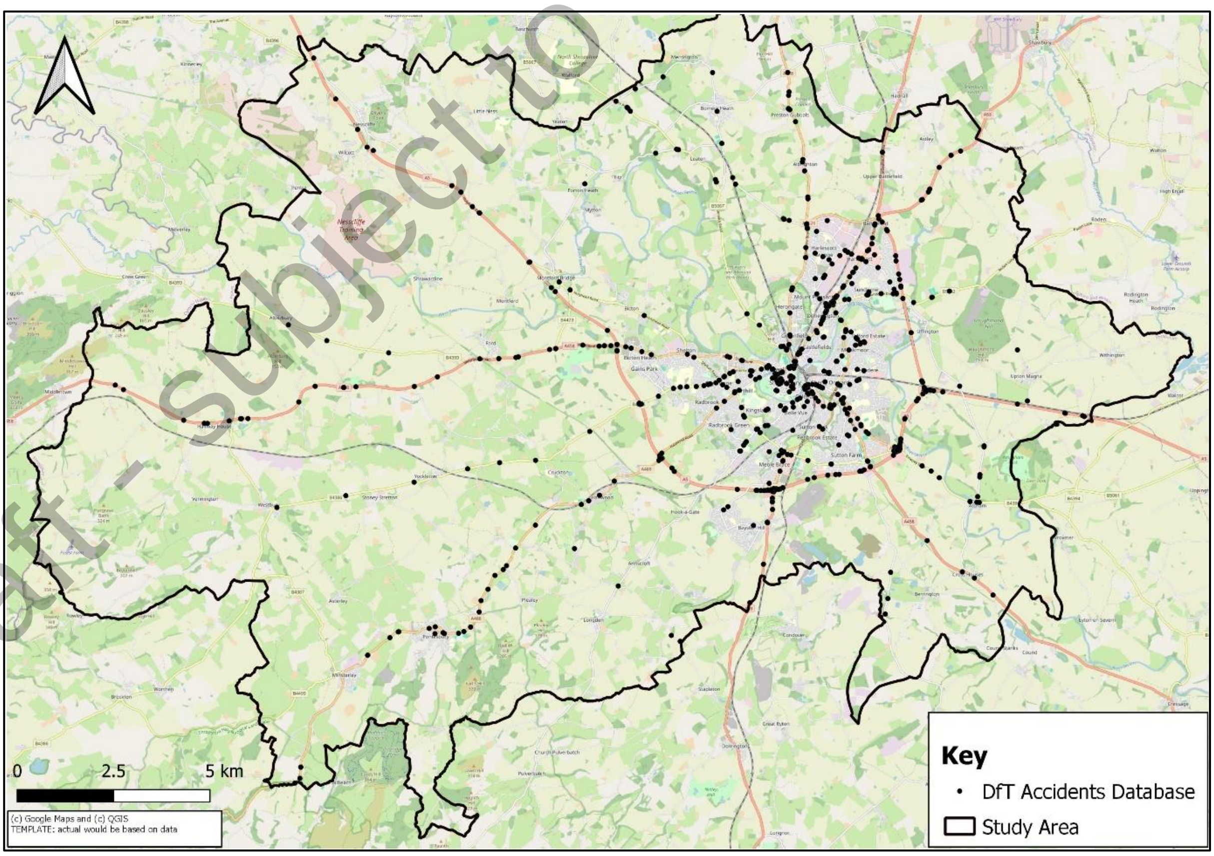
3.3.10. The accident assessment study area aligns with the Shrewsbury Transport Model study area. All the Do Minimum and Do Something links in the study area were considered for the analysis.

Accident Rates

3.3.11. The observed accidents data (STATS 19 Personal Injury Accident) in the study area was extracted from the government website for 2016, 2017, 2018, 2019 and 2022 (the latest five years available, excluding the COVID-19 pandemic affected years of 2020 and 2021). The observed accident data was then assigned to the appropriate links or junctions within the study area.

3.3.12. The observed accident data was plotted and compared to the links in the study area to find out the links for which the accident data was available, as shown in Figure 3-4. The links for which the local accident data was available were used in the COBALT assessment and default accident rates (national average) provided in the TAG Databook were used for the rest of the links in the study area.

Figure 3-4 – Study area & DfT accident database 2016-2022 (excl. 2020 & 2021)



3.3.13. Any accidents reported and included in DfT's accident database during the five-year analysis period that occurred at locations not represented within the SATURN model network, were omitted from the assessment.

Preparation of the COBALT Input File

3.3.14. The input file for the COBALT software requires the following data:

- Link classification (link name, road type, length and speed limit)
- Link flows (AADT for each modelled year)
- Accident rates

3.3.15. The link classification data is extracted from the traffic model, as well as the hourly flow data from the AM, IP and PM models for the base year and the 2027, 2042 and 2050 Do Minimum and Do Something models. The hourly flow data was converted to the Annual Average Daily Traffic (AADT) using the expansion factors calculated for the scheme based on the observed traffic data.

Results

3.3.16. The safety benefits of the scheme are calculated by comparing the cost of accidents over the 60-year appraisal period, with and without the scheme, at 2010 prices, discounted to 2010, as detailed in Table 3-11.

Table 3-11 – Accident impact over 60-year appraisal period

	Number of Accidents	£'000s, 2010 PV over Appraisal Period
Accident impact without scheme	35,613	1,614,440
Accident impact with scheme	35,357	1,609,735
Accident benefit of the scheme	**256**	**4,705**

3.3.17. The COBALT assessment shows that the scheme is forecast to save 256 accidents and generate accident benefits of £4.705 million. COBALT also forecasts that 274.8 casualties will be saved over 60 years as a result of the scheme, as shown in Table 3-12.

Table 3-12 – Casualty impact over 60-year appraisal period

Casualty Severity	Number Without NWRR	Number With NWRR	Casualty Reduction
Fatal	671.0	674.1	-3.1
Serious	5,157.3	5,139.4	17.9
Slight	47,345.1	47,085.1	260.0
Total	**53,173.4**	**52,898.6**	**274.8**

3.4 Active Modes

3.4.1. The NWRR will include a shared 3m wide footway / cycleway along the length of its southern side, providing a new active travel link between north and west of the town that adds to the existing active travel network and addresses the severance of a number of local roads, footpaths and ProW.

3.4.2. In line with TAG Unit A5.1, the DfT's Active Mode Appraisal Toolkit (AMAT) has been used to estimate the benefits associated with improved walking and cycling infrastructure. The AMAT captures the impacts of the scheme in terms of journey quality to active mode users, health impacts from more people travelling by cycling or walking and decongestion impacts associated with modal shift from private car. Active mode impacts have been considered over a 40-year period from scheme opening year in 2027, in line with Table 2 of TAG Unit A1.1.

3.4.3. To estimate these benefits, the tool requires inputs in terms of existing and anticipated demand, as well as the change in infrastructure provision as a result of the scheme. It combines the benefits linked to the active model interventions with a set of assumptions from the National Travel Survey (NTS) concerning travel distance, travel speed, distribution of travel purposes, and factors affecting the diversion from other modes. It then estimates the benefits based upon a comparison of the existing and proposed infrastructure.

Existing and Scheme Induced demand

3.4.4. To estimate the potential existing demand for the scheme, three different data sources were considered:

- Propensity to Cycle Tool (PCT) data for faster and quiet routes
- PCT data for straight lines
- DfT traffic count point data

3.4.5. Given the scheme represents a new piece of active travel infrastructure that provides a new link in the active travel network, the PCT straight line data was selected as the most appropriate data source as it considers the origin and destination (OD) rather than the existing route taken by each trip.

3.4.6. An assessment of the OD trips that have the highest probability of using the scheme identified a total likely 2011 commuting demand of 16 cycle trips and no pedestrian trips.

3.4.7. PCT commuting demand data is based on 2011 ONS Census data from the main mode of travel to work (commuting demand), and so data from the most recently available NTS (undertaken in 2023) was utilised to uplift the 2011 PCT demands to 2023, resulting in a 2.94% uplift for cycle trips and 17.09% uplift for pedestrian trips.

3.4.8. These 2023 commuting demands were then converted to the two-way demand by all trip purposes again utilising the NTS data. This conversion involved multiplying the 2023 commuting demands by 6 (2 x 3) for cyclist trips and 32 (2 x 16) for pedestrian trips, giving final estimated 2023 all trip purpose demands of 99 cyclist trips and no pedestrian trips.

3.4.9. Based on the type of intervention, and the location of the scheme, the appraisal has identified case study evidence from the Shrewsbury Cycling City and Town Programme, which recorded a 15% increase in townwide cycling between 2007 and 2017. Consistent with this study, a 15% uplift in demand has been assumed to be induced as a result of scheme implementation, which equates to an uplift of 15 cyclist trips and no pedestrian trips.

3.4.10. Therefore, the estimated scheme induced all trip purpose demands are 114 cyclist trips and no pedestrian trips.

3.4.11. The AMAT allows the current and proposed infrastructure for the route to be selected and, as the proposed new infrastructure as input.

Cycling

3.4.12. The DfT AMAT User Guide (May 2022) provides illustrative examples of different cycling infrastructure types that have been used to inform inputs for the 'before' and 'after' state. Preliminary design drawings have also been consulted to understand and categorise the proposed new infrastructure for the purposes of the AMAT and economic appraisal.

3.4.13. The options that can be selected in the AMAT to capture this before and after state for cycling infrastructure are:

- No provision
- Shared bus lane
- Wider lane
- On-road non-segregated cycle lane
- On-road segregated cycle lane
- Off-road segregated cycle track.

3.4.14. For the NWRR, there is currently no infrastructure in place and the proposed infrastructure type selected in AMAT was 'off-road segregated cycle track'.

Pedestrians

3.4.15. The options that can be selected in the AMAT to capture the before and after state for walking infrastructure are shown below but, as we have no pedestrian demand, these are not considered in the assessment:

- Street lighting
- Kerb level
- Crowding
- Pavement evenness
- Information panels
- Benches
- Directional signage

Results

3.4.16. The outputs of the AMAT are shown overleaf in Table 3-13.

Table 3-13 – Monetised active mode impact

Benefit	£'000s, 2010 PV over Appraisal Period
Decongestion	3
Infrastructure maintenance	negligible
Accidents	1
Local air quality	negligible
Noise	negligible
Greenhouse gas emissions	1
Indirect taxation	negligible
Absenteeism	26
Reduced mortality	140
Journey ambience (new and existing users)	1,111
Total	**1,281**

4 Level 2 Impacts

4.1 Introduction

4.1.1. This chapter focuses on the following elements, which address the evolving impacts of the scheme:

- Wider economic impacts; using WSP's Wider Impacts Transport Appraisal (WITA) tool
- Reliability assessment; using urban roads assessment

4.2 Wider Economic Impacts

4.2.1. Transport investments such as the NWRR are likely to affect the wider economy beyond the direct transport impact, affecting economic performance.

4.2.2. TAG Unit A2-4 highlights that productivity impacts are most likely to occur when schemes are located within or neighbouring a Functional Urban Region (FUR) as these regions contains a high density of economic activity that could benefit from improved connectivity and clustering.

4.2.3. As the NWRR lies in the hinterland, and so is a neighbour, of the FUR that encompasses Shrewsbury town centre and the three neighbouring Middle layer Super Output Areas (MSOA) to its north and west, the scheme is expected to enable the businesses to cluster more closely together, allowing them to better connect with each other, increasing interaction and knowledge sharing levels. This in turn is expected to boost productivity levels, which is key as Shropshire currently lags behind the regional and national productivity levels.

4.2.4. The methodology used to calculate 'wider benefits' is set out in TAG units A2.1 to unit A2.4. and includes the following components:

- **Agglomeration** - the concentration of economic activity in an area can be improved by transport schemes as accessibility between businesses and workers is improved by reduced journey times, thus generating productivity benefits from the 'closer' proximity of economic activity;
- **Changes to tax revenues arising from labour market impacts-** the labour supply (workers) can move to more productive jobs as locations further afield become more accessible because of a more efficient road network, or because businesses choose to locate in more productive locations. The changes in tax revenues associated with these impacts are not captured within commuter user benefits; and
- **Output change in imperfectly competitive markets** – a reduction in transport costs (for business and freight) allows businesses to profitably increase their output (goods and services) that require the use of transport in their production.

4.2.5. Agglomeration impacts arise from improving accessibility to an area for businesses and workers as they can cluster together and benefit from improved productivity. The scheme provides a new shorter and more direct link between the north and west of Shrewsbury which will enhance connectivity for businesses and workers alike, especially for those located close to both ends of the scheme in the Shrewsbury West Sustainable Urban Extension (SUE), Oxon Business Park and Battlefield Enterprise Park.

4.2.6. As a result, the scheme will bring firms closer together and generate a total increase in GDP, as existing workers become more productive due to these connectivity improvements.

4.2.7. With the scheme in place, impacts will also be felt by those making commuting journeys as well as currently unemployed people looking to enter the labour market. If commuting costs fall, then the net returns from working increase. This could influence some people to change whether or not they choose to work or how much they choose to work. The private benefits to these people are captured in transport user benefits. The value of time used for travel time savings does not include exchequer benefits that happen when people make different decisions about employment as a result of a transport scheme.

4.2.8. Companies will also benefit from time savings as a result of the implementation of the scheme, leading to a reduction in production costs, incentivising firms to increase their output whilst maintaining an attractive profit margin. Firms can pass on these cost savings to consumers, reflecting a net benefit to consumers which is in addition to transport cost changes.

Method

4.2.9. To assess the wider economic impacts for the scheme, WSP's Wider Impacts Transport Appraisal (WITA) tool has been used. The WSP tool uses the same methodology as the WITA 2.2 tool. The tool estimates the following impacts: agglomeration, labour supply and output change in imperfectly competitive markets.

4.2.10. WITA calculates wider impacts as described in TAG Unit A2.1 to Unit A2.4. The WITA methodology seeks only to capture the part of the above impacts that are not already captured in conventional transport user benefit calculations.

4.2.11. Within WITA, the value of 'increased output in imperfectly competitive markets' has been estimated by including a 10% uplift of business and freight user benefits, in accordance with TAG Unit A2.2. Output change in imperfectly competitive markets has been estimated based on Table 3 of TAG Unit A2.1 to avoid double counting.

4.2.12. The appraisal of wider impacts for the scheme is concerned with the core scenario. As defined in TAG Unit A2.1, the core scenario assumes that employment is consistent between the with and without scheme scenarios.

4.2.13. Wider economic impact assessment is only concerned with trips and travel costs made for travel to and from work. Therefore, only the car business and car commute user classes have been assessed. The same highway matrix data and annualisation factors that are used as in the conventional transport user benefit appraisal (TUBA) are input into the appraisal of wider economic impacts.

4.2.14. The economic appraisal for both TUBA and WITA was undertaken over a 60-year period, from 2027 (opening year) to 2086. The WITA calculations have used TAG Data Book v1.23 (May 2024) and Version 4 of DfT's Wider Impacts dataset (May 2024), which were the latest available datasets at the time.

4.2.15. Travel distance, travel time and trip number matrices are input as skim files within the WITA tool to calculate Generalised Travel Cost's (GTCs) for the with and without scheme scenarios.

4.2.16. To ensure that the wider impacts are not exaggerated, cost differences for trips to and from external transport model / WITA zones have been excluded and also, the remaining trips were analysed at a Local Authority District (LAD) level and movements to, from or between LADs that were not expected to experience impacts from the scheme, have also excluded from the benefits calculation for agglomeration impacts.

