Aberdeen Low Emission Zone **10/06/2021**

Reference number GB01T19I15/220421

NATIONAL LOW EMISSION FRAMEWORK – INTERIM STAGE 2 ASSESSMENT

ABERDEEN
CITY COUNCIL

SYSTRA

ABERDEEN LOW EMISSION ZONE

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IDENTIFICATION TABLE	
Client/Project owner	Aberdeen City Council
Project	Aberdeen Low Emission Zone
Type of document	National Low Emission Framework – Interim Stage 2 Assessment
Type of document	Final Report
Date	10/06/2021
Reference number	GB01T19I15/220421
Number of pages	191

APPROVAL

Version	Name		Position	Date	Modifications
1	Author	David Murtagh	Principal Consultant	25/05/2021	Draft issued to ACC for comment
	Checked by	Callum Guild	Associate Engineer	25/05/2021	
	Approved by	David Murtagh	Principal Consultant	25/05/2021	
2	Author	David Murtagh	Principal Consultant	10/06/2021	Final Document
	Checked by	Callum Guild	Associate Engineer	10/06/2021	
	Approved by	Boris Johansson	Director	10/06/2021	

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1. INTRODUCTION

1.1 National Low Emission Framework – Interim Stage 2 Assessment

1.1.1 In September 2017, the Scottish Government, in their Programme for Government, committed to the introduction of Low Emission Zones (LEZs) into Scotland's four biggest cities (Glasgow, Edinburgh, Aberdeen and Dundee) by 2020. Due to the impact of the COVID-19 pandemic in 2020 and 2021, plans to implement LEZs were temporarily paused with an indicative timeline for the introduction moved to between February 2022 and May 2022.

1.1.2 An LEZ is a scheme under which individuals will be prohibited from driving vehicles which fail to meet specified emissions standards within a designated geographical area in contravention of the terms of the scheme as proposed by a local authority.

1.1.3 Low Emission Zones are included in the Transport (Scotland) Act which received Royal Assent in November 2019. The Act provides the legislative framework for Scottish local authorities to design, establish and operate nationally consistent LEZs. It allows the Scottish Government to set consistent national standards for a number of key aspects including emissions, penalties, exemptions and parameters for grace periods. Local authorities will then have the powers to create, enforce, operate or revoke a LEZ in their areas and to design the shape, size and vehicle scope of their low emission zone.

1.1.4 The accompanying LEZ Regulations were laid in Parliament in January 2021, thereby allowing Scottish Ministers to set nationally consistent standards (Regulations) on LEZ matters specified in the Act (e.g. emission standards, penalties and exemptions, statutory consultees). There are two sets of regulations for LEZs in Scotland. The Low Emission Zones (Emission Standards, Exemptions and Enforcement) (Scotland) Regulations 2021 cover the topics of emission standards, exemptions, penalty charge rates, and enforcement. The Low Emission Zones (Scotland) Regulations 2021 cover the topics of consultation, publication and representations, examinations, approved devices, accounts and amending or revoking LEZs.

1.1.5 An assessment and appraisal process to inform the size and scope of Aberdeen's LEZ follows the National Low Emission Framework (NLEF) guidance. The NLEF is "*an air quality-focused, evidence-based appraisal process developed to help local authorities consider transport related actions to improve local air quality, where transport is identified as the key contributor to air quality problems"* (NLEF, 2019).

1.1.6 The NLEF is a two stage process consisting of the following elements:

- Stage 1 – Screening
- Stage 2 – Assessment

1.1.7 The NLEF Stage 1 screening should review Aberdeen's Local Air Quality Management and build an evidence base to assist in the decision of whether a LEZ is appropriate for an Air Quality Management Area (AQMA) and subsequently inform the appraisal and implementation of Aberdeen's LEZ through the Stage 2 Assessment process. Transport Scotland advised Aberdeen City Council (ACC) that NLEF Stage 1 was not formally required as Aberdeen are committed to delivering a LEZ for the city as a result of the Programme for Government commitment.

1.1.8 A first Interim NLEF Stage 2 Assessment Report (*Aberdeen Low Emission Zone, National Low Emission Framework Interim Stage 2 Report, SYSTRA 2020)* was published in June 2020. The report provided an evidence base and policy review from which came the identification of the LEZ objectives and the LEZ options for stakeholder and public consultation and detailed testing through local traffic and air quality models.

1.1.9 This second Interim NLEF Stage 2 Assessment Report builds on the first interim report and incorporates findings from public and stakeholder engagement and detailed traffic modelling to identify a final LEZ option for Aberdeen.

1.1.10 The final Aberdeen LEZ option identified in this second Interim NLEF Stage 2 Report will then be subject to further stakeholder and public consultation, as set out in the LEZ Regulations. It will also be subject to detailed impact and environmental assessments (Strategic Environmental Assessment, Integrated Impact Assessment, Business and Regulatory Impact Assessment) and be assessed in the National Modelling Framework (NMF) Aberdeen City Air Quality Model before the NLEF process is finalised and a final NLEF Stage 2 Report is prepared. It is expected that these tasks will be complete by autumn 2021.

1.1.11 This Interim NLEF Stage 2 Assessment Report is structured as follows:

1. Introduction
2. Background of Aberdeen's LEZ
3. The Policy Framework for Aberdeen's LEZ
4. Air Quality in Aberdeen
5. National Modelling Framework Scenario Modelling
6. Objectives of Aberdeen's LEZ
7. LEZ Option Generation
8. LEZ Option analysis and emerging options for consultation and detailed modelling
9. LEZ Public & Stakeholder Engagement
10. LEZ Traffic Modelling and Appraisal
11. Final recommended LEZ Option for Aberdeen

2. ABERDEEN LOW EMISSION ZONE

2.1 Background

2.1.1 The Environment Act 1995 requires all local authorities in the UK the statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives for a number of pollutants. The process of review and assessment of air quality undertaken by local authorities is set out under the Local Air Quality Management (LAQM) regime.

2.1.2 Where the results of the review and assessment process highlight problems in meeting the objectives for air quality, the authority is required to declare an Air Quality Management Area (AQMA). Following the declaration of an AQMA, the local authority is then required to produce an Air Quality Action Plan (AQAP) which sets out measures that it will implement to work towards achieving the air quality objectives.

2.1.3 In 2001 ACC first declared part of the City Centre (Union Street and Market Street) an Air Quality Management Area (AQMA) due to predicted exceedances of the annual mean national air quality objective for nitrogen dioxide (NO_2). The AQMA has been expanded several times since its declaration and two further AMQAs have since been declared in the city for the Anderson Drive/Haudagain roundabout/Auchmill Road corridor and the Wellington Road corridor (Queen Elizabeth Bridge/Balnagask Road).

2.1.4 Chapter 4 details the development of the AQMAs in Aberdeen and its current air quality issues and concludes the focus of the NLEF appraisal for Aberdeen's LEZ should be the city centre AQMA, as shown in Figure 2.1.

Figure 2.1: Aberdeen City Centre AQMA for NO_2 and PM_{10}

2.1.5 The AQAP provide the mechanism by which local authorities, in collaboration with national agencies and others, will state their intentions for working towards the air quality objectives using the powers they have available. ACC's AQAP includes a series of measures that they will introduce in pursuit of the Air Quality Standards (AQS). The principal aim of the AQAP is to minimise the effects of air pollution on human health within the local authority area using all reasonable measures, within reasonable time frames, and by working towards achieving the AQS.

2.1.6 Despite improvements in air quality since the introduction of the AQAP, there remain several locations in the AQMA where exceedances of emissions exist and where the AQS are not being met. The number of exceedances of the NO_2 annual mean objective has decreased from 11 in 2018 to 8 in 2019. The 2020 Air Quality Annual Progress Report (APR) for Aberdeen City Council, contains the latest (2019) information on air quality in Aberdeen and is summarised in Chapter 4

2.1.7 A LEZ, and any associated measures are therefore being introduced in the city to accelerate Aberdeen's required compliance with the AQS.

2.2 Legislative Framework and operation of a LEZ

2.2.1 Low Emission Zones are included in the Transport (Scotland) Act 2019 which received Royal Assent in November 2019. The Act provides the legislative framework for Scottish local authorities to design, establish and operate nationally consistent LEZs. It allows the Scottish Government to set consistent national standards for a number of key aspects including emissions, penalties, exemptions and parameters for grace periods. Local authorities have the powers to create, enforce, operate or revoke a LEZ in their areas and to design the shape, size and vehicle scope of their low emission zone.

2.2.2 The accompanying LEZ Regulations were laid in Parliament in January 2021, thereby allowing Scottish Ministers to set nationally consistent standards (Regulations) on LEZ matters specified in the Act (e.g. emission standards, penalties and exemptions, statutory consultees). There are two sets of regulations for LEZs in Scotland. The Low Emission Zones (Emission Standards, Exemptions and Enforcement) (Scotland) Regulations 2021 cover the topics of emission standards, exemptions, penalty charge rates, and enforcement. The Low Emission Zones (Scotland) Regulations 2021 cover the topics of consultation, publication and representations, examinations, approved devices, accounts and amending or revoking LEZs.

2.2.3 The Transport (Scotland) Act 2019 section 6(4)(a) provides the powers to specify LEZ emission standards for vehicles in the Regulations and allows all Scottish LEZs to operate to a consistent national level. A person may not drive a vehicle on a road within a LEZ unless that vehicle meets the specified emission standard. Vehicles that fail to comply with the LEZ emission standard will be subject to LEZ enforcement measures once any LEZ grace period has ended. The LEZ emission standards are:

- Euro VI emission standards for buses, coaches and heavy good vehicles with diesel engines, with retrofitted vehicles to this standard also being acceptable (Euro VI vehicle registrations from 2013)
- Minibuses, large vans, taxis and cars are set at the Euro 6 for diesel and Euro 4 for petrol vehicles (Euro 6 diesel vehicle registrations in 2015, Euro 4 petrol vehicles in 2006).
- Euro 3 for Motorcycles and Mopeds

2.2.4 Section 6(4)(a) of the Transport (Scotland) Act 2019 enables exemptions to be set consistently across Scotland. ACC will have no ability to vary or choose from the national LEZ exemptions listed in Regulation 3 of the LEZ Regulations and outlined in Table 2.1. ACC are therefore required to operate their LEZ in compliance with the exemption list, so that there is national consistency in its application.