Masking

4.2.17. Figure 4-1 shows LAD masking, where the red cells marked with a zero represent the LAD movements that have been excluded and the green cells marked with a 1 represent the LAD movements that have been retained for the benefits calculation.

Figure 4-1 – LAD masking

Origin	Shropshire	Telford and Wrekin	Cheshire East	Herefordshire, County of	Powys	Halton	Hartlepool	Middlesbrough	North East Lincolnshire	Peterborough	Thurrock	Swindon	Gwynedd	Cheshire West and Chester	Northumberland
Shropshire	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Telford and Wrekin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheshire East	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Herefordshire, County of	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powys	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Halton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hartlepool	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Middlesbrough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Lincolnshire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peterborough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thurrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swindon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gwynedd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheshire West and Chester	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northumberland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Results

Agglomeration

4.2.18. The agglomeration impacts are calculated across the four sectors of the economy within the appraisal guidance.

4.2.19. Table 4-1 overleaf presents the agglomeration impacts across the construction, consumer services, manufacturing and producer services.

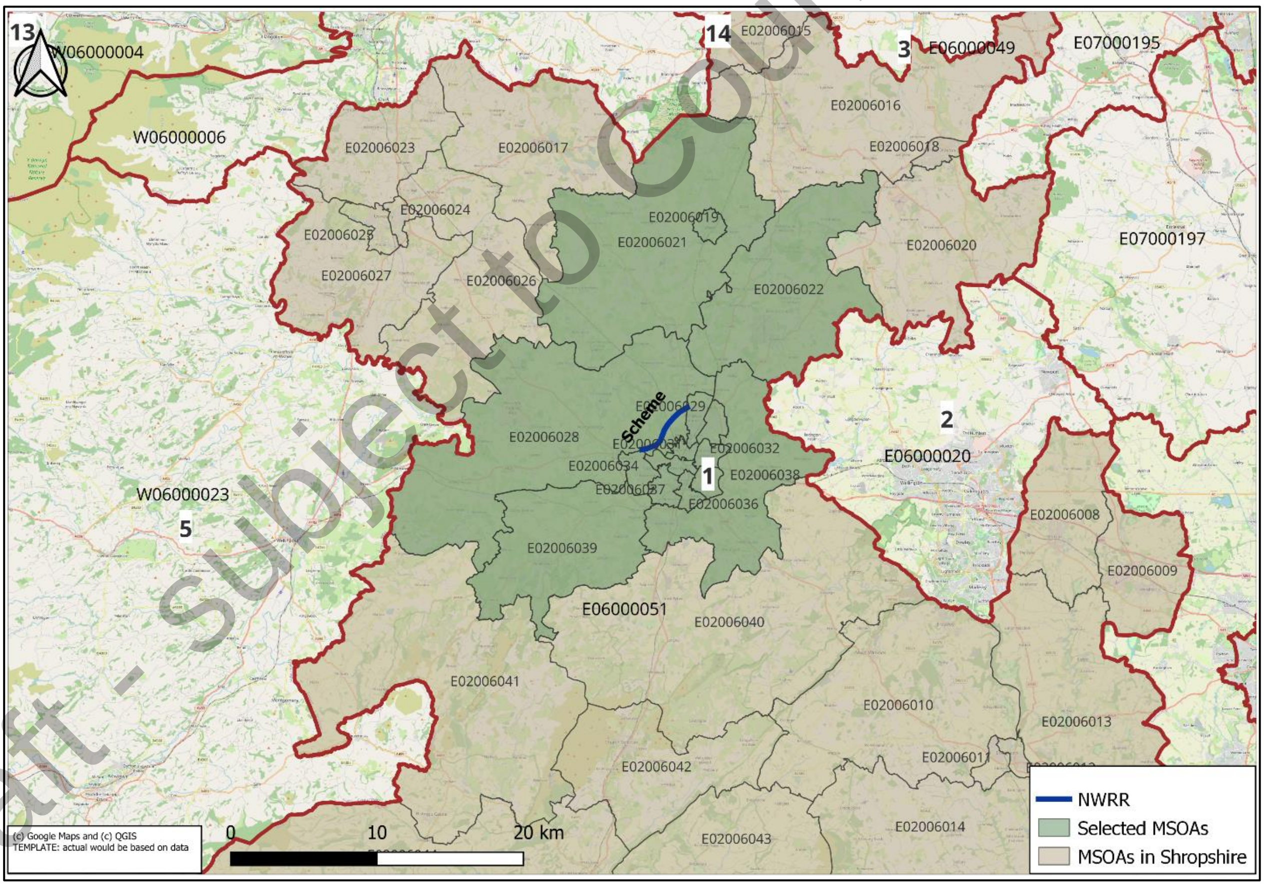
Table 4-1 – Agglomeration impacts comparison with other modes

	£'000s, 2010 PV over Appraisal Period
Manufacturing	5,076
Construction	2,989

	£’000s, 2010 PV over Appraisal Period
Consumer Services	9,676
Producer Services	37,752
Total	**55,493**

4.2.20. Shropshire (E0600051) LAD covers the scheme area and is the largest within the modelled area of the scheme, with a total population of 323,547. Following a review of the initial agglomeration assessment, certain MSOAs within the Shropshire LAD that are not expected to not be directly impacted by the scheme have been excluded from the agglomeration calculations. The remaining MSOAs selected for inclusion in the agglomeration assessment are shown in dark green in Figure 4-2 and accounted for a population of 122,969 or 38% of the total Shropshire LAD population. Therefore, only 38% of the total agglomeration benefit experienced by the Shropshire LAD is considered to be attributable to the scheme.

Figure 4-2 – MSOAs selected for agglomeration benefits within the Shropshire LAD



Other Modes Adjustment

4.2.21. In addition, TAG Unit A2.4 guidance recommends including transport model data for two modes (private and public transport), segmented by both business and commuting. As the traffic model is a purely car-based model, the wider impacts analysis does not include walking, cycling and public transport. Without these other modes, it is likely that the agglomeration benefits will be exaggerated slightly. Therefore, an allowance within the average cost calculations has been made to account for their impact, with adjustment factors being applied for each LAD considered in WITA, based on the proportion of car driver trips compared to the total number of trips obtained for the year 2024 from the TEMPRO 8.1 database.

4.2.22. Table 4-2 presents the base agglomeration impacts after Shropshire LAD adjustment for the scheme compared to the impact after the other modes adjustment across the manufacturing, construction, consumer services and producer services.

Table 4-2 – Agglomeration impacts comparison with other modes

	£'000s, 2010 PV over Appraisal Period	
Sector	**Base Agglomeration Impacts After Shropshire LAD Adjustment**	**Other Modes Adjusted Agglomeration Impacts**
Manufacturing	10,187	5,076
Construction	5,977	2,989
Consumer Services	19,348	9,676
Producer Services	75,485	37,752
Sub-Total	**110,997**	**55,493**

4.2.23. The agglomeration impacts are **£55.493m (2010 PV)** representing approximately 26% of the scheme Transport Economic Efficiency (TEE) impacts, which is considered proportional to the size of the project and location of the scheme.

Labour supply impacts

4.2.24. Taxes arising from labour supply impacts have been calculated for all forecast years. Table 4-3 presents the labour supply impacts for the scheme.

Table 4-3 – Labour supply impacts

	£'000s, 2010 PV over Appraisal Period
Labour supply impacts	1,465

4.2.25. The total benefits arising due to labour supply impacts over the 60-year appraisal period are approximately **£1.465m (2010 PV)**. These impacts are considered to be very minor as the analysis only considers the increased tax revenues associated with changes in the labour supply to be additional at UK level. Calculations for this element are based on the link between the cost of commuting and the increase in labour supply.

Output Change in Imperfectly Competitive Markets

4.2.26. Table 4-4 presents the output change in imperfectly competitive markets impacts for the scheme.

Table 4-4 – Output change in imperfectly competitive markets

	£'000s, 2010 PV over Appraisal Period
Output change in imperfectly competitive markets	6,659

4.2.27. The total additional benefits arising due to output change in imperfectly competitive markets are about **£6.659m (2010 PV)**, assuming that benefits are incurred across all time periods. This suggests that business users benefit most from the improved accessibility and connectivity within the Shrewsbury area and the subsequent reduction in congestion brought about by the scheme.

Summary

4.2.28. A summary of wider impact benefits is presented in Table 4-5 and provides a breakdown for the three wider economic impacts that have been calculated.

Table 4-5 – Total wider economic impacts

Impacts	£'000s, 2010 PV over Appraisal Period
Agglomeration impacts	55,493
Tax revenues arising from labour market impacts	1,465
Output change in imperfectly competitive market	6,659
Total wider impact benefits	**63,616**

4.2.29. The WITA analysis shows that the scheme is expected to deliver approximately **£63.616m (2010 PV)** of wider economic impacts. The highest contribution come from the agglomeration impacts. This suggests that business users are the main beneficiaries from the enhanced connectivity and consequent congestion reductions brought about by the scheme.

4.2.30. The impacts are positive for all categories, which suggests that the scheme has a positive outcome on non-transport markets, contributing to an increase in productivity and Government income.

4.3 Reliability Impacts

4.3.1. Journey time reliability refers to the day-to-day variation in journey times that individual travellers are unable to predict (also known as journey time variability). Such variation could come from recurring congestion at the same period each day (where the level of delay changes day on day) or from non-recurring events, such as incidents. It excludes predictable variation relating to varying levels of demand by time of day, day of week, and seasonal effects which travellers are assumed to be aware of.

4.3.2. Journey time reliability impacts all users, and impacts travel efficiency, for example, causing problems with delivery schedules or leading to travellers including more contingency time in their journeys to account for potential impacts.

4.3.3. As highlighted in the previous section, the scheme lies in the hinterland of the FUR that encompasses Shrewsbury town centre and the three neighbouring MSOAs to its north and west. Given the range of route choice on the road network in the area, an urban roads reliability assessment has been undertaken, in line with the process and guidance set out in TAG Unit A1-3, Section 6.3.

4.3.4. The process uses outputs from the SATURN model to estimate the reliability impact for urban roads as a result of transport schemes. This provides an estimate of the change in the level of journey time variability depending on the change in average journey time for each origin/destination pair due to a scheme and the demand and distance between each pair.

Reliability benefit $= -\sum \Delta\sigma_{ij} \left(\frac{T_{ij2}+T_{ij1}}{2}\right) \times 0.4 \times VOT$

Where:

$\Delta\sigma_{ij} = 0.0018\left(\left(t_{ij2}\right)^{2.02} - \left(t_{ij1}\right)^{2.02}\right) d_{ij}{}^{-1.41}$

VOT = value of time (£/sec)

$\Delta\sigma_{ij}$ = is the change in the standard deviation of journey time from i to j (seconds)

t_{ij1} and t_{ij2} = the journey times, before and after the change, from i to j (seconds)

d_{ij} = the journey distance from i to j (km)

4.3.5. No benefits are counted for journeys of less than 1km distance and no masking has been applied in the assessment.

Results

4.3.6. The journey time reliability benefits by time-period and each of the three forecast years are shown in Table 4-6 overleaf.

Table 4-6 – Journey time reliability benefits by time period and forecast year

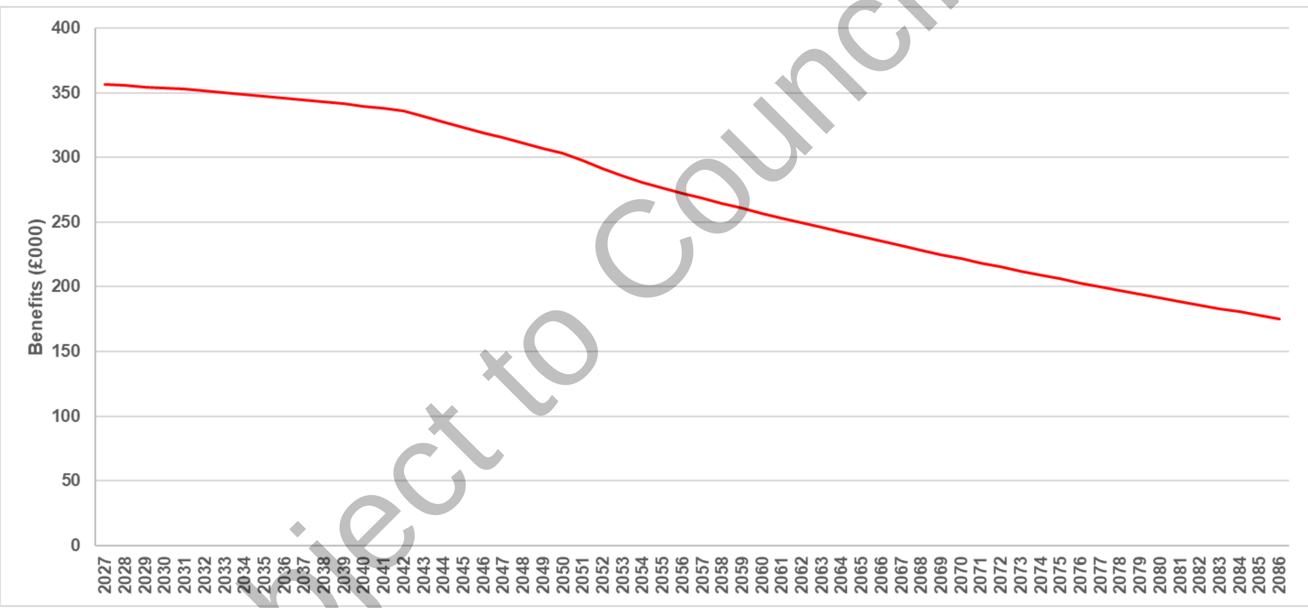
Time Period	£'000s, 2010 PV		
	2027	2042	2050
AM	155	135	117

Time Period	£'000s, 2010 PV		
	2027	2042	2050
IP	95	98	93
PM	106	103	93
Total	**356**	**336**	**303**

4.3.7. The total journey time reliability benefit over the 60-year appraisal period is **£16.361m (2010 PV)**.

4.3.8. Figure 4-3 shows the profile of reliability benefits across the 60 year apprasial period.

Figure 4-3 – Reliability benefit profile over the 60-year appraisal period



5 Common Analytical Scenarios

5.1 Introduction

5.1.1. In order to understand how sensitive the benefits described above are to alternative parameters, and in line with DfT's Uncertainty Toolkit (November 2023), which sets out the requirement to evaluate the seven standard "Common Analytical Scenarios (CAS)", these scenarios need to be tested based on their level of uncertainty from Low, Medium and High impact categories.

5.1.2. The scheme has been assumed to be in the Medium Impact category as its cost is in the £50m to £500m range and there is a limited corporate risk.

5.1.3. For a Medium impact scheme at FBC stage, the recommended scenarios to be run are the critical CAS. Analysis has been carried out to understand the impact of alternative growth outcomes provided by the different CAS and further details can be found within the Forecasting Report in Appendix J of the FBC.

5.1.4. For the purposes of the FBC, the following CAS have been considered:

- **Low Economy**- where population, employment and GDP all experience lower levels of growth than the core scenario.
- **High Economy**- where population employment and GDP would all see higher levels of growth than the core scenario.
- **Regional**- where there would be redistribution of national economic growth, with out-migration from London, the South-East and the East of England, leading to increased economic growth across the rest of the country.