Table 2.1 : National LEZ Exemptions

Vehicle type of classification	Description
Emergency Vehicles	For or in connection with the exercise of any function of:
	the Scottish Ambulance Service,
	the Scottish Fire and Rescue Service,
	Her Majesty's Coastguard, and
	the National Crime Agency.
Military Vehicles	Vehicles belonging to any of Her Majesty's forces; or used for the purposes of any of those forces
Vehicles of Historic Interest	Vehicles which are 30 years old or older, are no longer in production and historically preserved or maintained
Vehicles for Disabled Persons	Vehicles registered with a 'disabled' or 'disabled passenger vehicles' tax class
	Vehicles being used for the purposes of the 'Blue Badge Scheme'.
Showman Vehicles	Highly specialised vehicles used for the purposes of travelling showmen, where the vehicle is used during the performance, used for the purpose of providing the performance or used for carrying performance equipment.

2.2.5 The Transport (Scotland) Act 2019 requires a LEZ to specify a grace period before penalty enforcement of the scheme. Section 15 details the scope and time-limits of the grace period. The grace period applicable to non-residents must expire:

- not less than 1 year after it (LEZ declaration) begins, and
- not more than 4 years after it begins.

2.2.6 The grace period applicable to residents (whose registered address is inside the zone) must expire not more than 2 years after the expiry of the grace period applicable to non-residents.

2.2.7 Section 6(4)(a) of the Transport (Scotland) Act 2019 enables penalty charges to be set, based on the vehicle class, and sets out the circumstances in which penalty charges can be subject to a discount or surcharges or to escalate the penalties over time. The LEZ Regulation 4 and Schedule 4 has set 'tiers' of penalties based on a pre-set number of Penalty Charge Notices (PCNs) being issued. The tier structure is outlined in Table 2.2

Table 2.2 : Proposed penalty charge structure for a non-compliant, non-exempt vehicles in a LEZ

Vehicle Category / Tier	Tier				
	1	2	3	4	5
Car, Taxi and Private Hire	£60	£120	£240	£480	£480
Minibus	£60	£120	£240	£480	£960
Light goods vehicles	£60	£120	£240	£480	£480
Bus or Coach	£60	£120	£240	£480	£960
Heavy goods vehicles	£60	£120	£240	£480	£960
Motorcycle or Mopeds	£60	£120	£240	£480	£480
Special purpose vehicles	£60	£120	£240	£480	£480

2.2.8 Section 8 of the Transport (Scotland) Act 2019 also enables the enforcement of LEZ schemes. The LEZ will be enforced through Automatic Number Plate Recognition (ANPR) cameras with the LEZ Regulations Schedule 6 detailing the approved devices.

2.3 National Low Emission Framework & National Modelling Framework

2.3.1 The National Low Emission Framework (NLEF) guidance, published in January 2019, states that NLEF *is an air quality-focused, evidence-based appraisal process developed to help local authorities consider transport related actions to improve local air quality, where transport is identified as the key contributor to air quality problems (*NLEF, 2019).

2.3.2 The guidance states that the aim of the NLEF is to improve local air quality in areas where Scottish Air Quality Objectives (AQOs) are exceeded, or likely to be exceeded, and transport is identified as the key contributor. Local authorities that have declared AQMAs should have regard to the NLEF when developing their air quality action plans and Low Emission Zones.

2.3.3 The NLEF appraisal process provides a consistent approach that can be applied across Scotland to inform decisions on transport-related actions to improve local air quality. It is designed to support local authorities in considering transport-related issues in the context of local air quality management and help develop evidence to support consideration of the introduction of an LEZ as an appropriate option to improve air quality.

2.3.4 It is intended to be a two stage process consisting of screening and assessment. The initial screening stage should be completed by local authorities that have identified air quality problems (where transport is the primary cause) and declared an AQMA.

2.3.5 As the Scottish Government is committed to delivering a LEZ in Scotland's four biggest cities (Glasgow, Edinburgh, Dundee and Aberdeen) through its Programme for Government, the NLEF Stage 1 screening was not utilised to determine if a LEZ is required in Aberdeen but used to review Aberdeen's Local Air Quality Management and build an evidence base to inform the appraisal and implementation of Aberdeen's LEZ through the Stage 2 Assessment process. The NLEF Stage 1 process is therefore used as a tool to build a suitable evidence base to assess all potential LEZ options.

2.3.6 NLEF Guidance describes the following key steps that should be undertaken as part of the Stage 2 Assessment:

1. Define the objectives for the potential LEZ
2. Assess the impact of potential LEZ options with regard to air quality using the National Modelling Framework Aberdeen City Model
3. Identify the preferred option, including consideration of geographical extent and scope of vehicles to be included
4. Stakeholder input and consultation
5. Consider the wider impacts of the preferred option (e.g. traffic and air quality modelling, Strategic Environmental Assessment, Equality Impact Assessment)

2.3.7 An Interim NLEF Stage 2 Assessment Report (*Aberdeen Low Emission Zone, National Low Emission Framework Interim Stage 2 Report, SYSTRA 2020)* was published in June 2020 and detailed the identification of the LEZ objectives and a set of LEZ options (steps 1-3) for stakeholder and public consultation, detailed testing through local traffic and air quality models and wider impact assessments of the preferred option (steps 4-5). The first Interim Stage 2 Report did not include results from the consultation period or the detailed testing.

2.3.8 At Stage 2, the National Modelling Framework (NMF) supports the identification of the scope and key contributors to air quality issues and provides the evidence to help assess potential benefits of transport-related actions to address those issues, with a focus on the introduction of an LEZ. The NMF Aberdeen City Air Quality Model has been utilised to provide high level impacts from the inclusion of particular vehicles types in a LEZ and to inform the appraisal process of the emerging LEZ options.

2.3.9 It should be noted that SEPA, who develop and run the National Modelling Framework (NMF) Aberdeen City Air Quality Model, were subject to a cyber-attack in late 2020 and detailed NMF analysis is delayed and cannot currently be utilised in the final LEZ option assessment at this stage. Any final LEZ option will however be assessed in the NMF prior to submission to Scottish Minsters, subject to the availability of the NMF Aberdeen City Model.

2.3.10 This second Interim NLEF Stage 2 Assessment Report builds on the first interim report and incorporates findings from public and stakeholder engagement and detailed traffic modelling to identify a final LEZ option for Aberdeen.

2.3.11 The final LEZ option identified in the second Interim NLEF Stage 2 Report will then be subject to further stakeholder and public consultation, as set out in the LEZ Regulations. It will also be subject to detailed impact and environmental assessments (SEA, IIA, BRIA) and be assessed in the NMF Aberdeen City Air Quality Model before the NLEF process is finalised and a final NLEF Stage 2 Report is prepared. It is expected that these tasks will be complete by autumn 2021.

2.4 Covid-19 pandemic

2.4.1 Due to the impact of the COVID-19 pandemic in 2020 and 2021, plans to implement LEZs were temporarily paused with an indicative timeline for the introduction moved to between February 2022 and May 2022. The LEZ Leadership Group, which includes Scottish Ministers and representatives from Glasgow City Council, The City of Edinburgh Council, Dundee City Council, Aberdeen City Council, Public Health Scotland and SEPA, agreed the indicative timeframe to introduce LEZs across Scotland's four largest cities.

2.4.2 It is recognised that the Covid-19 pandemic has had an unprecedented impact on society, including on the wider environment and the economy. Transport Scotland and ACC recognise that the Covid-19 pandemic may significantly influence future travel demand and in turn emissions attributed to road transport. Transport Scotland commissioned a study to consider the uncertainty over what travel will look like after the Covid-19 pandemic has ended. Outcomes from this study are summarised in Chapter 14 and used to inform the final LEZ Option.

2.4.3 In light of the difficulties faced by many throughout 2020 and 2021, particularly, in the context of an Aberdeen city centre LEZ, city businesses and bus operators, ACC were keen to understand the level of support for the introduction of a LEZ in the city post pandemic and gauge the impact the pandemic may have had on businesses and bus operators in preparing for its introduction. As a result, additional consultation on this issue was undertaken in March 2021, with the outcomes summarised in Chapter 11 and used to inform the final LEZ Option detail.

3. POLICY FRAMEWORK

3.1 Introduction

3.1.1 Activities relating to monitoring and management of air quality in Scotland are primarily driven by European (EU) legislation. It is therefore important to review EU legislation and its influence on UK and Scottish air quality policy. A review of Scottish air quality legislation and regulations will set out the specific context in which the delivery of Aberdeen's Low Emission Zone will be delivered.