5.1.5. The results of these tests are summarised below.

5.2 Transport Economic Efficiency Benefits

5.2.1. In line with the current guidance set out in TAG Unit M4 (May 2024), the Common Analytical Scenarios (CAS) have been developed to investigate the Proposed scheme's robustness in the light of uncertainty in demand levels. The low, high and regional growth scenarios have included the same local developments as the Core scenario, taken from the Uncertainty Log.

5.2.2. The same demand process developed for the Core scenario is applied to the CAS. The tests comprise applying the Low Economy, High Economy and Regional growth assumptions calculated from NTEM version 8.1. Low, High and Regional factors are also extracted from NRTP-22 for LGV and HGV. Details on the demand process and analysis of the low, high, and regional scenario assignments are presented in the Forecasting Report.

5.2.3. Applying the low, high and regional growth scenarios for the transport modelling, outputs were produced for analysis using TUBA. This produced the user benefits, which contribute the greatest proportion of benefits. For the other benefit streams the results for the Core scenario were pro-rated based upon the percentage change in user benefits.

5.2.4. The transport user benefits for Core and alternative growth scenarios (low, high and regional) for the Transport User Benefits in terms of core and operation impacts elements are shown in Table 5-1 and Table 5-2.

Table 5-1 – TEE benefits of core- Core, Low, High and Regional scenarios

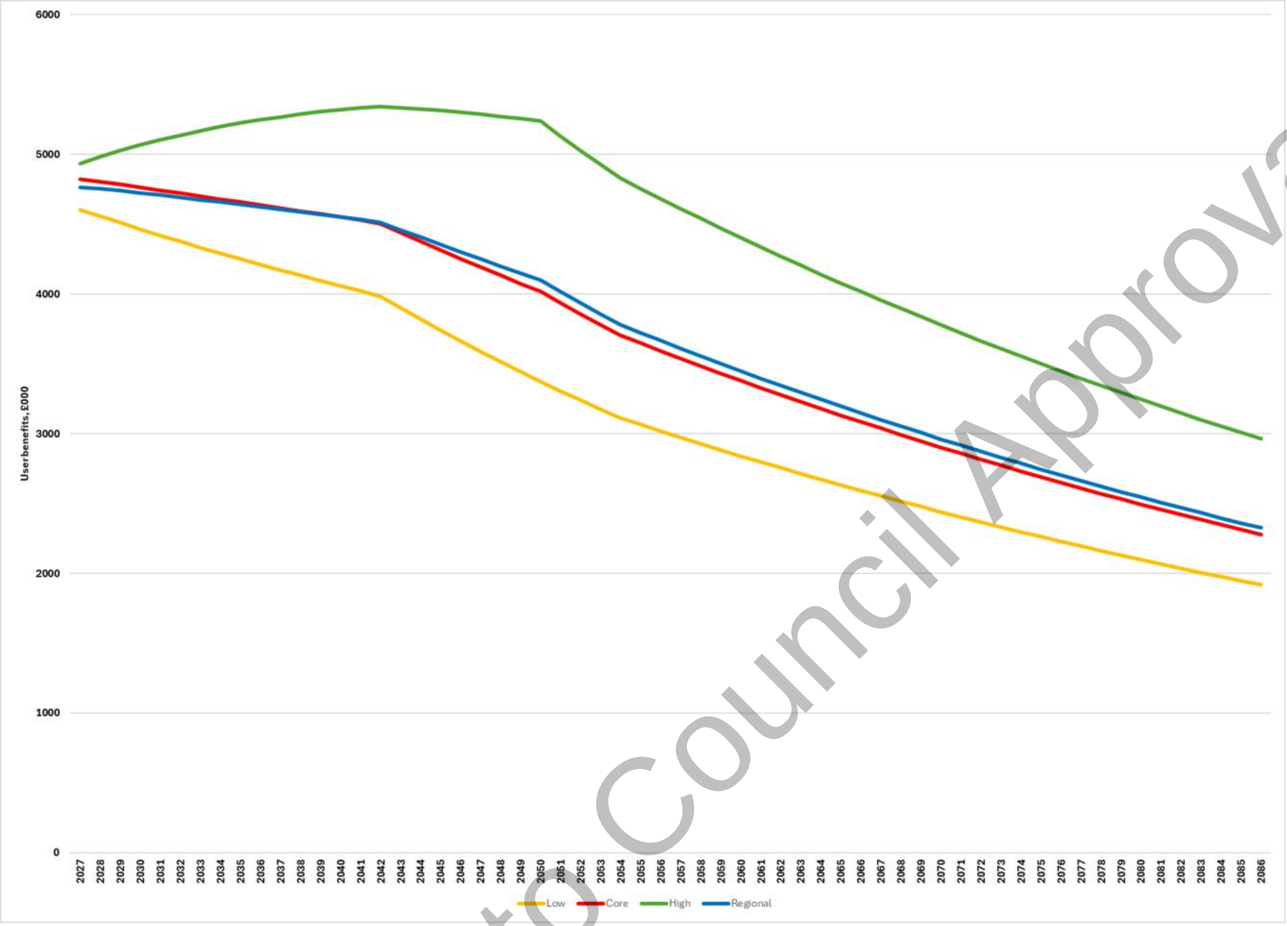
Benefits (£'000s, 2010 PV over Appraisal Period)		Low Economy	Core	High Economy	Regional
Consumer – Commuting user benefits	Travel time	50,148	56,285	68,268	56,966
	Vehicle operating costs	744	1,155	1,436	1,115
	Subtotal	50,893	57,440	69,704	58,082
Consumer – Other user benefits	Travel time	78,842	90,719	110,560	91,737
	Vehicle operating costs	1,916	2,172	3,553	2,244
	Subtotal	80,758	92,891	114,113	93,981
Business user benefits	Travel time	51,061	59,750	74,214	60,255
	Vehicle operating costs	5,979	6,836	8,430	6,899
	Subtotal	57,040	66,586	82,643	67,153
Total TEE benefit		**188,691**	**216,918**	**266,460**	**219,216**

Table 5-2 – TEE benefits of operation- Core, Low, High and Regional scenarios

Benefits (£'000s, 2010 PV over Appraisal Period)		Low Economy	Core	High Economy	Regional
Consumer – Commuting user benefits	Travel time	-482	-569	-731	-580
	Vehicle operating costs	-22	-28	-36	-28
	Subtotal	-503	-597	-767	-608
Consumer – Other user benefits	Travel time	-837	-988	-1,270	-1,006
	Vehicle operating costs	-33	-40	-63	-41
	Subtotal	-870	-1,028	-1,333	-1,047
Business user benefits	Travel time	-512	-619	-803	-630
	Vehicle operating costs	-46	-56	-77	-57
	Subtotal	-559	-675	-880	-688
Total TEE benefit		**-1,932**	**-2,300**	**-2,980**	**-2,343**

5.2.5. The benefits of core impacts over the 60-year appraisal period for the Low, Core, High and Regional scenarios are shown in Figure 5-1 overleaf. The graphs show that the Low scenario has smaller benefits, and the Regional and High scenarios have larger benefits than the Core scenario.

Figure 5-1 – Benefits profile



5.3 Accidents Benefits

5.3.1. The low, high and regional scenario outputs from the transport modelling were used for the assessment of accidents benefits for the low, high and regional scenarios. The results are shown in Table 5-3.

Table 5-3 – PIA savings

PIAs over Appraisal Period	Low Economy	Core	High Economy	Regional
PIA saving	228	256	301	262

5.3.2. The overall outcomes of these sensitivity tests in terms of accident benefits against the Core Scenario are shown in Table 5-4 overleaf. In which, both Regional and High scenarios show greater benefits than the Core scenario, while the Low scenario reflects the least benefits.

Table 5-4 – Economic summary

£'000s, 2010 PV over Appraisal Period	Low Economy	Core	High Economy	Regional
Accident Impact	4,142	4,705	5,904	4,827

5.4 Active Modes

5.4.1. The Active Modes assessment has been assumed to remain consistent with the Core scenario across all sensitivity scenarios.

5.5 Reliability

5.5.1. For the reliability assessment, transport modelling outputs from the for the low, high and regional scenarios were used to assess the reliability benefits for each case. The results, shown in Table 5-5, indicate that both Regional and High scenarios provide greater benefits than the Core scenario, while the Low scenario reflects the least benefits.

Table 5-5 – Journey time reliability benefits summary

£000s, 2010 PV over Appraisal Period	Low Economy	Core	High Economy	Regional
Reliability	13,531	16,361	22,349	16,532

5.6 Wider Economic Impacts

5.6.1. Similarly, for the wider economic impacts assessment, transport modelling outputs from the low, high and regional scenario were used to assess the WITA benefit. The respective results, shown in Table 5-6, indicate that both Regional and High scenarios yield greater benefits compared to the Core scenario, while the Low scenario reflects the least benefits.

Table 5-6 – Wider economic impact summary

£000s, 2010 PV over Appraisal Period	Low Economy	Core	High Economy	Regional
WITA	60,529	63,616	66,153	63,796

Appendix A

TUBA Warnings by Sector

INTRODUCTION

Transport User Benefit Analysis (TUBA) is used to calculate the part of economic benefits to transport users by comparing the costs associated with Do-Minimum and Do-Something scenarios by establishing the savings in travel times and vehicle operation costs.

As part of the analysis, the warnings generated for the Core scenario TUBA were reviewed by disaggregating them into eight groups as shown in Table A-1.

Table A-1 - TUBA warnings for Core scenario

ID	Group	Total Warnings
1	None serious: Ratio of DM to DS travel time lower than limit	865
2	57 serious: Ratio of DM to DS travel time higher than limit	57994
3	None serious: Ratio of DM to DS travel distance lower than limit	17076
4	73 serious: Ratio of DM to DS travel distance higher than limit	19384
5	DM speeds less than limit	9078
6	DS speeds less than limit	5277
7	DM speeds greater than limit	59526
8	DS speeds greater than limit	63420

The total number of warnings appears high; however, there are numerous repetitions of the same OD pairs across different time periods, vehicle types, purposes, and modelled years.

GROUP 1: RATIO OF DM/DS TRAVEL TIME LOWER THAN LIMIT

The warnings are generated for the OD pairs having higher Do-Something travel time compared to Do-Minimum.

From Figure A-1 it can be observed the origin zones are mainly in the Shrewsbury city centre which has existing traffic issues. Origin zones can also be observed close to National cycle route 81, between Churncote and Holyhead roundabout and Welshpool road. This is due to the increase in traffic in the Do-Something scenario on the signalised junction connecting National cycle route 81 and Welshpool road.

Figures A-2 and A-3 provide examples for Group 1 for the Do-Minimum and Do-Something scenarios, respectively. The change in routing is due to a change in the network, wherein the Little Oxon roundabout, which was present in the Do-Minimum scenario and provided direct access, is removed as part of the Do-Something scenario, generating the warning.

Figure A-1 – Origins for Group 1 warnings

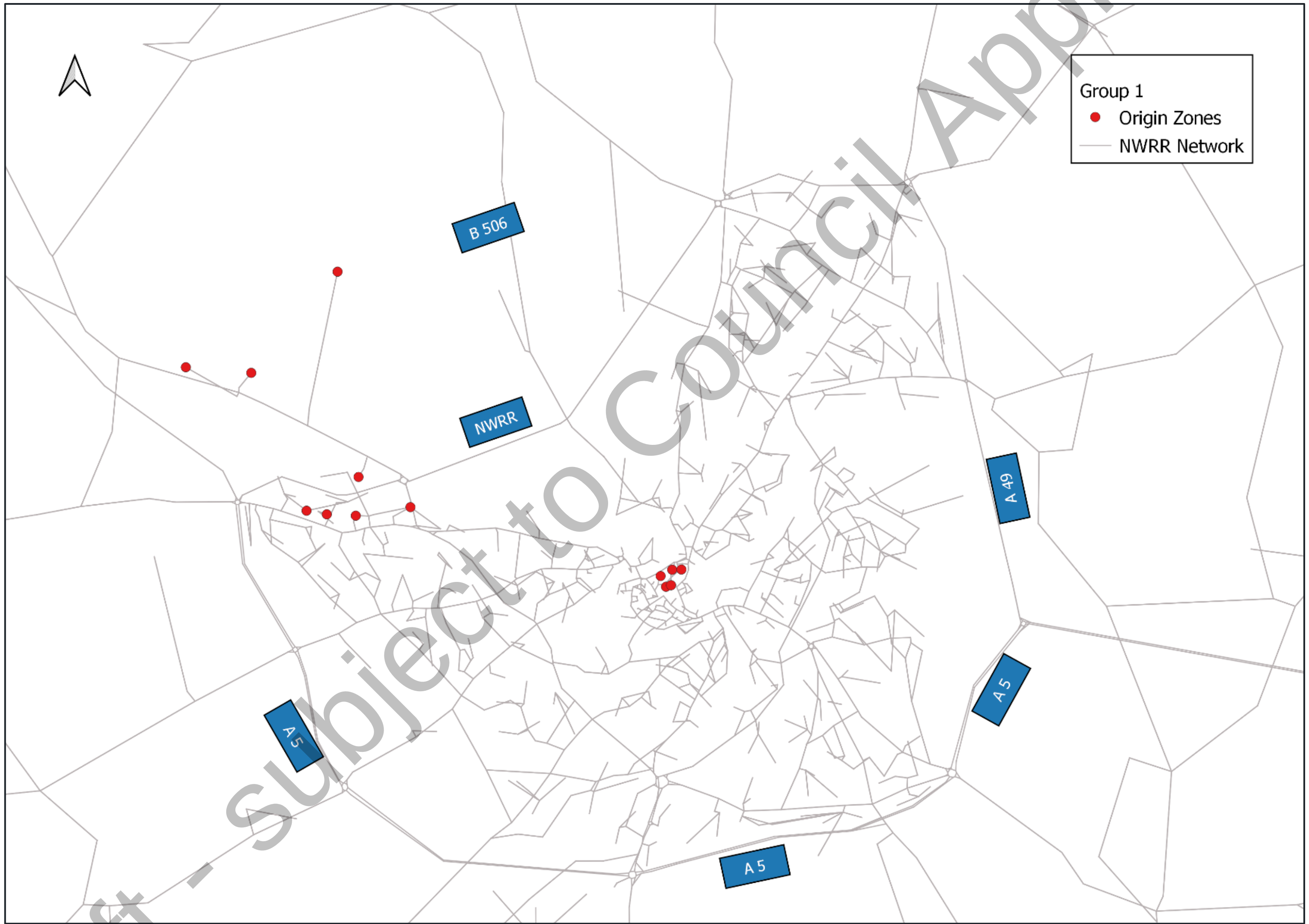


Figure A-2 - Example of a specific OD pair path from Group 1 warning - Do-Minimum

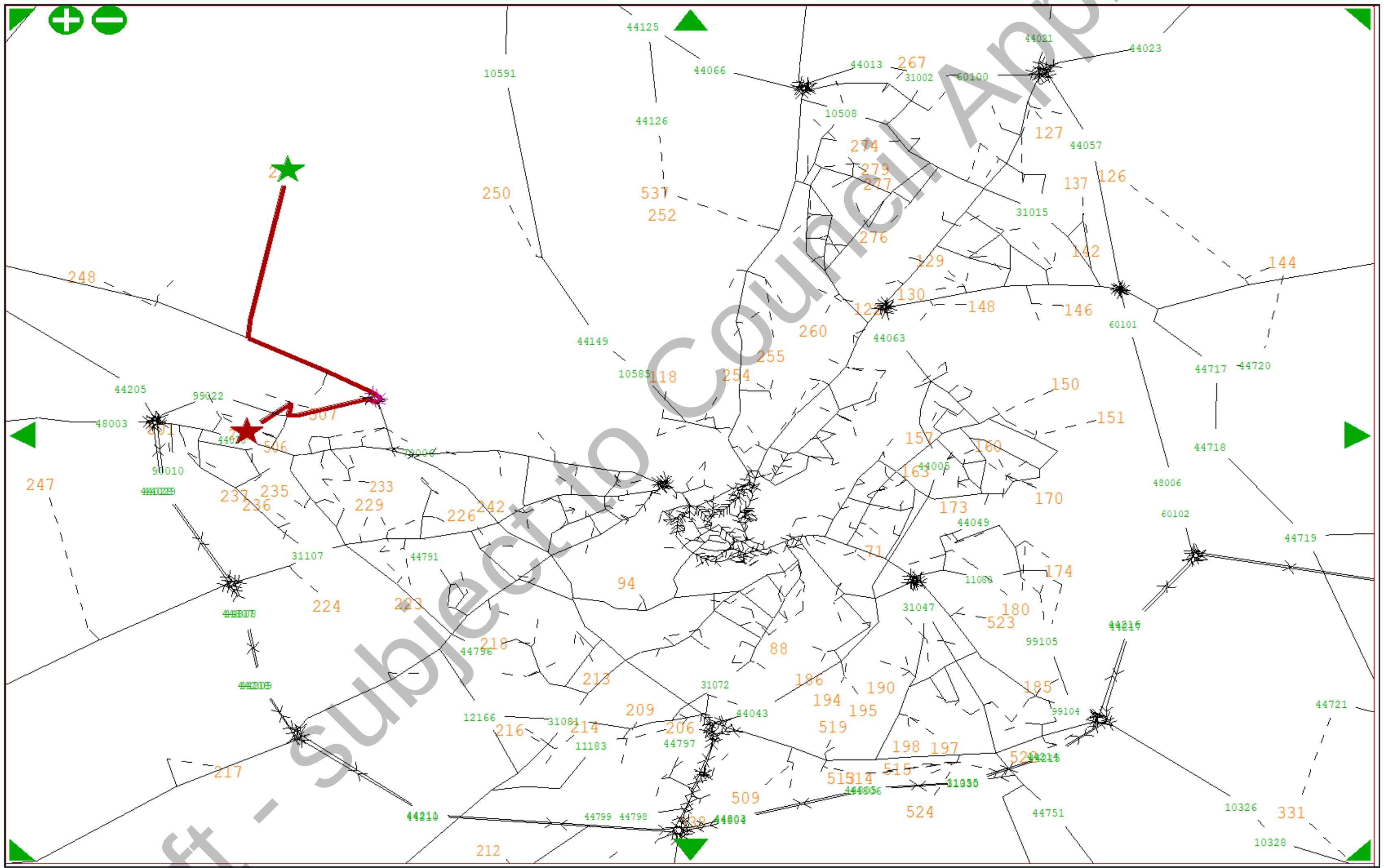
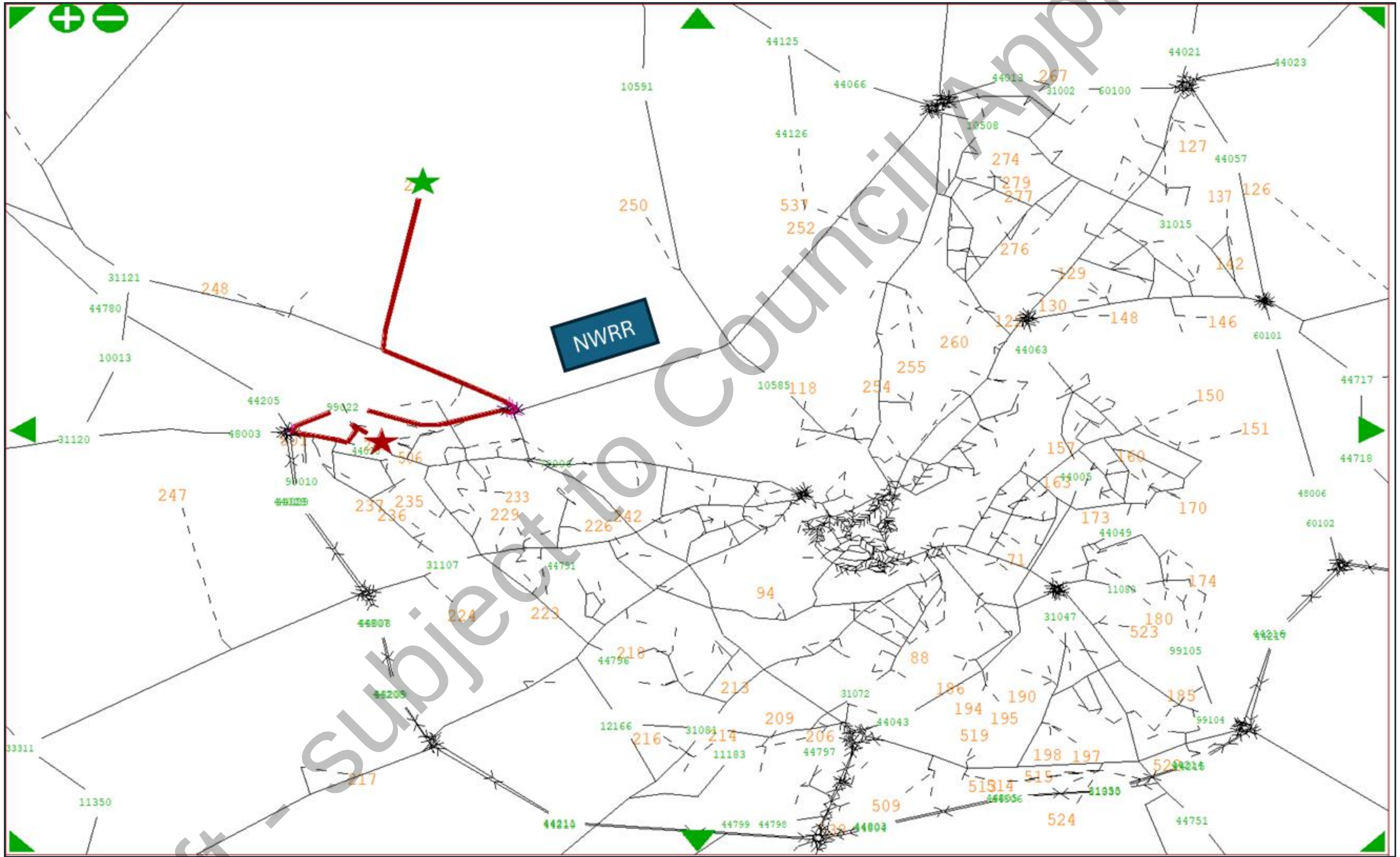


Figure A-3 - Example of a specific OD pair path from Group 1 warning - Do-Something



GROUP 2: RATIO OF DM/DS TRAVEL TIME HIGHER THAN LIMIT

These warnings are due to Do-Something having higher travel time compared to Do-Minimum for the OD pairs.

Figure A-4 displays the set of origins for Group 2 warnings. From this figure, it is evident that the origin zones are near the future location of the NWRR scheme. Consequently, the OD pairs will experience reduced travel time in the Do-Something scenario.

Figures A-5 and A-6 provide examples for Group 2 for the Do-Minimum and Do-Something scenarios. This is because vehicles can travel faster in the Do-Something scenario due to reduced delays within Shrewsbury as a result of the new scheme.

Figure A-4 - Main trip origins for Group 2 warnings

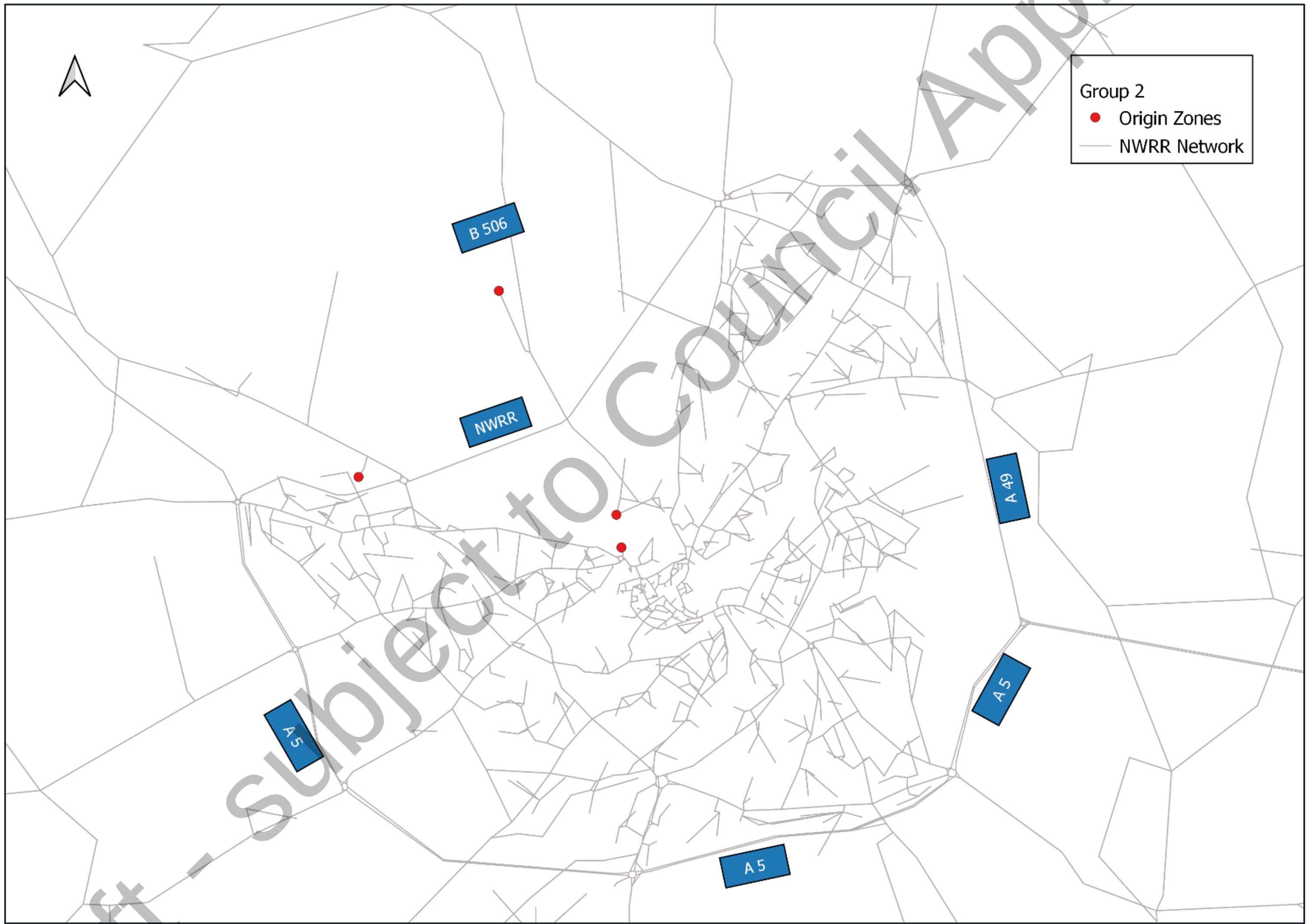


Figure A-5 - Example of a specific OD pair path from Group 2 warning - Do-Minimum

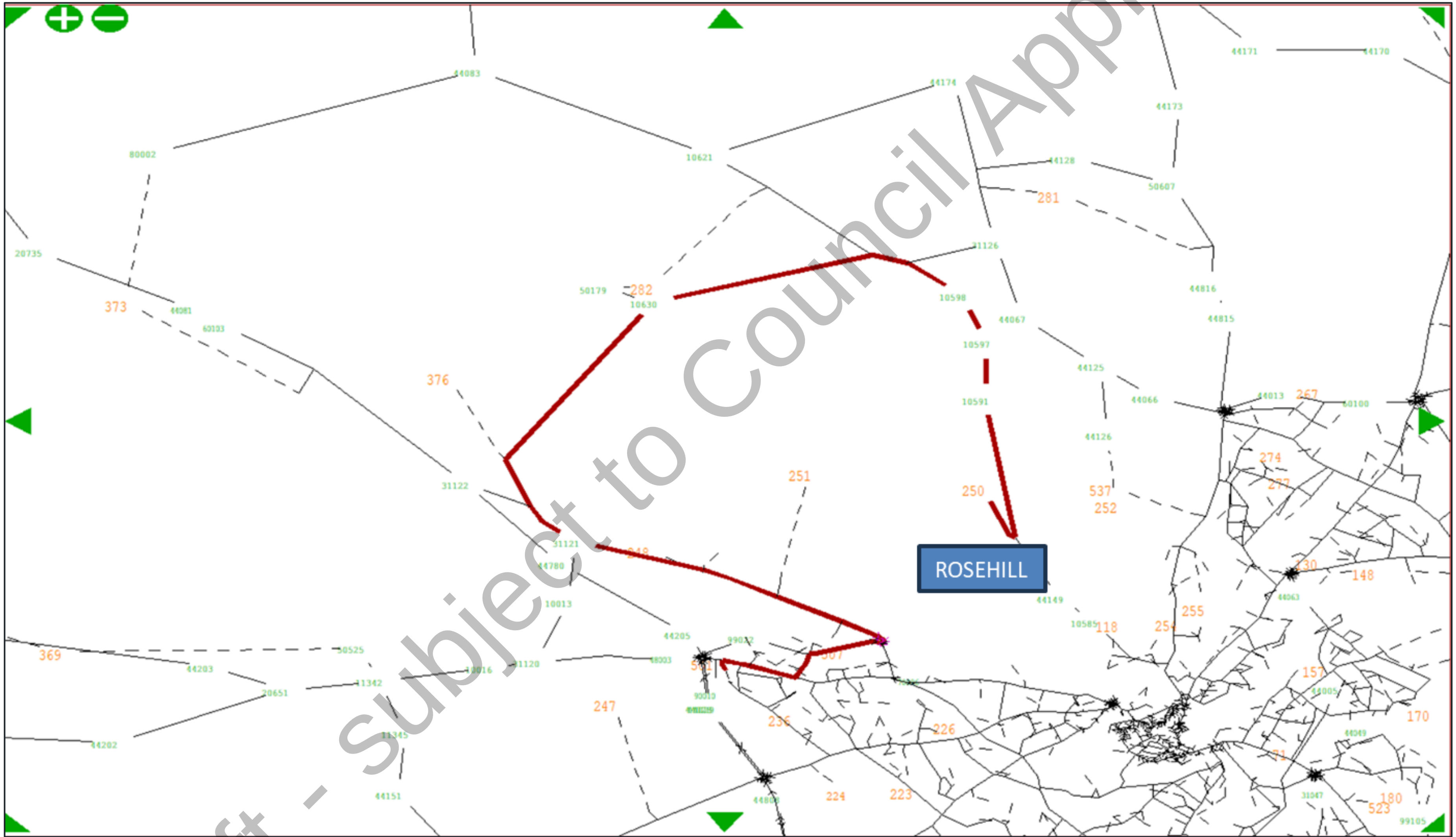
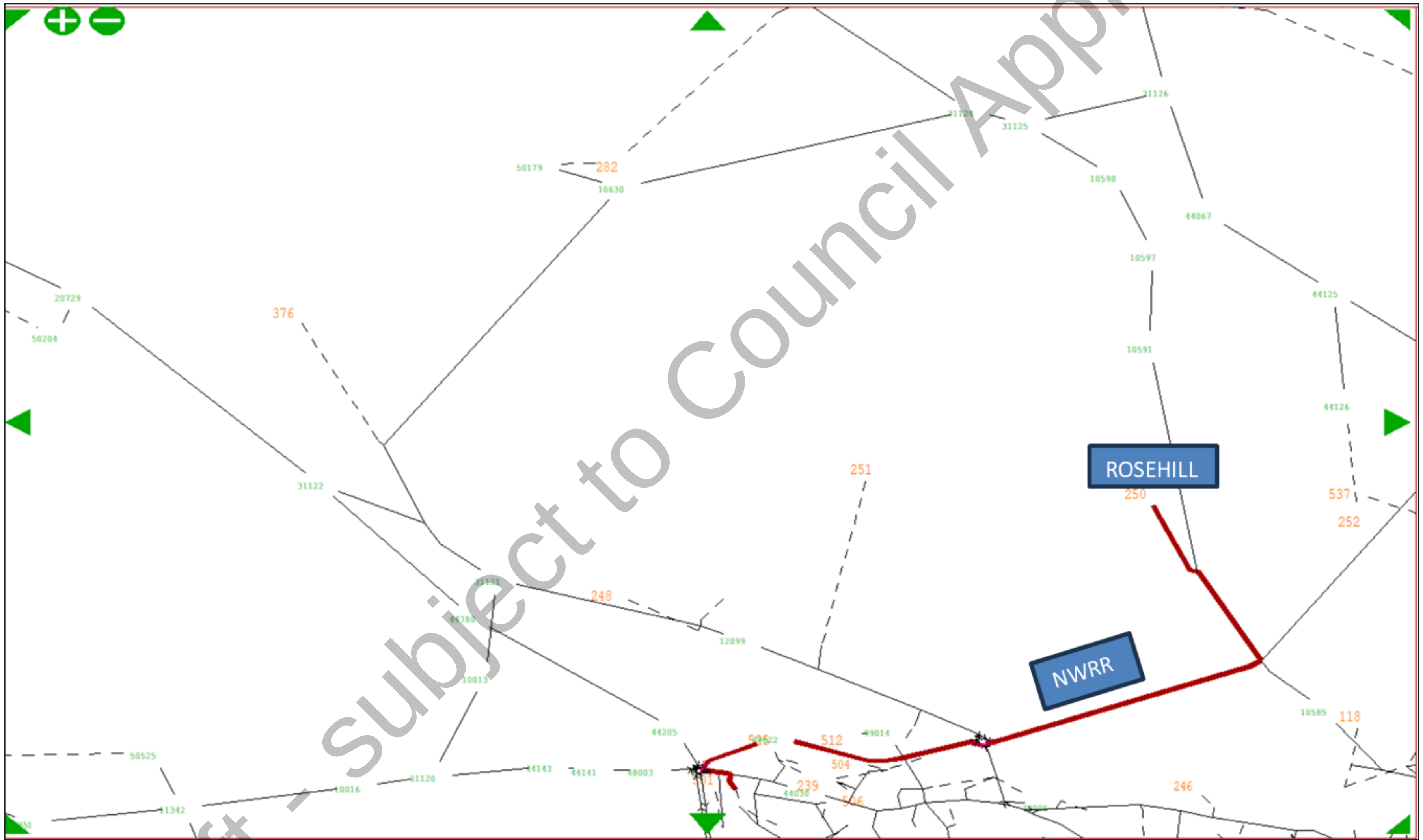