3.1.2 Low Emissions Zones positioning in the EU, UK and Scottish legislation is shown in Figure 3.1

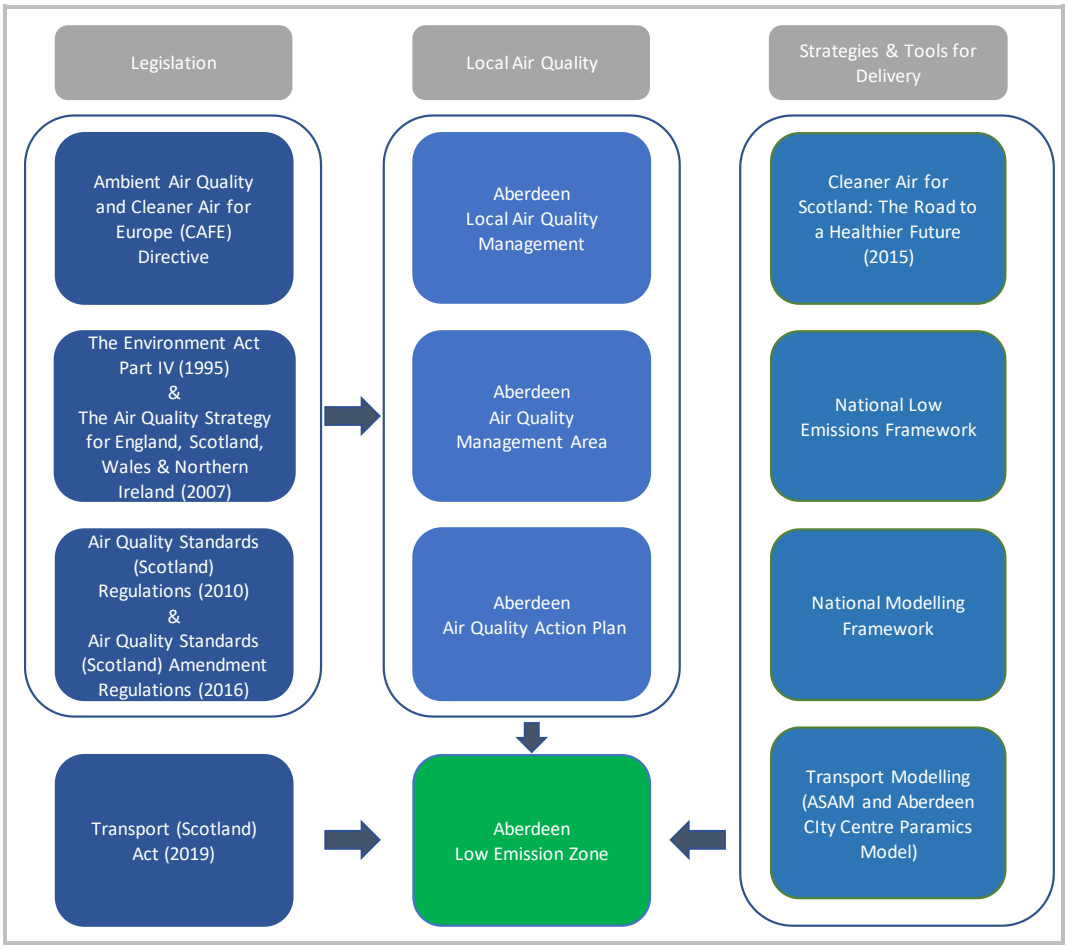

Figure 3.1 : Low Emission Zones Legislation

3.1.3 There are also a number of related national, regional and local policies and strategies that can influence and be influenced by, the delivery of Aberdeen's Low Emission Zone. Many of these policies and strategies are focused on transportation issues, and may help contribute to overall improvements in air quality in Aberdeen's AQMAs.

3.2 Air Quality Legislation

European Air Quality Legislation

3.2.1 The **Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive** (2008/50/EC) establishes air quality objectives for improving human health and environmental quality up to 2020. It also specifies ways of assessing these and of taking any corrective action if the standards are not met. The directive includes the following key elements:

- Thresholds, limit values and target values are set to assess each pollutant covered by the directive: sulphur dioxide, nitrogen dioxide, particulate matter, lead, benzene and carbon monoxide. National authorities designate specific bodies to carry out these tasks using data collected at selected sampling points.
- Where pollution levels in any particular area are higher than the thresholds, air quality plans must be introduced to correct the situation. These may include specific measures to protect sensitive groups, such as children. If there is a risk that pollution levels may exceed the thresholds, short-term action plans to reduce road traffic, construction works or certain industrial activities, for instance, must be implemented to head off the danger.
- National authorities must ensure that not only the public, but also environmental, consumer and other relevant organisations, including health care bodies and industry federations, are kept informed of the ambient air quality(i.e. the outdoor air) in their area.
- Governments of EU countries must publish annual reports on all the pollutants covered by the legislation.

3.2.2 The air quality objectives defined in CAFE have been assessed and reset at regular intervals. The 2013 **Clean Air Programme for Europe** (COM(2013)918) reconfirmed the EU objectives to achieve full compliance with existing air quality standards across the EU as soon as possible and set objectives for 2020 and 2030. The 2016 **National Emissions Ceiling Directive** (2016/2284/EU) revised the reduction targets to include new limits that need to be met in 2020 and 2030, and an additional pollutant – fine particulate matter ($PM_{2.5}$).

UK Air Quality Legislation

3.2.3 The Environment Act 1995: Part IV requires the UK government and devolved administrations to produce a national air quality strategy, with the devolved national administrations responsible for meeting EU Directive air quality limit values.

3.2.4 The most recent version of this strategy, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (UK Government, 2007), defines the roles of central and local government, Scottish Environment Protection Agency (SEPA), industry, business, transport, individuals and other groups in meeting air quality (EU) limits for the ten main pollutants (particulate matter (PM_{10} & $PM_{2.5}$), oxides of nitrogen (NOx), ozone (O3), sulphur dioxide (SO2), Hydrocarbons (PAHs), benzene, 1,3-butadiene, carbon monoxide (CO), lead (Pb), and ammonia (NH3)). Local authorities are required to monitor air quality, and for areas where the air quality limits are not met the relevant authority must declare it an Air Quality Management Area (AQMA) and draw up an action plan aimed at reducing levels of the pollutant.

3.2.5 The Air Quality Standards (Scotland) Regulations 2010 transpose the Ambient Air Quality and CAFE Directive requirements (2008/50/EC) into Scottish legislation. These limits are identical across the UK and achievement is a mandatory requirement for Member States. Domestic objectives have also been set under the Environment Act 1995 and these are set out in the Air Quality (Scotland) Regulations 2000, the Air Quality (Scotland) Amendment Regulations 2002 and the Air Quality (Scotland) Amendment Regulations 2016. In contrast to the EU requirements, Scotland has set stricter levels for PM_{10} and $PM_{2.5}$. In April 2016, the Scottish Government became the first country in Europe to adopt the WHO recommended guideline value for $PM_{2.5}$ of 10 $\mu g/m^3$ annual mean.

3.2.6 A summary of the air pollutant limits and guidelines in Scotland is detailed in Table 3.1. Local authorities are responsible for achieving these objectives, and the implementation of this legislation will require all local authorities in Scotland to add $PM_{2.5}$ to the list of other air pollutants currently being monitored.

Table 3.1 : Air Pollutant Limits and Guidelines

Pollutant	Air Quality Objective	
	Concentration	Measured as
Nitrogen Dioxide (NO2)	200 µg/m³ (not to be exceeded more than 10 times a year)	1-hour mean
	40 µg/m³	Annual mean
Coarse Particulate Matter (PM10)	50 µg/m³ (not to be exceeded more than 7 times a year)	24-hour mean
	18 µg/m³	Annual mean
Fine Particulate Matter (PM2.5)	10 µg/m³	Annual mean
Sulphur Dioxide (S02)	350 µg/m³ (not to be exceeded more than 24 times a year)	1-hour mean
	125 µg/m³ (not to be exceeded more than 3 times a year)	24-hour mean
	266 µg/m³ (not to be exceeded more than 35 times a year)	15 minute mean
Benzene	3.25 µg/m³	Running annual mean
1,3 Butadiene	2.25 µg/m³	Running annual mean
Carbon Monoxide (CO)	10.0 mg m³	Running 8-hour mean
Lead	0.25 µg/m³	Annual mean

Local Air Quality Management

3.2.7 Through the Environment Act 1995 Part IV, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives for a number of pollutants. The process of review and assessment of air quality undertaken by local authorities is set out under the **Local Air Quality Management (LAQM) regime**.

3.2.8 Where the results of the LAQM review and assessment process highlight that problems in the attainment of objectives for air quality will arise, the authority is required to declare an **Air Quality Management Area (AQMA)**.

3.2.9 Following the declaration of an AQMA, the local authority is then required to produce an **Air Quality Action Plan** which sets out measures that the local authority, and any other key stakeholders, will implement to work towards achieving the air quality objective levels for the pollutants that have exceeded the objectives levels.

3.2.10 Full details of Aberdeen City Council's Local Air Quality Management can be found in Chapter 4.

Cleaner Air for Scotland: The Road to a Healthier Future

3.2.11 Cleaner Air for Scotland – The Road to a Healthier Future (CAFS) is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland's legal responsibilities.

3.2.12 A series of actions across a range of policy areas are outlined, including a number of key initiatives:

- A National Low Emission Framework

- A National Modelling Framework
- Adoption of World Health Organization guideline values for particulate matter in Scottish legislation

National Low Emission Framework

3.2.13 The National Low Emission Framework (NLEF) guidance, published in January 2019, underpins the development of Aberdeen's LEZ. It is summarised in Chapters 2 and 4.

National Modelling Framework

3.2.14 The National Modelling Framework (NMF) is a key strand of CAFS which will develop a national, two-tiered modelling approach for air quality within Scotland with the development of Regional and Local air quality models. The NMF aims to standardise data collection requirements, analysis processes and presentation of outputs to provide local authorities with information required to appraise measures for improving urban air quality.

3.2.15 The development of Regional NMF models will support decision-making around placemaking and transport planning in relation to air quality management across city regions.

3.2.16 Local NMF models will represent a standardised approach to modelling air quality for local authorities undertaking a stage two NLEF assessment. The focus will be on identifying detailed traffic-related source apportionment across the appropriate area, with the outputs providing quantitative evidence to support decision-making, including on the potential benefits of introducing LEZs to improve air quality. It is expected that local NMF models will provide a significant proportion of the quantitative evidence required within the NLEF appraisal process, producing outputs and visualisation tools to aid decision-making.

3.2.17 High level scenario testing is undertaken as part of the NLEF Stage 2 Assessment and is detailed in Chapter 5 of this report.

3.2.18 NLEF Guidance suggests a summary of the current NMF Aberdeen City model should be included in Stage 1 screening. This should be informed by the Air Quality Evidence Report, not yet published by SEPA. Given the timeline for the development of the LEZ for Aberdeen and the Stage 2 reporting of the NMF, no summary of the NMF is provided here. Subsequent NLEF Stage 1 Screenings, if required, will be able to provide detail of the NMF Aberdeen City model.

Transport (Scotland) Act

3.2.19 The Transport (Scotland) Act 2019 covers a wide range of transport issues and aims to establish consistent standards across all local authorities in order to tackle existing and future transport problems.