Figure A-6 - Example of a specific OD pair path from Group 2 warning - Do-Something



GROUP 3: RATIO OF DM/DS TRAVEL DISTANCE LOWER THAN LIMIT

These warnings are due to the increase in travel distance in the Do-Something scenario.

Figure A-7 shows the origin and destination zones of the main OD pairs. Similar to previous groups, the changes between Do-Minimum and Do-Something are associated with the new NWRR. With the scheme in place, users avoid the congested town centre routes (although they are shorter) and prefer to use the scheme link due to the shorter journey time, thanks to increased speed.

Figures A-8 and A-9 provide examples for Group 3 in the Do-Minimum and Do-Something scenarios, respectively, showing that the NWRR scheme offers reduced travel time even though the travel distance is higher.

Figure A-7 - Main trip origins and destinations for Group 3 warnings

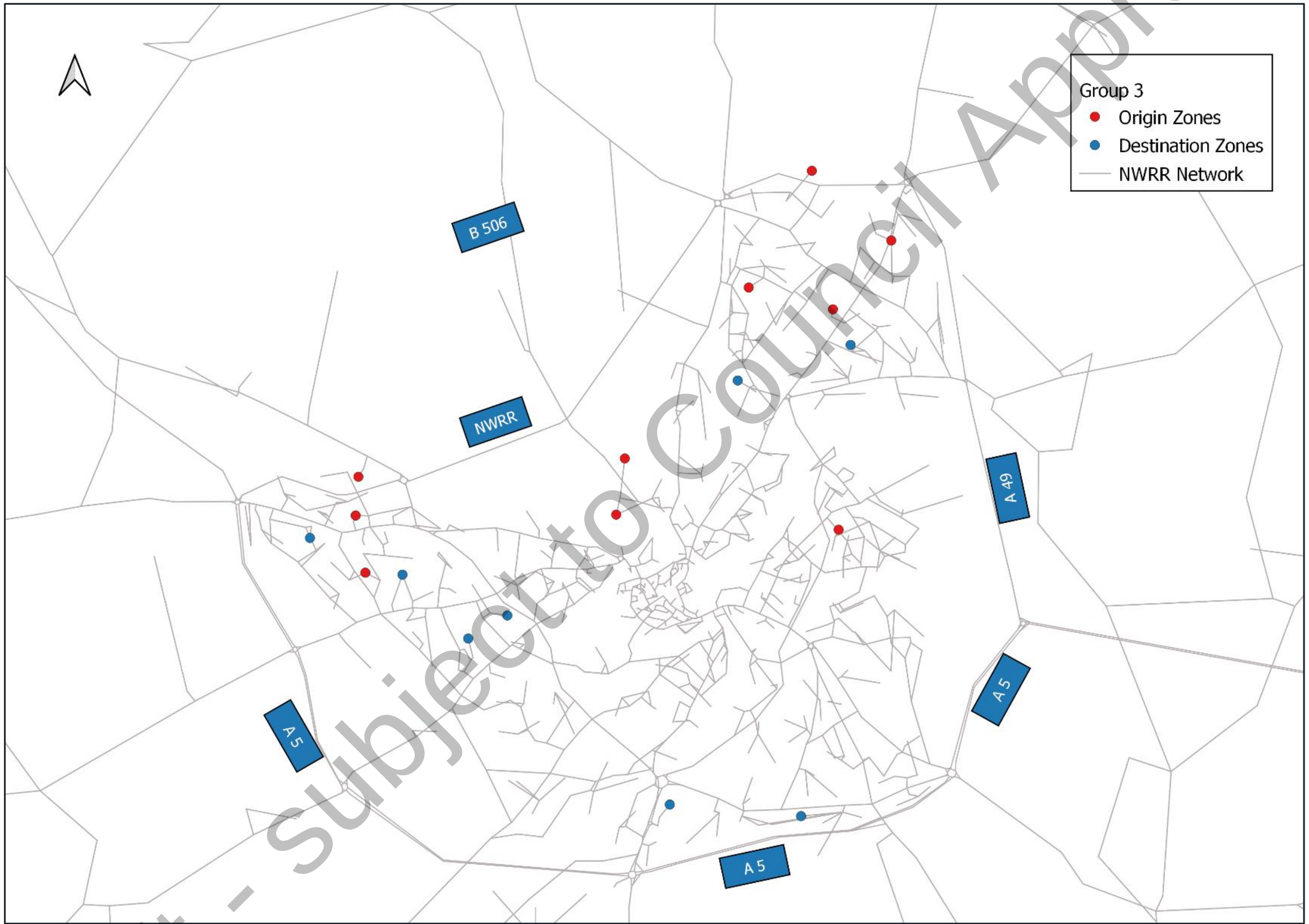


Figure A-8 - Example of a specific OD pair path from Group 3 warning - Do-Minimum

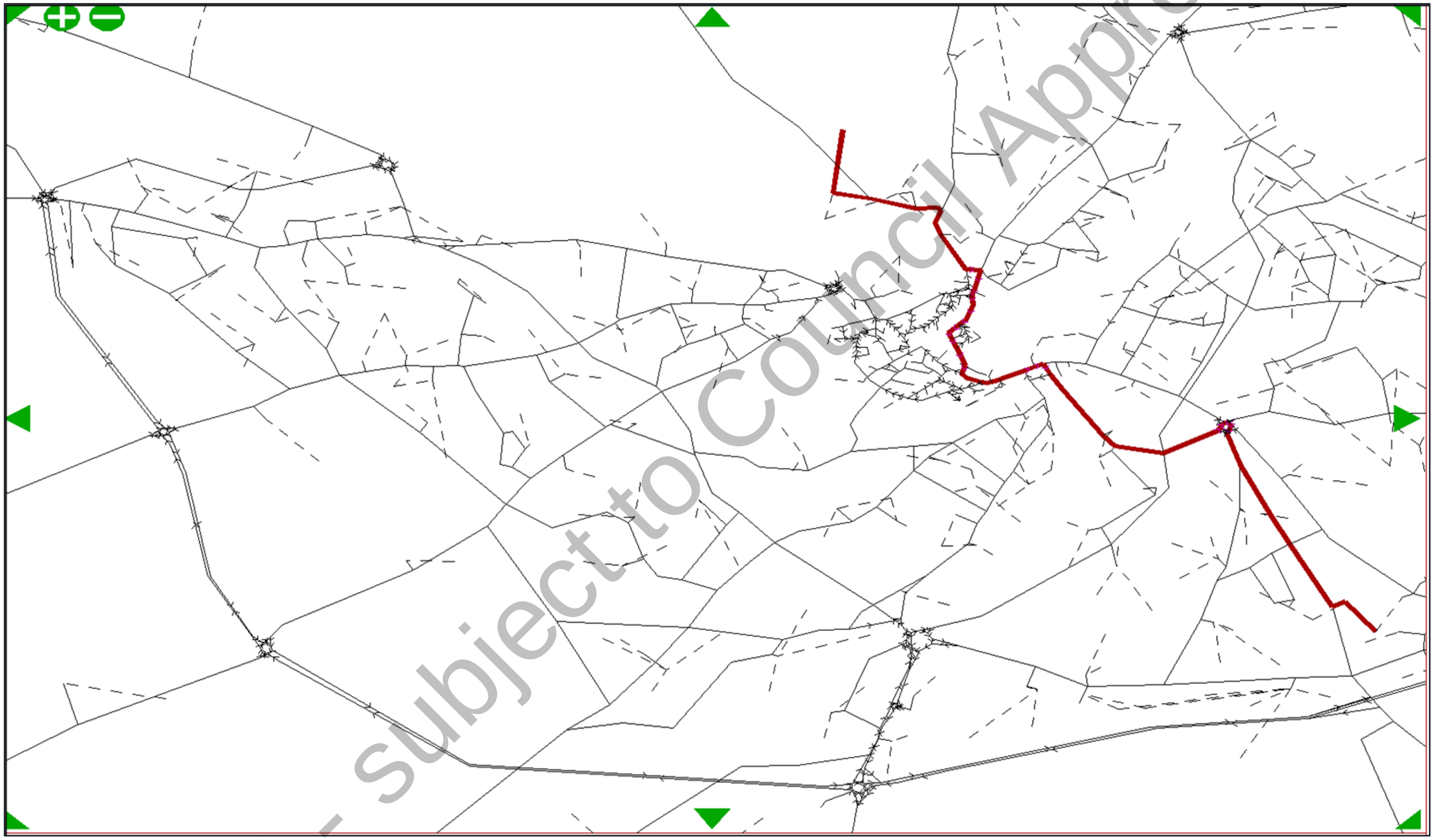
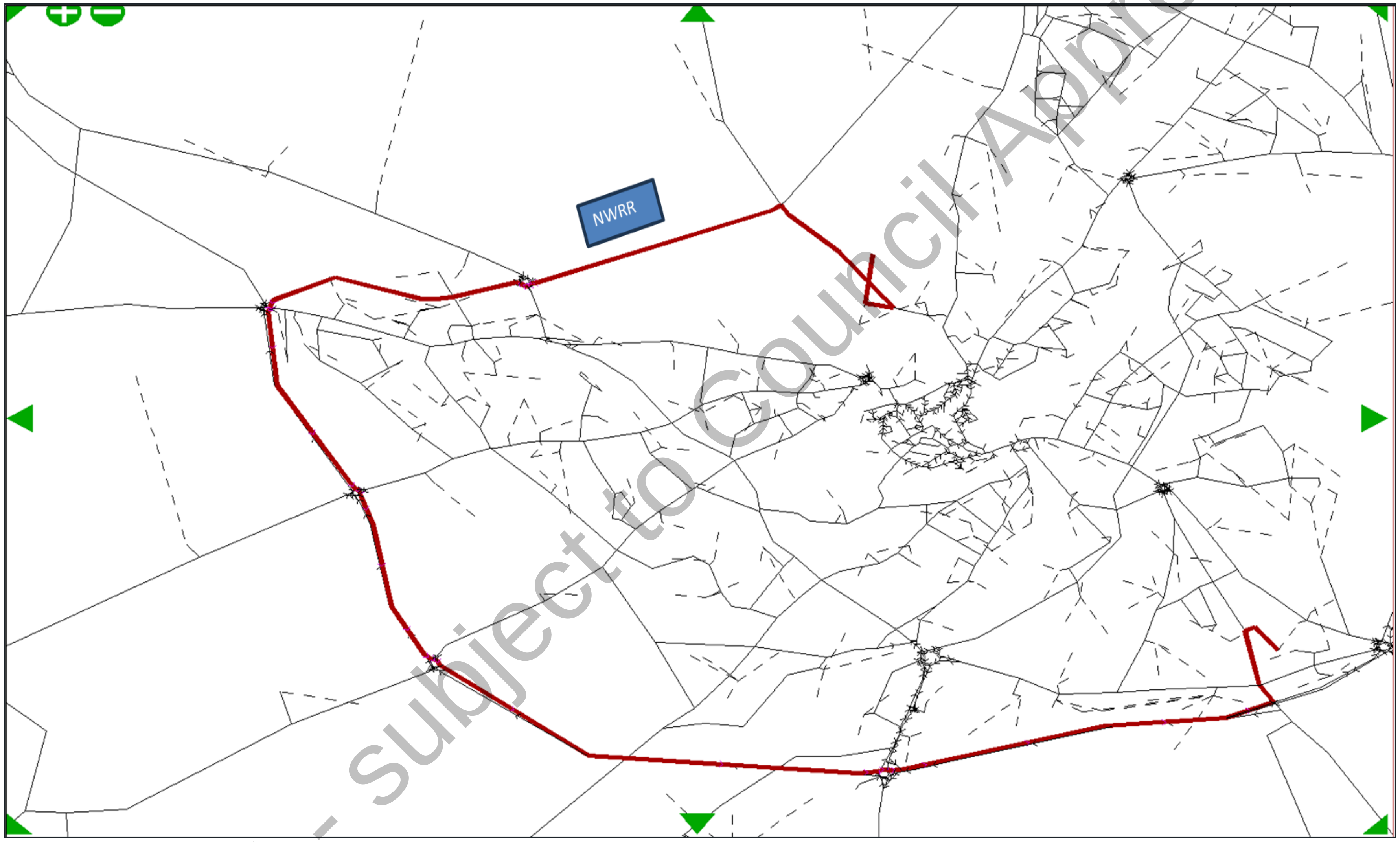


Figure A-9 - Example of a specific OD pair path from Group 3 warning - Do-Something



GROUP 4: RATIO OF DM/DS TRAVEL DISTANCE HIGHER THAN LIMIT

These warnings are due to the decrease in travel distance in the Do-Something scenario.