3.2.20 The main provisions include:

- The creation, regulation and enforcement of low emission zones.
- Extending the powers of local authorities to run buses and develop bus partnership plans. The aim is to allow councils to act more flexibly to improve services, either by working with bus companies or by stepping in and running services themselves.
- Extending existing ticketing arrangements and schemes to include connecting services. Scottish Ministers will have the power to set a national technological standard for smart ticketing and set up the National Smart Ticketing Advisory Board.

- A national ban on pavement and double parking and provision to make it easier for local authorities to enforce the ban.
- A regulatory environment which encourages getting road work reinstatements right first time. There will be better information about road works, and a consistent approach to safety at road works sites regardless of who is carrying them out.

3.2.21 The Act received Royal Assent in November 2019.

Low Emission Zones

3.2.22 The Transport (Scotland) Act enables the creation and civil enforcement of low emission zones by local authorities, and will allow the Scottish Government to set consistent national standards for a number of key aspects including, but not limited to, emissions, penalties, certain exemptions and parameters for grace periods for low emission zones.

3.2.23 As detailed in the Act, a low emission zone is a scheme under which individuals driving vehicles which fail to meet specified emission standards will be prohibited from driving those vehicles in contravention of the terms of the scheme as proposed by a local authority within a designated geographical area. Typically, where a registered keeper of a vehicle breaches this rule, a penalty charge will be payable unless the vehicle is exempt (noting that drivers of car club and hire cars will also be considered too).

3.2.24 The Act will therefore:

- Provide local authorities with powers to create, enforce, operate or revoke a low emission zone in their area and to design the shape, size and vehicle scope of their low emission zone
- Set specified emission standard for a LEZ
- Allow local authorities to set grace-periods to allow those wishing to drive within the low emission zone an opportunity to upgrade their vehicle to a less polluting model (either by replacing it or having it modified) before penalty charges begin to be applied
- Give local authorities the ability to promote permanent and/or time-limited exemptions from the requirements of a low emission zone, where certain requirements are met to a strict criteria
- Enable Scottish Ministers to specify by regulations the amount of the penalty charge, with the ability to specify different levels of penalty charge depending on, for example, the class of vehicle, the emission standard of the non-compliant vehicle, or whether there are repeated contraventions
- Define how contravention of the low emission zone standards would be handled
- Provide detailed regulations and guidance for local authorities to deliver a consistent approach in how they enforce the new low emission zone requirements
- Set out the rules which will apply to penalty charge notices, such as the form they take, the time allowed for payment, internal review of a notice and/or appeal of the notice to an external adjudicator
- Provide local authorities with powers to create, operate and revoke low emission zones with other councils
- Require local authorities to utilise the money they receive from the enforcement of the new restrictions for ring-fenced purposes, particularly to facilitate the achievement of the low emission zone scheme objectives

3.3 National, Regional and Local Policy Review

National Plans and Policies

National Planning Framework 3

3.3.1 National Planning Framework 3 (NPF3) sets out the Scottish Government's strategy for the long-term development of Scotland's towns, cities and countryside. It guides Scotland's development to 2040, setting out strategic development priorities to support the Scottish Government's central purpose - sustainable economic growth.

3.3.2 Aberdeen and its region are recognised by NPF3 as having a key role as a driver of economic activity and growth within Scotland, where it is recognised that Aberdeen, a key driver for the economy, continues to exceed what may be expected from its population size.

3.3.3 In order to develop this potential, it is considered that there is the need to ensure that:

- The City Investment Plan sets out an ambition "to maintain Aberdeen's position as one of the world's key energy capitals and to maximize its growth potential and diversification into other sectors"
- Investment in new or improved infrastructure reflects economic development priorities and the need to support sustainable growth

3.3.4 To further build on Aberdeen's improvements, the NPF3 strategy for the City is to:

- Explore opportunities from the oil and gas reserves West of Shetland, from decommissioning and deployment of offshore renewables
- Ensure the economic significance of the region is recognised through the need for infrastructure capacity enhancement in the city such as Aberdeen Harbour, Aberdeen Western Peripheral Route (AWPR) and Aberdeen Airport
- Continue to improve the quality of urban living within the City and create a low carbon place
- Further develop connectivity to maintain good internal, national and global connections

3.3.5 The implementation of a Low Emission Zone in Aberdeen may indirectly help the city achieve NPF3 targets on the quality of urban living in Aberdeen. In January 2020, the Scottish Government announced the early engagement period for NPF4 was commencing and cognisance should be of the emerging themes from NP4 as timescales for the delivery of a LEZ allow.

National Transport Strategy 2

3.3.6 The National Transport Strategy 2 (NTS2) for Scotland was published in February 2020 and *advocates a Vision for Scotland's transport system, that will help create great places - a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors (*National transport Strategy 2, Scottish Government, 2020).

3.3.7 NTS 2 is underpinned by four priorities and associated outcomes:

- Reduce inequalities
  - Provide fair access to services we need
  - Be easy to use for all
  - Be affordable for all
- Takes climate action
  - Help deliver a net-zero target
  - Adapt to the effects of climate change
  - Promote greener, cleaner choices
- Help deliver inclusive economic growth
  - Get people and goods where they need to get to

- Be reliable, efficient and high quality
- Use beneficial innovation

- Improve health and wellbeing
  - Be safe and secure for all
  - Enable us to make healthy travel choices
  - Help make our communities great places to live

3.3.8 Overarching all the key priorities, policies and outcomes is the NTS2 approach to the Sustainable Travel Hierarchy in decision making by promoting walking, wheeling, cycling, public transport and shared transport options in preference to single occupancy private car use for the movement of people. NTS2 also promotes efficient and sustainable freight transport for the movement of goods, particularly the shift from road to rail, and improved journey times and connections, to tackle congestion and lack of integration and connections in transport.

3.3.9 The NLEF also has a correlation to the NTS2 key strategic outcomes, which has a particular focus on reducing emissions to tackle climate change, air quality, health improvement, along with cross-over to elements such as congestion and accessibility.

3.3.10 Implementation of a Low Emission Zone in Aberdeen through the NLEF can help the city achieve the required outcomes from the NTS2.

Strategic Transport Projects Review (STPR)

3.3.11 The Strategic Transport Projects Review (STPR), published in December 2008, sets out the Scottish Government's 29 transport investment priorities over the period to 2032.

3.3.12 The STPR supports both the National Planning Framework and the delivery of the strategic outcomes identified in the National Transport Strategy.

3.3.13 STPR has 29 interventions that aim to make a positive contribution towards the Scottish Government's Purpose and Objectives with a number of interventions– rail enhancement between Aberdeen, Inverness and the Central belt, park & choose and access strategies, as well as the delivery of the Aberdeen Western Peripheral Route (AWPR) – having the potential to directly impact on Aberdeen traffic patterns and air quality.

3.3.14 These and wider STPR interventions, such as *Strategic Park & Ride/Park & Choose Strategy, Further Electrification of the Strategic Rail Network*, *Integrated Ticketing* and *Rail Enhancements in the East of Scotland* may have an indirect benefit on Aberdeen's air quality by moving road trips to other modes of transport.

3.3.15 In 2018, the Scottish Government announced STPR2 that will review all interventions in STPR and identify potential transport investment in Scotland over the next 20 years. In February 2021 Transport Scotland published Phase 1 recommendations and associated impact assessment progress reports . It will be important to ensure that the development of Aberdeen's LEZ takes cognisance of any development in STPR2.

Regional Plans and Polices

Aberdeen City and Shire Strategic Development Plan

3.3.16 The approved 2020 Aberdeen City and Shire Strategic Development Plan sets out the vision, principles and objectives for the region and provides the context for the preparation of the Aberdeen and Aberdeenshire Local Development Plans. The 2020 Aberdeen City and Shire Strategic Development Plan was approved by Scottish Ministers in August 2020.

3.3.17 The vision of the Plan is for Aberdeen and Aberdeenshire to be an even more attractive, prosperous and sustainable European city region and an excellent place to live, visit and do business. To contribute to the Scottish Government's central purpose of increasing sustainable economic growth, a number of key aims are defined:

- provide a strong framework for investment decisions which will help to grow and diversify the regional economy in a sustainable manner
- promote the need to use resources more efficiently and effectively whilst protecting and where appropriate enhancing our assets
- take on the urgent challenges of climate change

3.3.18 To support these main aims, the plan also aims to:

- make sure the area has enough people, homes and jobs to support the level of services and facilities needed to maintain and improve the quality of life
- protect and, where appropriate, enhance our valued assets and resources, including biodiversity, the historic and natural environment and our cultural heritage
- help create and support sustainable mixed communities, and the provision of associated infrastructure, which will meet the highest standards of placemaking, urban and rural design, and cater for the needs of the whole population
- encourage opportunities for greater digital connectivity across the City Region
- make the most efficient use of the transport network, reducing the need for people to travel and making sure that walking, cycling and public transport are attractive choices

3.3.19 The Plan identifies four strategic growth areas which will be the main focus for development in the area up to 2040. Aberdeen City is one of these strategic growth areas A City Centre Transformation Zone is identified by this Plan to build on existing work undertaken by the City Centre Masterplan and Delivery Programme (see below) and the Business Improvement District.

3.3.20 The plan introduces a wide range of transport measures to either tackle existing problems or support the growth defined in the Plan's lifetime. The Plan recognises that while congestion is a key factor, reducing the effect of transport on the environment, including improving air quality is also important. In addition to already committed or complete transport projects such as the Aberdeen Western Peripheral Route (AWPR), improvements to the Haudagain Roundabout and a new bridge over the River Don, improvements proposed specifically by the Plan are:

- Enhanced bus service provision through developing cross city bus services, bus stop review and optimisation of services with new bus priority infrastructure
- Additional rail station car parking capacity, improved interchange at Inverurie Station and potential new rail stations to the north and south of Aberdeen
- A range of active travel infrastructure initiatives improving accessibility and a package of behavioural change initiatives encouraging car-sharing, public transport use and active travel
- Junction and operational efficiency enhancements in Aberdeen City Centre and Wellington Road, Persley Bridge & Parkway, Parkhill, A96, Dyce Drive, and Bridge of Dee corridors

3.3.21 The Plan is supported by a number of objectives with several particularly relevant to the introduction of a LEZ in Aberdeen:

- To make sure new development safeguards and, where appropriate, enhances the City Region's historic, natural and cultural assets and is within the capacity of the environment.
- To be a City Region which:

- takes the lead in reducing the amount of emissions and pollutants released into the environment
- mitigates and adapts to the effects of climate change and changing weather patterns
- limits the amount of non-renewable resources it uses
- supports and protects our biodiversity

3.3.22 Cognisance of the aims, objectives and proposals outlined in the Aberdeen City and Shire Strategic Development Plan that identify the strategic growth areas for housing, employment and associated infrastructure projects has to be taken during the LEZ options development through the NLEF Stage 2 appraisal.