This group has the highest number of serious warnings, and a more detailed analysis has been carried out to identify any potential modelling anomalies. Table A-2 shows the breakdown of the warnings by ratio range. The highest DM/DS ratio [3-4] represents 0.4% of the total (73 of them) whilst ratios [2-3] and [1.5-2] represent 10.2% and 89.5% respectively. The detailed assessment established that these are logical distance reductions.

Table A-2 - Breakdown of the travel distance ratios

Range Ratio	Warnings	Average travel distance in DM (km)	Average travel distance in DS (km)	Average difference (DS - DM)
Ratio [3 - 4]	73	14.54	4.40	-10.14
Ratio [2 - 3]	1968	12.08	5.30	-6.78
Ratio [1.5 - 2]	17343	11.82	7.22	-4.59
Grand Total	19384	12.81	5.64	-7.17

Figures A-10 to A-12 show the OD pairs for this warning group. As seen in previous cases, the new NWRR is the main reason for the high DM/DS ratios in Figure A-10. Figures A-13 and A-14 provide examples for Group 4 in the Do-Minimum and Do-Something scenarios. This is because vehicles can travel faster in the Do-Something scenario due to fewer delays within Shrewsbury as a result of the new scheme.

Figure A-10 - Origins and destinations for Group 4 warnings ratio [3 - 4]

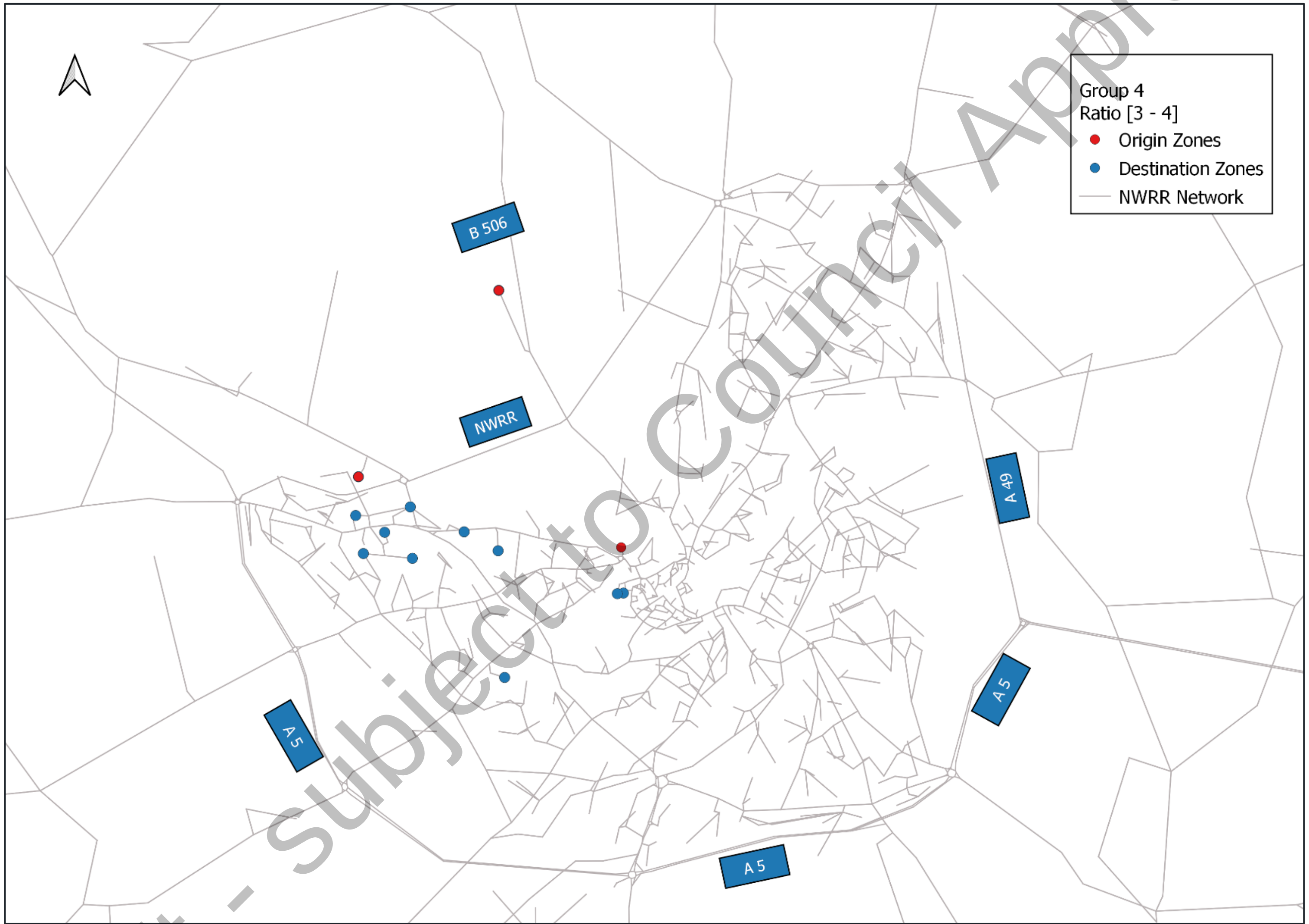


Figure A-11 - Origins and destinations for Group 4 warnings ratio [2 - 3]

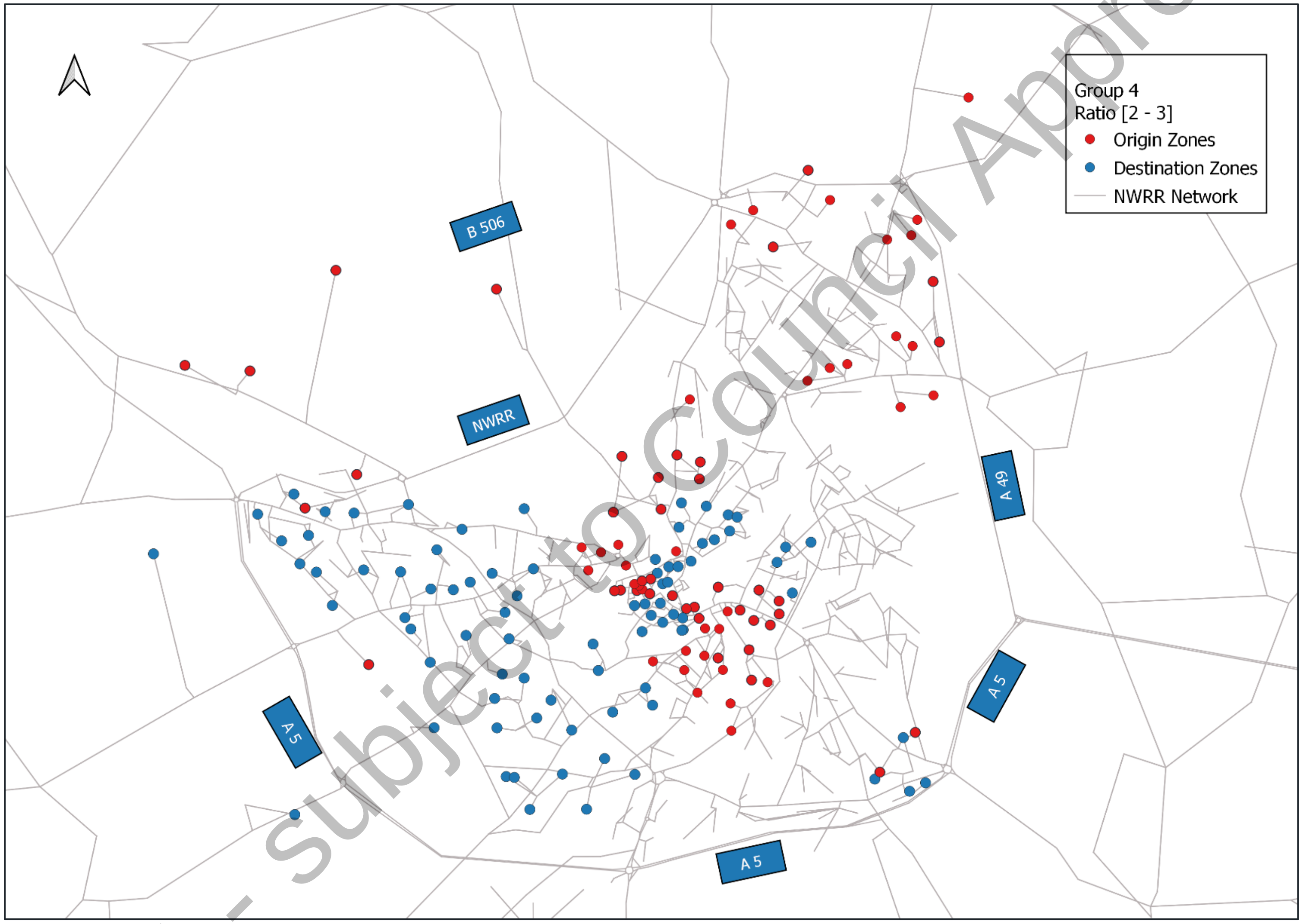


Figure A-12 - Origins and destinations for Group 4 warnings ratio [1.5 - 2]

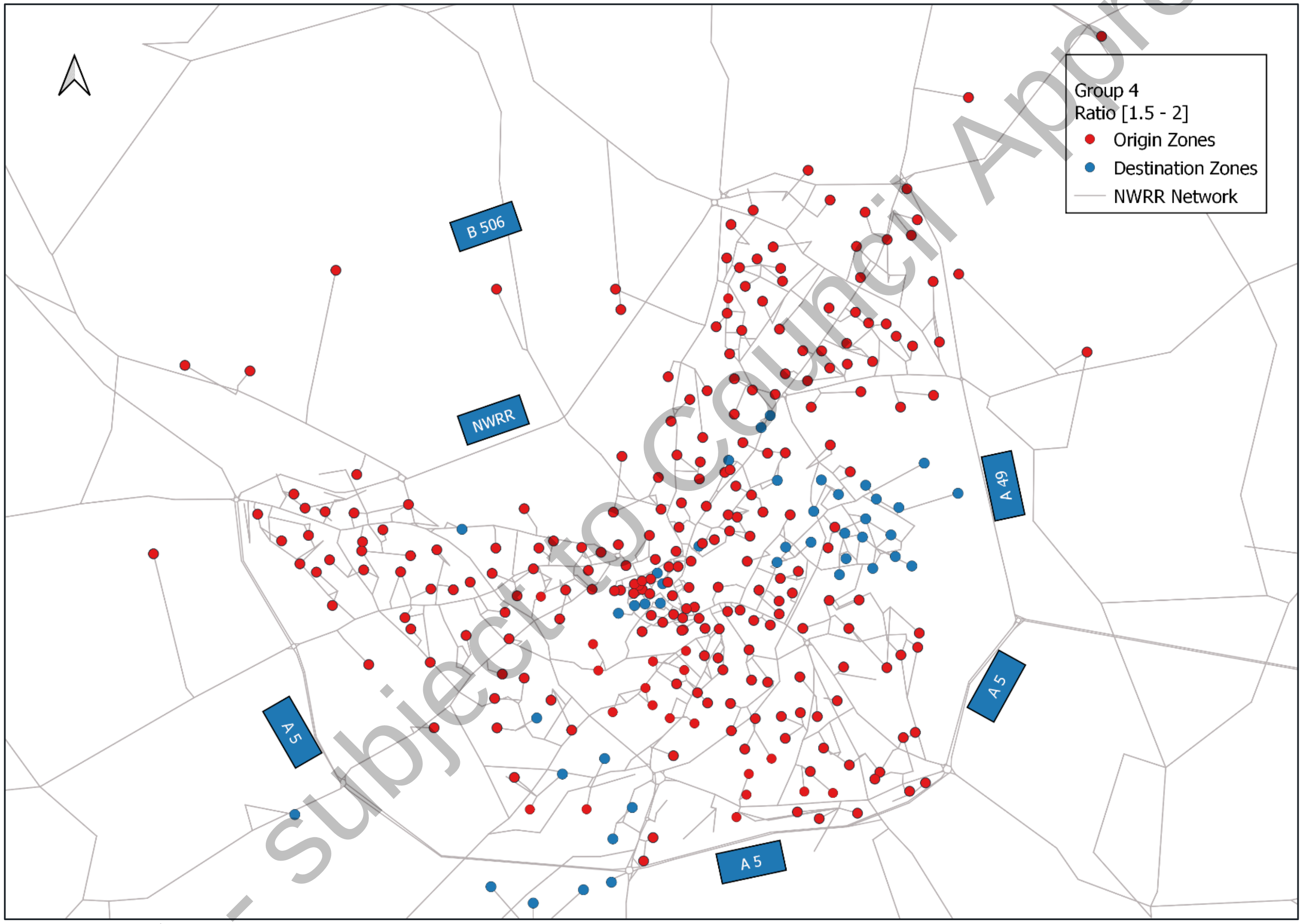


Figure A-13 - Example of a specific OD pair path from Group 4 warning - Do-Minimum