The Aberdeen City Region Deal

3.3.23 The Aberdeen City Region Deal is a key delivery mechanism for the Region's Economic Strategy. The Deal brings together Aberdeen City and Aberdeenshire councils, the local business community and the UK and Scottish Government to work together to address the challenges currently facing the Region and to capitalise on the substantial opportunities.

3.3.24 In December 2011, the UK government announced its intention to transfer a range of powers to cities and wider city regions, allowing them to play a vital role in the economic recovery of the country. The City Region Deals allow each city region to unlock financial support and powers from national government, giving local bodies greater control over spending and decision-making.

3.3.25 The Aberdeen City Region Deal is seen as the starting point of a long-term improvement programme providing what is possibly the best opportunity in the UK to build further growth into an already successful regional economy. The Deal aims to have far reaching impacts, not just on the economy, but on regional competitiveness, connectivity, infrastructure, housing, employment and lifestyle, all of which are key elements in attracting and retaining the people we will continue to need to power and support the energy sector.

3.3.26 The Aberdeen City Region Deal is valued to be worth £826.2 million over a ten year period. Significant investment is being provided by UK Government (£125m), Scottish Government (£125m), Aberdeenshire Council (£10m), Aberdeen City Council (£10m), the two Universities in Aberdeen (£23,500), Private Sector and other local economic partners (£532.7m).

3.3.27 Key projects supported in the Deal that may influence or be influenced by a LEZ include:

- Harbour Expansion
  The City Region Deal will contribute towards improved external transport links to the new Aberdeen South Harbour (subject to acceptable business case). The investment of up to £25 million in supporting infrastructure is predicated on the delivery of the core harbour expansion project by Aberdeen Harbour Board.

- Strategic Transport Appraisal
  In order to realise the full potential of the area a transport appraisal will take a 20 year strategic view of the transport implications of the investment unlocked by this Deal across all modes including road and rail. The work includes addressing issues at key gateways into Aberdeen; enabling safe, reliable and attractive connections (road and public transport) along key strategic corridors which promote economic growth; tying together transport infrastructure and development planning/management, on a city/region basis; and facilitating the City Centre Masterplan. Nestrans, building on the work started by the City Regional Deal,

continued working on the development of the new Regional Transport Strategy which will look ahead to 2040 and this is now with Scottish Ministers.

3.3.28 The development of options for Aberdeen's LEZ may look to share wider common aims of the Aberdeen City Regional Deal to ensure the strategy contributes to improvements in air quality.

Nestrans Regional Transport Strategy (2013-2035 Refresh and 2040)

3.3.29 The Nestrans Regional Transport Strategy (RTS) was first approved by Scottish Ministers in 2008. The current adopted strategy is a 2013 RTS Refresh and Nestrans have now finalised the next regional transport strategy for the next twenty years, up to 2040. This new Regional Transport Strategy is currently with Scottish Ministers for consideration.

3.3.30 The current adopted Nestrans Regional Transport Strategy 2013–2035 Refresh was formally approved by the Minister for Transport and Veterans on 16 January 2014. This version of the RTS, sets out the key policies and proposals required to deliver the Vision *of a transport system for the north east of Scotland which enables a more economically competitive, sustainable and socially inclusive society (Nestrans RTS 2013-2035 Refresh, 2014).*

3.3.31 The 2013-2035 RTS has four objectives under Economy, Accessibility, Safety & Social Inclusion, Environment and Spatial Planning. With three particularly relevant to Aberdeen's LEZ.

3.3.32 **Accessibility, Safety and Social Inclusion**: To enhance choice, accessibility and safety of transport for all in the north east, particularly for disadvantaged and vulnerable members of society and those living in areas where transport options are limited.

- To enhance travel opportunities and achieve sustained cost and quality advantages for public transport relative to the car.
- To reduce the number and severity of traffic related casualties and improve personal safety and security for all users of transport.
- To achieve increased use of active travel and improve air quality as part of wider strategies to improve the health of north east residents.

3.3.33 **Environment**: To conserve and enhance the north east's natural and built environment and heritage and reduce the effects of transport on climate, noise and air quality

- To reduce the proportion of journeys made by cars and especially by single occupant cars.
- To reduce the environmental impacts of transport, in line with national targets.
- To reduce growth in vehicle kilometres travelled.

3.3.34 **Spatial Planning**: To support transport integration and a strong, vibrant and dynamic city centre and town centres across the north east.

- To improve connectivity to and within Aberdeen City and Aberdeenshire towns, especially by public transport, walking and cycling.
- To encourage integration of transport and spatial planning and improve connections between transport modes and services.
- To enhance public transport opportunities and reduce barriers to use across the north east, especially rural areas.
- To ensure that all new developments and transport infrastructure improvements give consideration to and make provisions for pedestrians and cyclists as an integral part of the design process.

3.3.35 The Strategy is expressed through three Sub Strategies, reflecting different ways of achieving the objectives and indicators:

1. Improving external connections between the north east and elsewhere, so tackling the reality and perceptions of location, distance, travel time and peripherality and enhancing the performance of the north east as a location.
2. Improving internal connections, enhancing the performance of the north east in economic, social and environmental terms.
3. Strategic policy framework, which indicates areas where measures such as travel awareness, incentives and enforcement can influence travel choice.

3.3.36 The Regional Transport Strategy 2040 will set out an integrated approach to meet future transport needs and bring sustainable improvements to transport across the region between for the next 20 years, up to 2040. The development of options for Aberdeen's LEZ must take cognisance of the RTS to ensure the LEZ complements this key regional strategy.

Nestrans Freight Action Plan 2014 / Freight Distribution Strategy 2018

3.3.37 The Freight action plan sets out how Nestrans and its partners can assist in the delivery of more effective and efficient freight operations, for the wider benefit of the north east of Scotland.

3.3.38 The Freight Distribution Strategy provides a high list of objectives and actions in order to take forward a distribution strategy that will improve major freight movements within Aberdeen and the surrounding region. It's vision is *to enable a freight network for the north east of Scotland that is both economically competitive and sustainable, and that supports a greener, healthier environment for both communities and operators* (Freight Distribution Strategy, Nestrans 2018), covered under three key themes:

- Clean Air
- Efficient Use of Resources
- Provision of appropriate and high quality resources.

3.3.39 Factors affecting the future Freight movement in Aberdeen includes:

- New Bay of Nigg Harbour activity
- Congestion in Aberdeen
- Wellington Road Study – measures to improve HGV efficiency along route
- AWPR opening
- City Centre Masterplan
- Roads Hierarchy
- LEZ

3.3.40 The objectives derived from the strategy include clean air objectives:

- Deliver a routing strategy that ensures freight vehicles are not unnecessarily travelling through Aberdeen City or other towns in the region
- Encourage the use of low emission freight vehicles in the north east
- Encourage the use of low carbon last mile solutions for operators and delivery companies

3.3.41 Movement of freight vehicles in Aberdeen is likely to be key to the operation of any LEZ for the city and understanding of key freight strategies and consultation with freight representatives will be crucial in shaping the LEZ.

Local Plans and Policies and Projects

Aberdeen Local Transport Strategy 2016-2021

3.3.42 The Aberdeen Local Transport Strategy (LTS) 2016-2021 has been developed to set out the policies and interventions adopted by Aberdeen City Council to guide the planning and improvement of the local transport network over the next five years.

3.3.43 The previous LTS was adopted in 2008 and focussed on delivery of the Aberdeen Western Peripheral Route (AWPR) and the opportunities that this new road capacity would afford to reorganise and improve the use of the City's overall road network. Although the 2008 LTS has come to the end of its intended lifespan much of the content was still considered relevant and would continue to be so going into the period from 2016 to 2021. ACC therefore determined, with the AWPR not yet open at the time, that a fundamental change in the overall policy approach was not required; instead a 'refresh', reflective of changes to national, regional and local policy and circumstances since 2008, was considered appropriate.

3.3.44 Given the increasing role of transport in contributing, both positively and negatively, to the health agenda, the vision for the LTS refresh was updated and is now to develop a *sustainable transport system that is fit for the 21st Century, accessible to all, supports a vibrant economy, facilitates healthy living and minimises the impact on our environment*.

3.3.45 Taking into account the Scottish Government's strategic objectives (wealthier and fairer, safer and stronger, smarter, greener, healthier) and the City Council's 'smarter mobility' objectives, the five high-level aims have been updated to:

1. A transport system that enables the efficient movement of people and goods.
2. A safe and more secure transport system.
3. A cleaner, greener transport system.
4. An integrated, accessible and socially inclusive transport system.
5. A transport system that facilitates healthy and sustainable living.

3.3.46 The LTS also has a series of outcomes, with associated indicators and targets, to better enable progress to be measured. By 2021 Aberdeen's transport system should have:

- A. Increased modal share for public transport and active travel;
- B. Reduced the need to travel and reduced dependence on the private car;
- C. Improved journey time reliability for all modes;
- D. Improved road safety within the City;
- E. Improved air quality and the environment; and,
- F. Improved accessibility to transport for all.