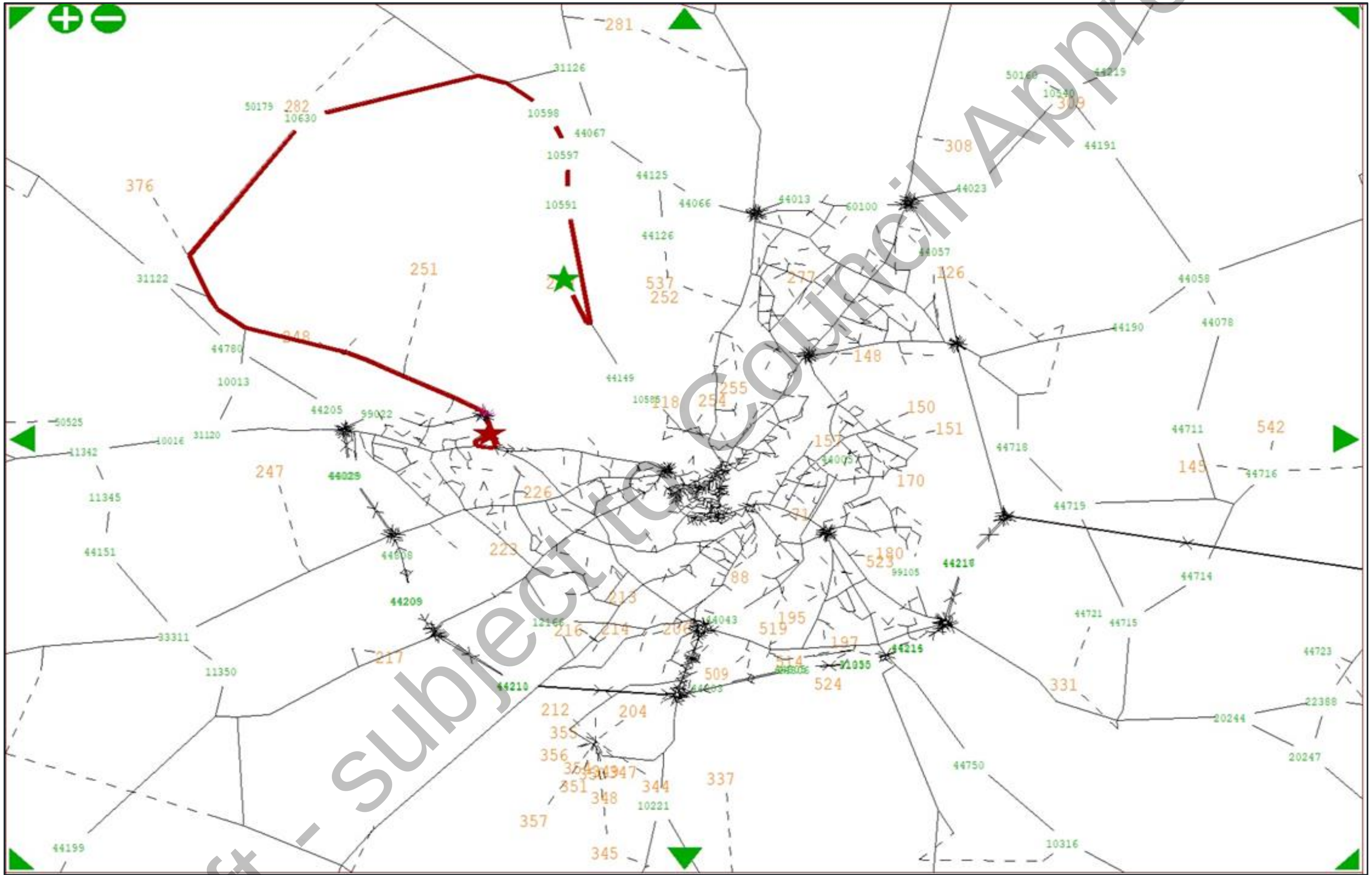
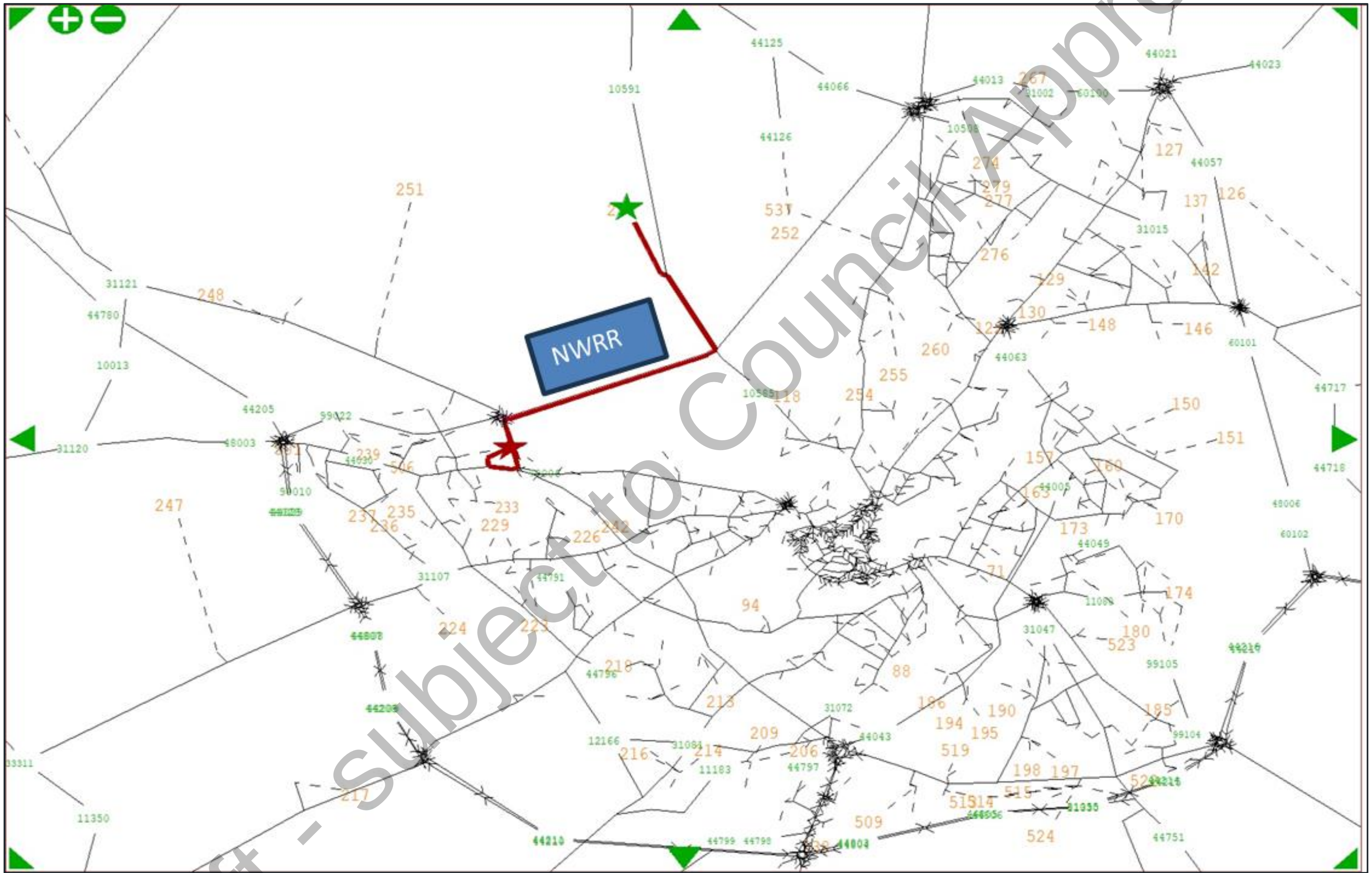


Figure A-14 - Example of a specific OD pair path from Group 4 warning - Do-Something

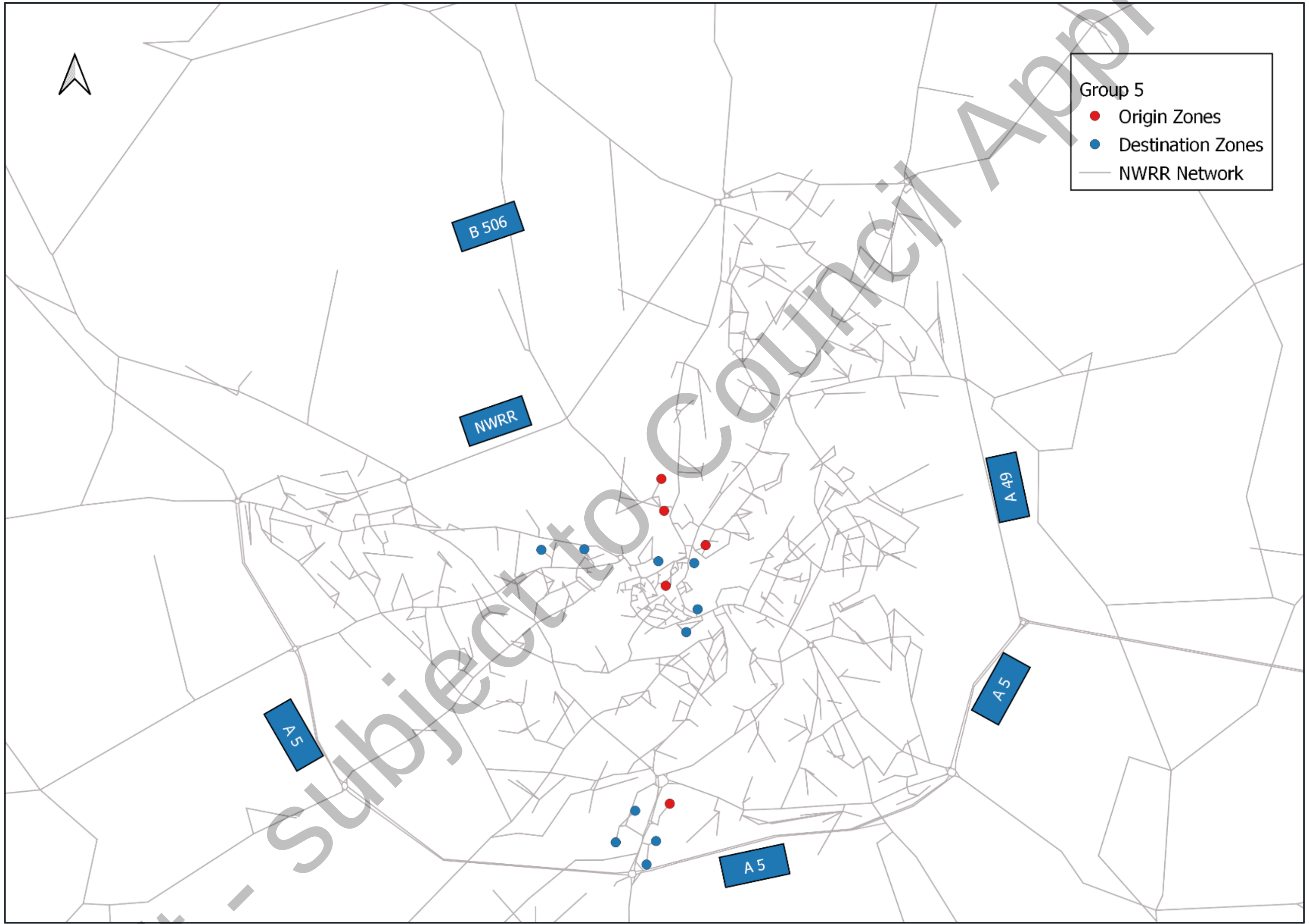


GROUP 5: DM SPEEDS LESS THAN THE LIMIT

The warnings are generated when the speed between the OD pairs is less than the limit in the Do-Minimum scenario.

Figure A-15 shows the main origins and destinations of the OD warnings in this group. Almost all the main pairs are located in the centre of Shrewsbury, which generally experiences heavy congestion during peak hours. Consequently, it is expected that the current DM speeds for these short trips are low. A few OD pairs linked to A5112 Hereford Road also fall under this group warning. This warning category is linked to Group 1 warnings discussed earlier.

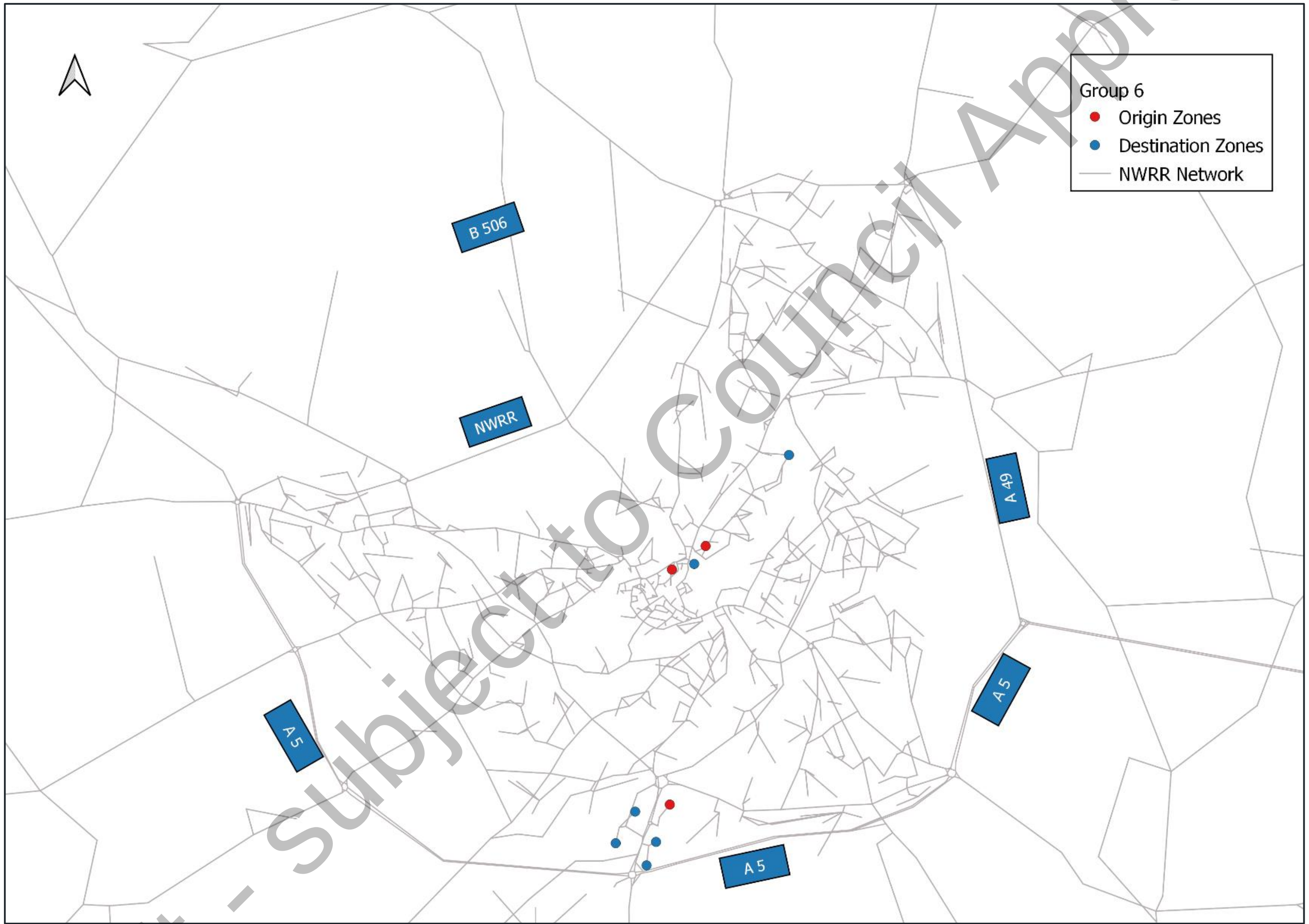
Figure A-15 - Main trip origins and destinations for Group 5 warnings



GROUP 6: DS SPEEDS LESS THAN THE LIMIT

This group of warnings are similar to Group 5 warnings discussed earlier. The speeds in Shrewsbury town centre are generally low in the base year and continue to remain low in the forecast years. Figure A-16 shows the origins and destinations of the main OD pairs for this group. Similar to Group 5, these pairs are all located in the town centre and linked to the A5112 Hereford Road.

Figure A-16 - Main trip origins and destinations for Group 6 warnings



GROUP 7: DM SPEEDS GREATER THAN THE LIMIT

These group of warnings is generated when the speed between the OD pairs exceeds the limit speed in the Do-Minimum scenarios.

These warnings are generated only for the HGVs that have both origin and destination in the buffer (external) area, or if either the origin or the destination is in the external (buffer) area, thereby using buffer network links. From Figure A-17, the origin is in the external (buffer) area and the destination is in Shrewsbury. Figure A-18 shows that both the origin and destination are in the external (buffer) area.