3.3.47 The LTS considers transport schemes that are important features of the Strategy and sets these out against a series of high level objectives, relevant to the delivery of a LEZ in Aberdeen:

- **AWPR Objective:** To support the implementation of the Aberdeen Western Peripheral Route (AWPR) and to fully realise the benefits the new road will bring in terms of improving conditions in the City for users of sustainable modes of transport.
  Although the AWPR is now fully open, the above objective is still relevant as the full benefits of the AWPR are still being realised.
  The LTS lists a number of schemes for implementation on key corridors that may influence LEZ option development:

  - Anderson Drive, Bridge of Dee – Haudagain (A92)
    - Circumferential bus route travelling the length of Anderson Drive, with priority at junctions and stops/ interchange facilities along the route

        - Improve and increase the number of pedestrian crossings. Introduce pedestrian phases on existing signalised junctions where they do not exist
        - Parallel cycle lanes and junction improvements for cyclists
        - All roundabouts converted to signals or signalised roundabouts
        - Change signal timings to give greater east-west priority
        - Upgrade junctions to accommodate large vehicles and to improve their manoeuvrability
    - Wellington Road, Queen Elizabeth II Bridge – Charleston (A956)
        - Improve key junctions along the corridor to allow easier manoeuvring of HGVs
    - Peterculter – Holburn Junction (A93)
        - Bus or bus/ high-occupancy vehicle (HOV) lane with junction priority, operational for eastbound vehicles only
        - New cycle/ pedestrian/equestrian lane
    - Mason Lodge – Hutcheon Street (A944)
        - Pedestrian/cycle route from B9119 junction to Berryden Road
        - Alter signalised roundabout timings
        - Extension of bus lane or conversion of existing bus lane to bus/ HOV lane from bus gate on Lang Stracht to Berryden Road, with junction priority for bus and HOV
        - Signalise roundabouts to give greater east-west priority
    - Switchback – Holburn Street (B9119)
        - Extension of existing bus lane or conversion of existing eastbound bus lane to bus/HOV lane to be continuous from A944/ B9119 Switchback junction to Anderson Drive junction, with priority for bus and HOV
        - Junction/ signal changes to allow greater east-west priority

    The LTS notes that any scheme listed will require review in light of AWPR opening and publication of further studies such as the Roads Hierarchy Study.

- **Car Parking Objective**: To develop a car parking regime that sustains and enhances the economic vitality of the City Centre and district shopping centres.

- **Air Quality Objective:** To improve air quality across the City, so that the existing Air Quality Management Areas are revoked and no further Air Quality Management Areas are declared.

- **Ultra-Low Emission vehicles Objective:** To facilitate the uptake of ultra-low and low emission vehicles as a contribution towards improving air quality in the City.

- **Climate Change Mitigation and Adaptation Objective:** To contribute to Aberdeen's carbon emissions targets and develop climate resilient infrastructure.

- **Walking Objective:** To increase the number of people walking, both as a means of travel and for recreation, in recognition of the significant health and environmental benefits it can bring to our citizens.

- **Cycling Objective:** To foster a cycling culture in Aberdeen by improving conditions for cycling in Aberdeen so that cycling becomes an everyday, safe mode of transport for all.

- **Bus Objective:** To increase public transport patronage by making bus travel an attractive option to all users and competitive with the car in terms of speed and cost.

- **Public Realm Objective:** To improve the public realm by prioritising pedestrians, cyclists and public transport with consequent traffic circulation (to enhance environment, aesthetic quality and air quality of the City) for the benefit of shoppers, visitors and residents.

3.3.48 In developing and appraising options for the Aberdeen LEZ it is important to take cognisance of the proposals in the Aberdeen LTS, and any internal updates since 2016, as it guides the planning of and improvements to the local transport network that may directly influence or be influence by a LEZ.

Aberdeen City Centre Masterplan

3.3.49 The Aberdeen City Centre Masterplan (CCMP) was approved by ACC in June 2015. It outlines a 25-year development strategy for the city centre designed to support economic growth by transforming Aberdeen as a place to live, visit, work and do business. Figure 3.2 details the CCMP boundary.

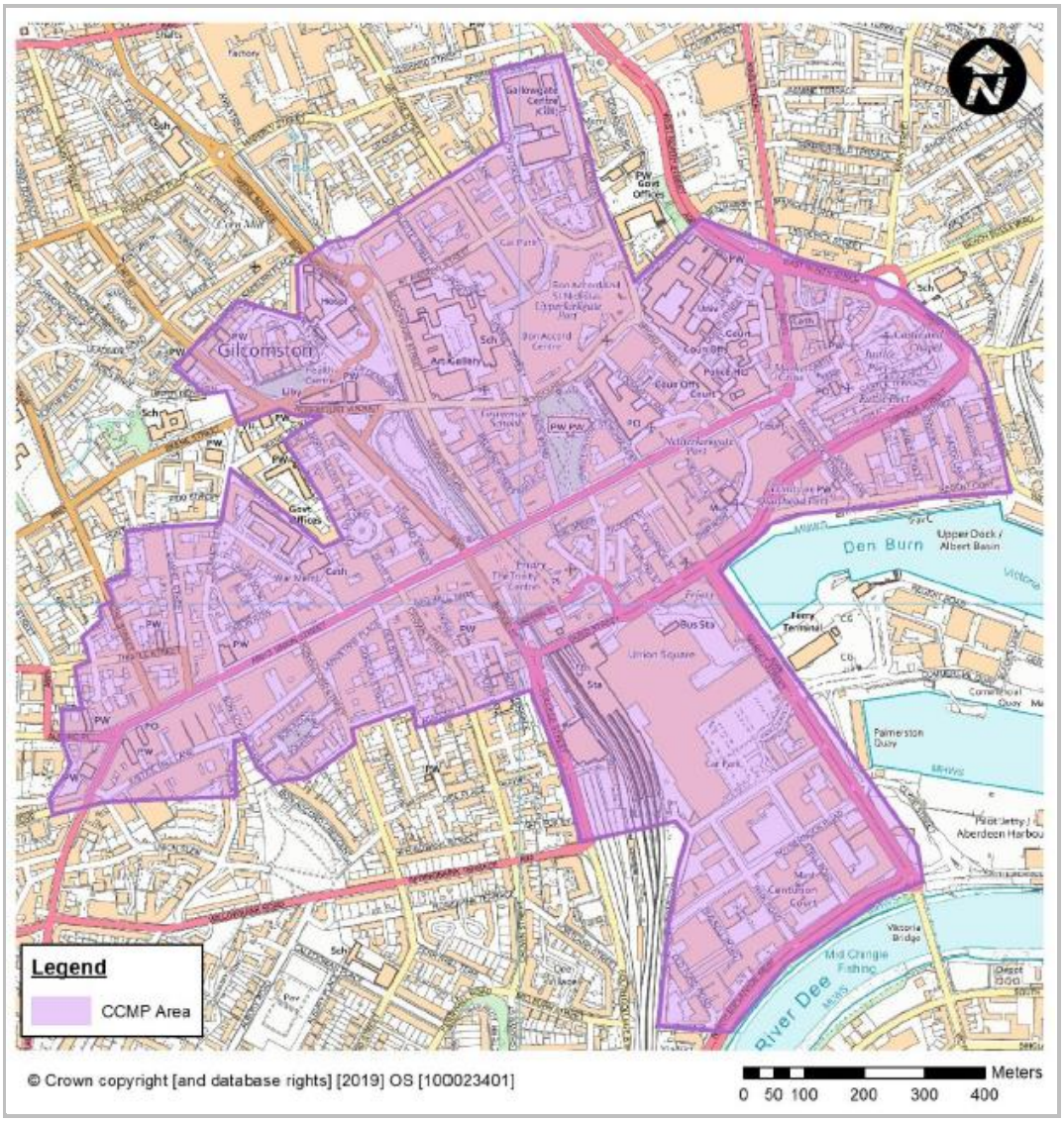

Figure 3.2 : CCMP (& SUMP) Boundary (Source ACC)

3.3.50 A key focus of the CCMP is that the city centre should become a destination, with access to it by active travel and sustainable modes becoming more attractive with the car playing a smaller role.

3.3.51 The £1 billion vision outlines 50 economic, environmental and social projects. A number of these have a transport focus, and form an integral part of the future road network

within the city centre. Further detail on the CCMP transport projects can be found on: https://aberdeencitycentremasterplan.com/projects