Figure A-17 - Example of a specific OD pair path for Group 7 warning

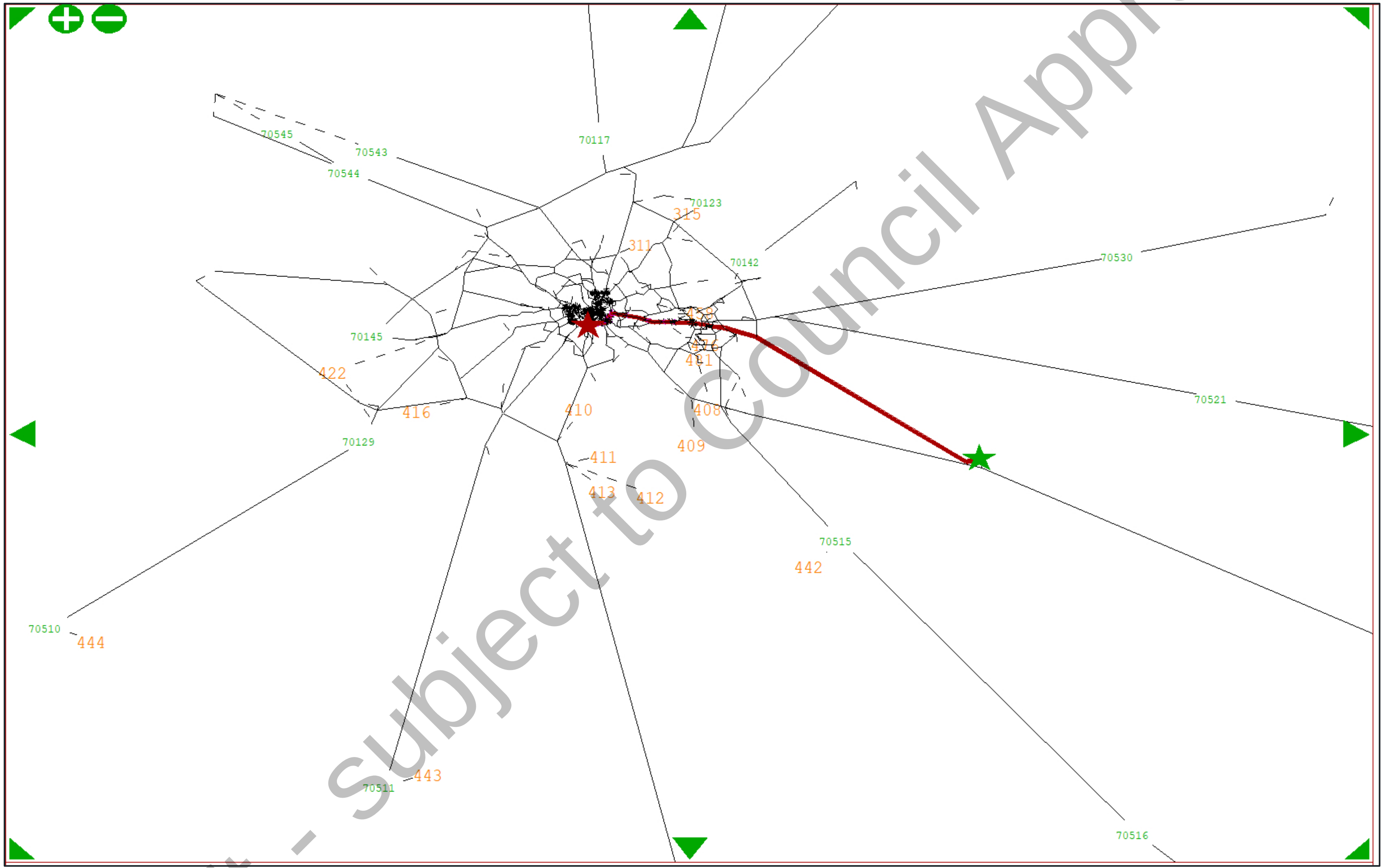
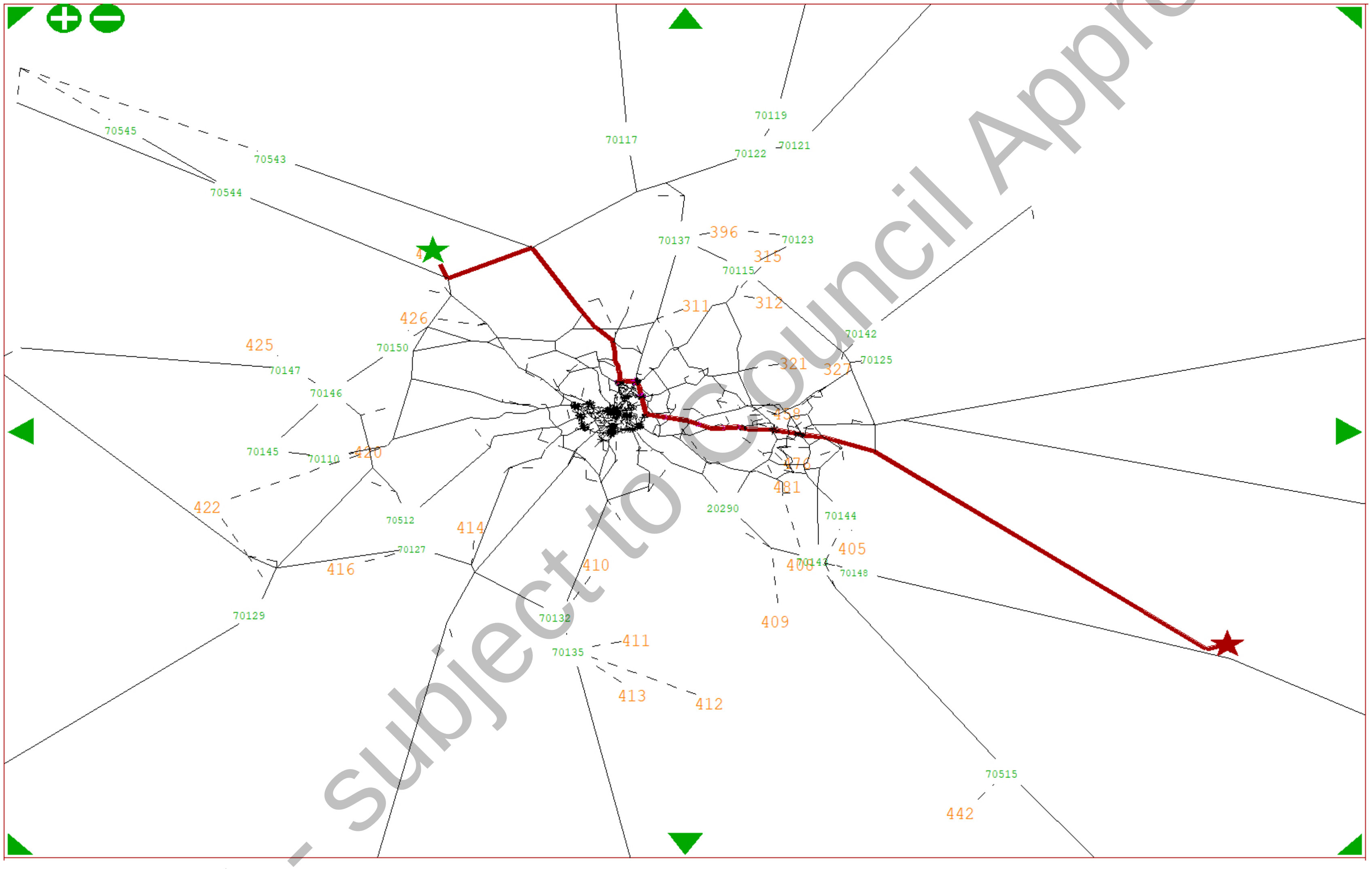


Figure A-18 - Example of a specific OD pair path for Group 7 warning



GROUP 8: DS SPEEDS GREATER THAN THE LIMIT

This group of warnings are similar to Group 7 warnings discussed earlier when the speed between the OD pairs is greater than the limit speed in the Do-Something scenarios. Most of these warnings are applicable for both Group 7 and Group 8.

As in the Do-Minimum scenario, Figure A-19 shows that the origin is in the external (buffer) area and the destination is in the centre, while Figure A-20 shows that both the origin and destination are in the external (buffer) area.

Figure A-19 - Example of a specific OD pair path for Group 8 warning

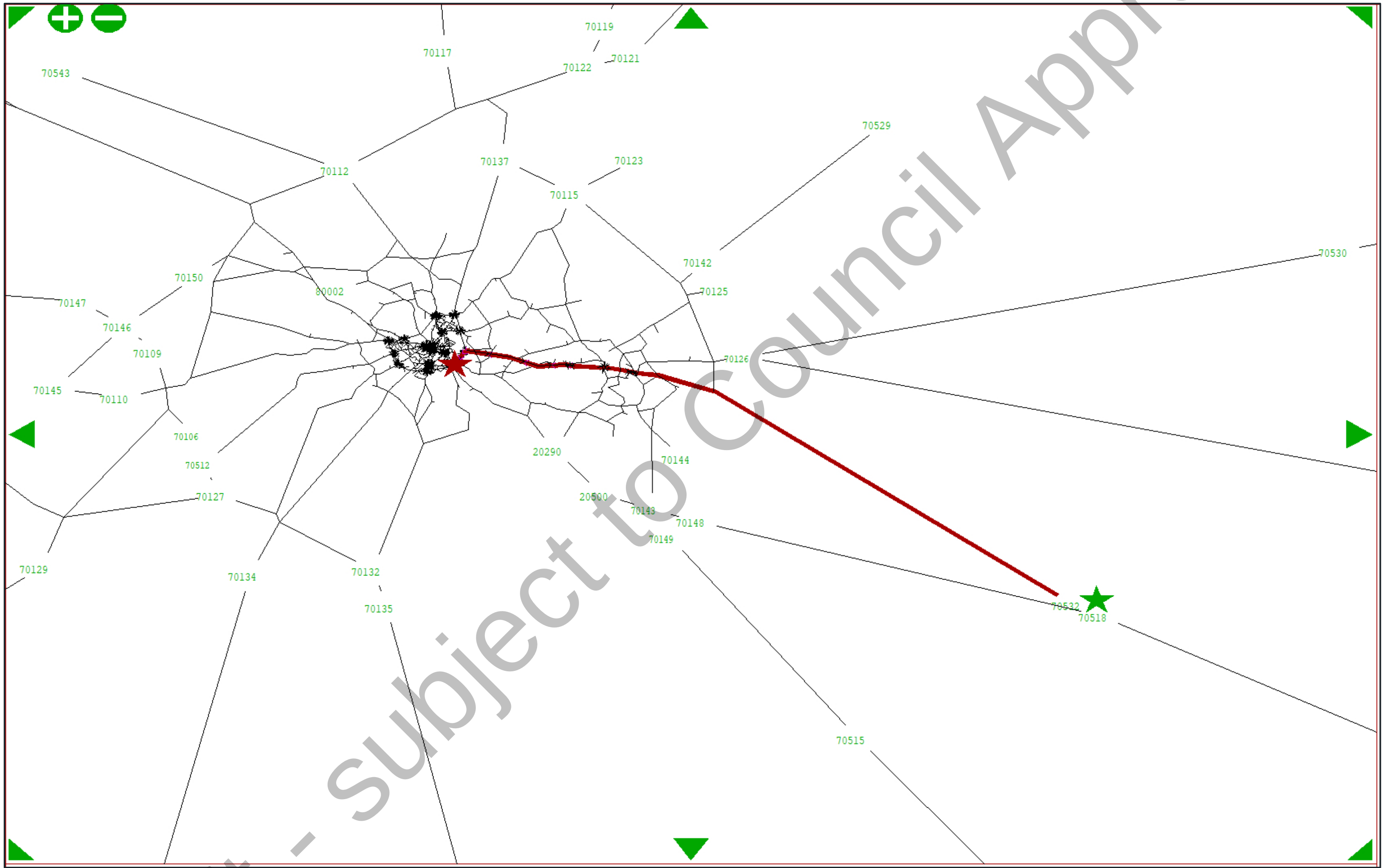
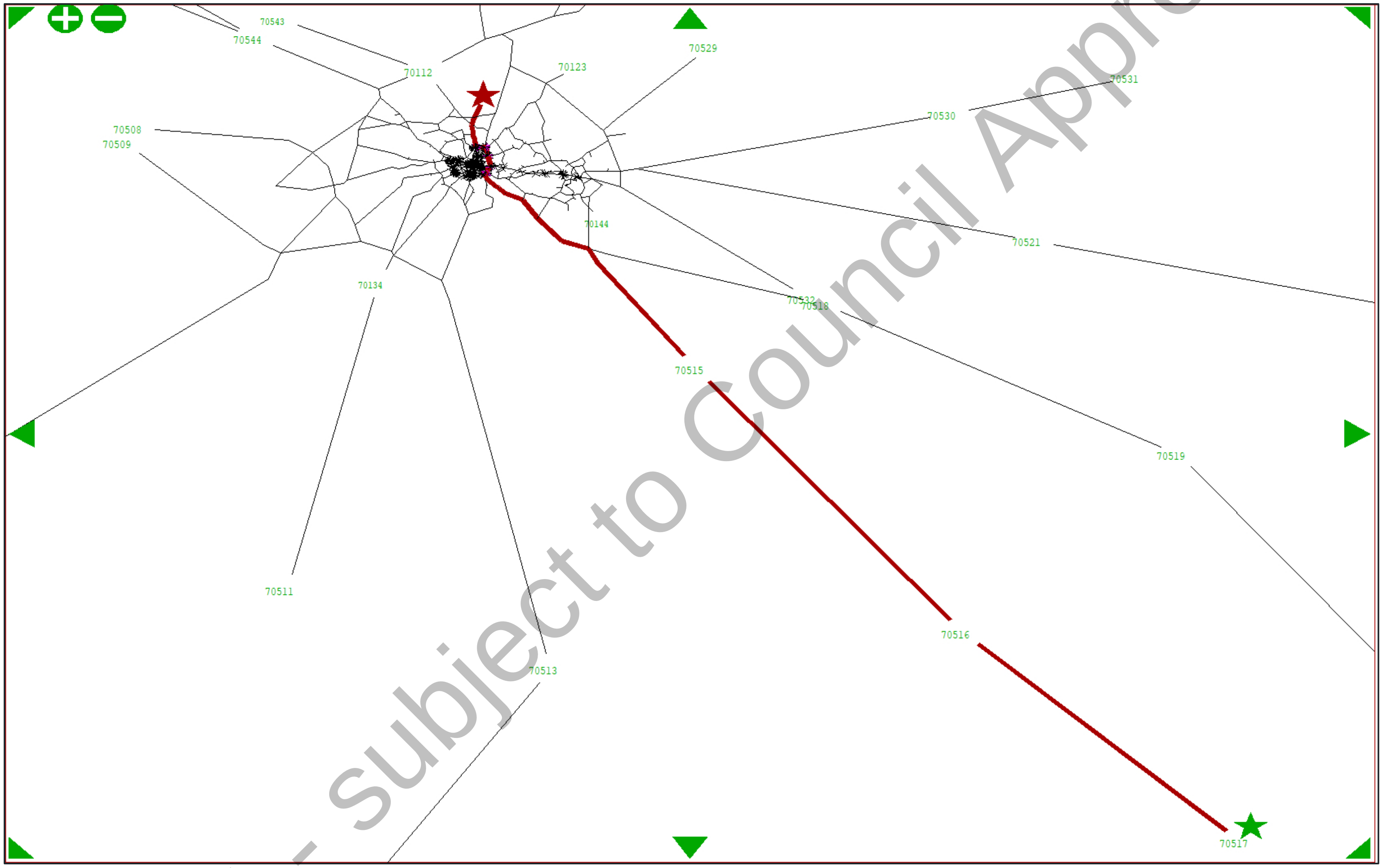


Figure A-20 - Example of a specific OD pair path for Group 8 warning



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