3.3.52 Figure 3.3 summarises the proposed vehicular access and restrictions for the full strategy.

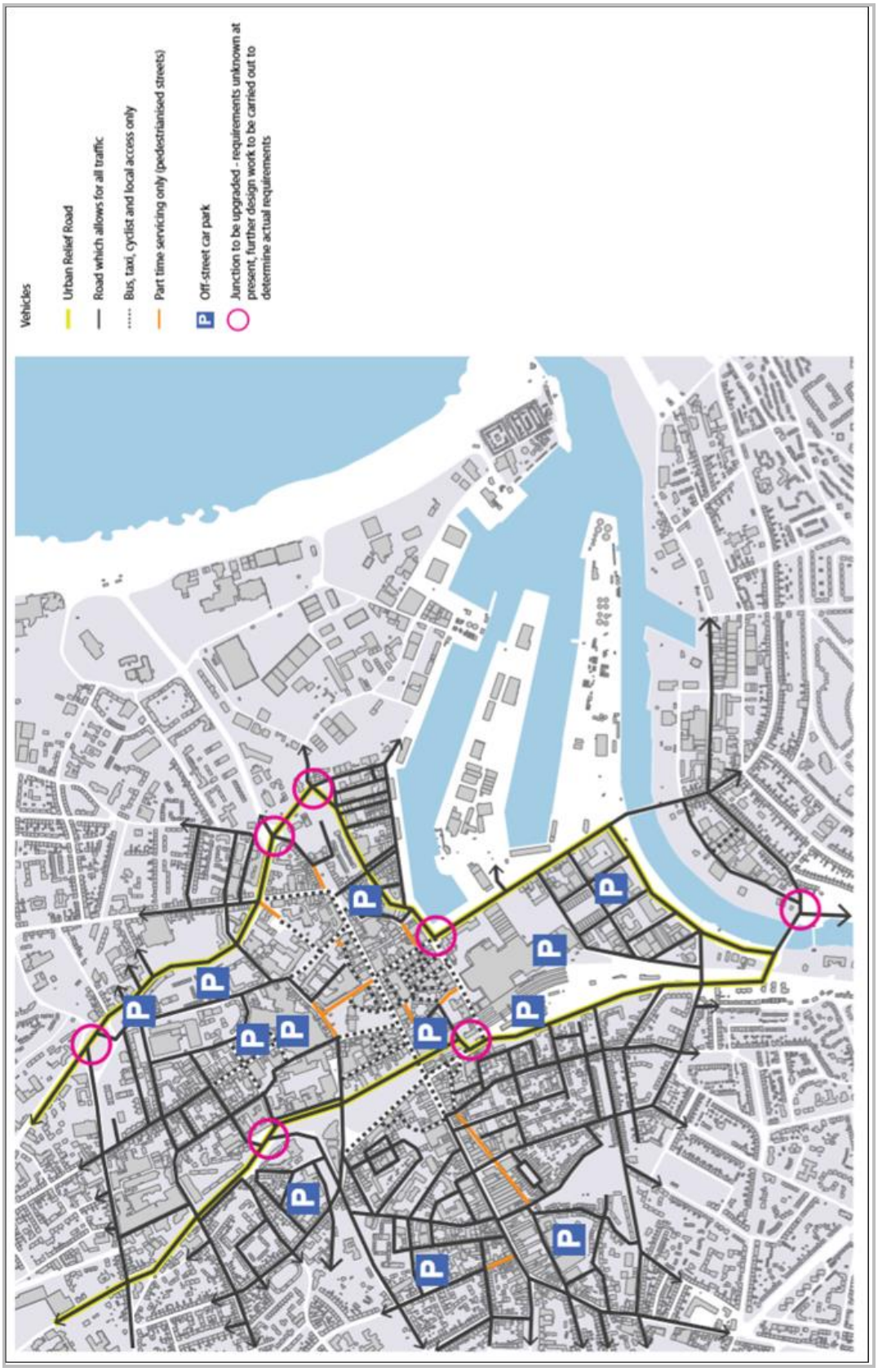

Figure 3.3 : Aberdeen City Centre Masterplan – Proposed Vehicular Access (Source: BDP, June 2015)

3.3.53 A transport assessment and traffic modelling study was undertaken by SYSTRA (then SIAS; *Aberdeen City Masterplan Testing – Phase 2 & 3, SIAS Ref: TPXACCM1/77954, April 2016*) in 2016 to review the CCMP transport interventions in order to identify infrastructure that

would be required to support the interventions and also to develop an optimum programme of delivery.

3.3.54 The findings suggested that a reduction in general peak traffic levels of 20% is required to enable the transportation and public realm objectives relating to pedestrian, cycle and bus movement in the city centre, as illustrated in the Figure 3.4 below. The report notes that modal shift from private vehicles to sustainable modes will be required in order to allow the network to operate satisfactorily.

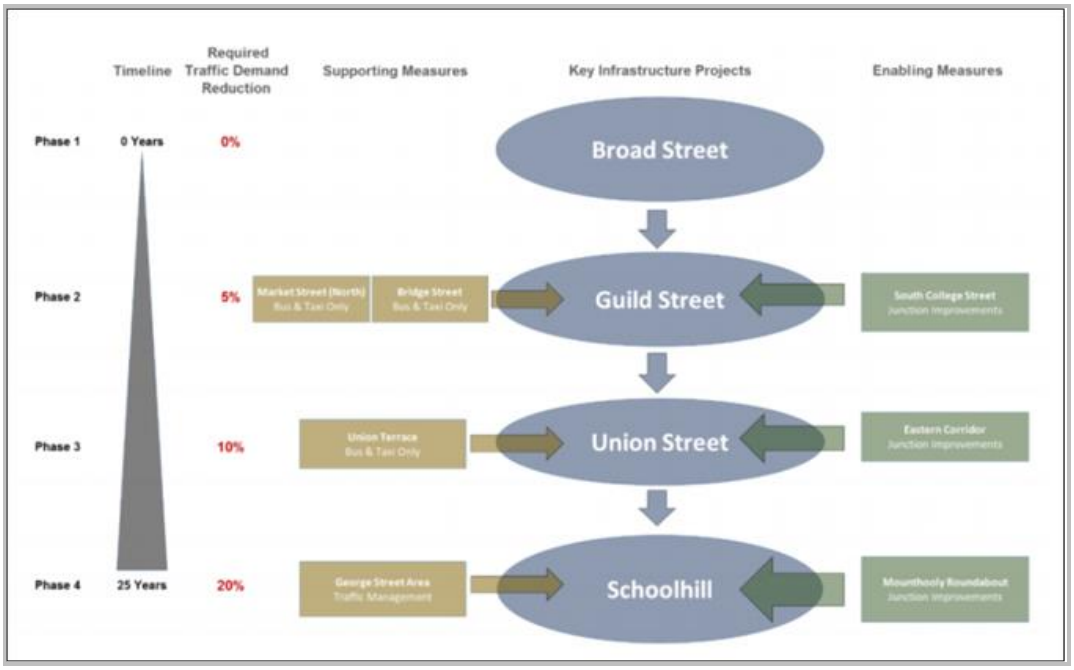

Figure 3.4 : City Centre Masterplan – Proposed Programme of Delivery (Source: ACC)

3.3.55 The report detailed the optimum delivery programme for the CCMP proposals identified through the testing process and the reasoning for the implementation order being proposed, and cognisance should be taken of this when developing LEZ options and undertaking detailed appraisal. The recommendations of the report were approved at the Council Committee meeting on 11 May 2016 and the optimum programme for CCMP delivery can be summarised as follows:

1. Broad Street 'Bus Only' or 'Road Closure' – **Key Infrastructure Project**
   - Interventions have minimal impact on the rest of the network and do not require a traffic demand reduction to be able to operate.
   - 'Bus only' has the least impact on the travelling public.
   - **Note: Broad Street is now a pedestrian-priority space, shared with cyclists and buses (**CCMP Broad Street**)**

2. Bridge Street 'Bus & Taxi Only'
   - Required to facilitate Guild Street proposals.

3. Market Street (North) 'Bus & Taxi Only'
   - Reduces traffic demand on Union Street (which is required when Guild Street is restricted).
   - Required to facilitate Guild Street proposals.

4. South College Street Junction - enabling measure
   - Capacity improvements essential prior to the implementation of key east-west routes (Guild Street & Union Street).

- Traffic patterns at South College Street directly affected by the north-south traffic throughput at Denburn Road.
- **Note: South College Street junction improvement designs and Compulsory Purchase Orders (CPOs) have been approved by ACC (**South College Street Improvements**)**

5. Guild Street 'Bus & Taxi Only' – **Key Infrastructure Project**
   - Requires network traffic demand reduction of approximately 5%.
   - Requires Bridge Street and Market Street interventions to already be in place.
   - Guild Street has a lower impact on the surrounding road network than the Union Street project. In addition, if Union Street was restricted first, significant congestion would occur on Guild Street.

6. Eastern Corridor Improvements
   - Union Street and Guild Street interventions both result in a significant relocation of traffic to the Eastern Corridor. Improved junction capacity is required through the Eastern Corridor (at Commerce Street/Virginia Street and Commerce Street/Beach Boulevard) prior to the implementation of both of these interventions. The Eastern Corridor enabling measures proposals are therefore required prior to the implementation of Union Street interventions but could be considered earlier.

7. Union Terrace 'Bus & Taxi Only'
   - Interventions required in advance of the Union Street intervention to prevent significant levels of displaced traffic routing along Schoolhill. This would improve the operation of Public Transport in this area.

8. Union Street 'Bus & Taxi Only' – **Key Infrastructure Project**
   - With above interventions already in place, this measure requires network traffic demand reduction of approximately 10%.
   - Requires Broad Street and Union Terrace interventions in place to protect Schoolhill from significant increases in traffic.

9. Mounthooly Roundabout Improvements
   - Forms part of the George Street area traffic management proposals but is also required to maximise the operation of the eastern corridor.
   - Can be considered before or after Union Street interventions are implemented.

10. George Street Traffic Management Interventions
    - Wide area traffic management required around George Street area (south of Hutcheon Street) to restrict through traffic but retain car park access. Required as part of the Schoolhill closure intervention.

11. Schoolhill 'Closure' – **Key Infrastructure Project**
    - With above interventions already in place, this measure requires network traffic demand reduction of approximately 20%.
    - Schoolhill closure would force high volumes of traffic through the John Street and Maberly Street corridors.

3.3.56 This delivery programme is now subject to change, given the AWPR opening and the expected changes in traffic flow in the city as a result. SYSTRA is currently examining the

traffic flow patterns between pre and post AWPR to inform any programme changes and it is expected that the CCMP phases and programme will be subject to further traffic model analysis using the 2019 Aberdeen City Centre Paramics Traffic Model (see 3.3.73 below).The CCMP contains a number of key proposals to change the strategic and local traffic movements in Aberdeen and these have been broadly approved by elected members. In May 2021 the City Growth and Resources Committee instructed a review of the CCMP. It is considered crucial that any LEZ option does not directly contradict the CCMP proposals and where additional mitigation is identified as being required as part of any LEZ option, the mitigation is informed by an updated and fully tested delivery programme for the CCMP.

North East Scotland Roads Hierarchy Study

3.3.57 ACC and regional partners Nestrans and Aberdeenshire Council commissioned The North East Scotland Roads Hierarchy Study to *update the city's roads hierarchy to provide a system that reflects the new role of the city centre (as a destination) and makes the most effective use of the Aberdeen Western Peripheral Route (AWPR) for distributing traffic around the city to the most appropriate radial route to reduce the extent of cross-city traffic movements* (AECOM, May 2019).

3.3.58 The aims of the Roads Hierarchy study is to update the city's road hierarchy in order to:

- Support the effective distribution and management of traffic around the city;
- Develop a network that makes best use of the Aberdeen Western Peripheral Route (AWPR) by taking advantage of the newly freed up road capacity within the City to lock in the benefits of the investment by giving more priority to sustainable transport journeys
- Facilitate delivery of transport elements of the Aberdeen City Centre masterplan (CCMP) by providing a means of reducing through traffic in the city centre, reflecting the role of the city centre as a destination rather than a through route for traffic; and
- Form a basis for identifying future transport priorities for the city, along with the Regional and Local Transport Strategies and ongoing City Region Deal (CRD) Strategic Transport Appraisal.

3.3.59 Four option packages were developed from an option sifting and validation exercise:

- **Do-Minimum Package:**
  Committed Schemes & City signage as per signing framework developed by ACC (for post-AWPR routing)

- **City Hierarchy Package:**
  Proposed new roads hierarchy (Figure 3.5 and Figure 3.6)

- **Road Space Re-allocation Package:**
  Proposed new Roads hierarchy with additional intervention to reduce capacity for general traffic between the north, south, and west of the city centre

- **Access Only Package:**
  Proposed new Roads hierarchy with high level intervention to restrict general traffic between the north, south, and west of the city centre

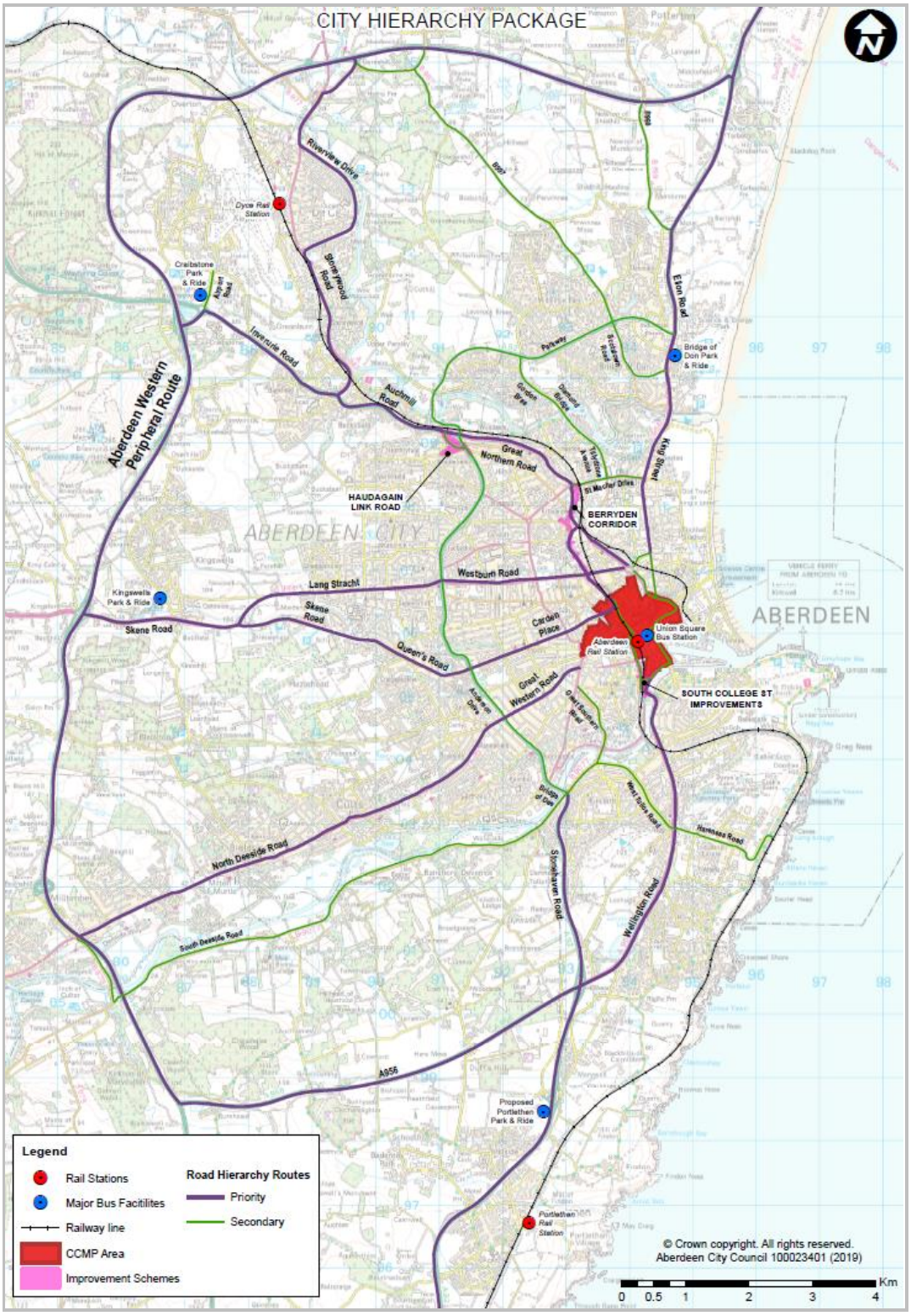

Figure 3.5 : Proposed City Hierarchy Package (Source: ACC, 2020)

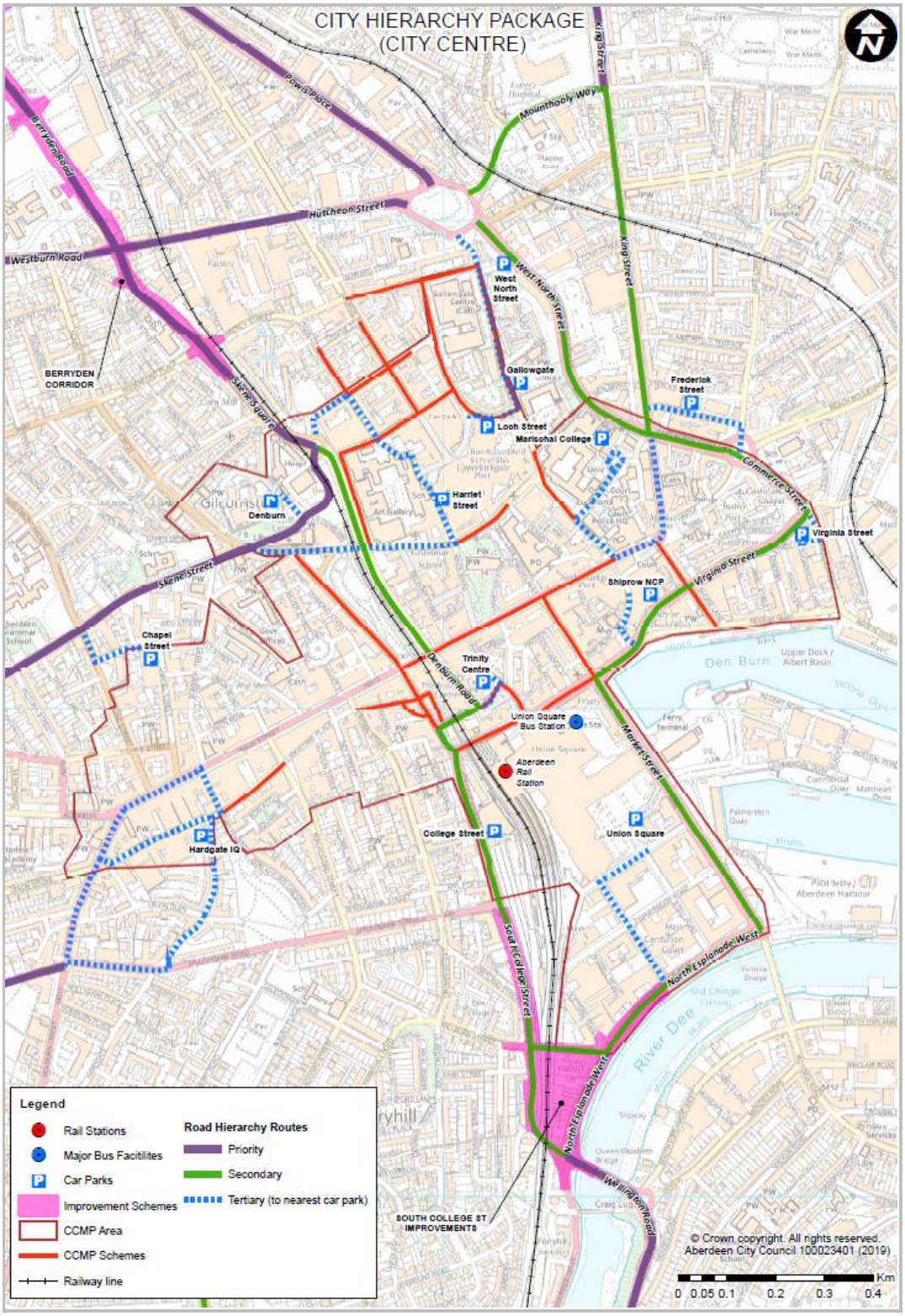

Figure 3.6 : Proposed City Hierarchy Package – City Centre (Source: ACC, 2020)

3.3.60 The Roads Hierarchy Study was approved by Aberdeen City Council City Growth and Resources committee in 2019 and the committee instructed officers to implement the proposed changes on an incremental basis. Instead of adopting one of the individual packages, it was agreed that the optimum approach would involve elements of each of the packages, subject to further feasibility and design work.

3.3.61 The changes to the roads hierarchy will significantly influence strategic and local traffic movements in Aberdeen. As with the CCMP, it is considered crucial that any LEZ option does not directly contradict the Road Hierarchy Study and takes cognisance of the approved measures. The option development for the LEZ must recognise the planned declassification of A and B class streets in the city centre, changed to reflect the fact that

they are no longer considered primary traffic routes or through routes in the context of the AWPR and CCMP with traffic not signed to use these routes unless going to a specific destination.

3.3.62 The Do-minimum and City hierarchy packages are proposed to be implemented during the 20 year plan for the CCMP and SUMP and it is anticipated that some signage and road numbering changes will be completed during 2020. The individual projects that comprise the high levels intervention packages (Road Space Re-allocation and Access Only packages) are now subject to further feasibility and design work via multimodal corridor studies of priority and secondary routes, with the city centre elements considered as part of the SUMP.

Aberdeen City Sustainable Urban Mobility Plan

3.3.63 The Aberdeen Sustainable Urban Mobility Plan (SUMP) was developed by Aberdeen City Council to identify transport interventions that could be delivered to help realise certain city centre elements of the revised hierarchy and complement and expand upon city centre transport interventions identified in the CCMP.

3.3.64 The vision of the SUMP is *a city centre transport network that enhances accessibility and permeability by those walking, cycling and using public transport and which contributes to wider aspirations to deliver a safe, sustainable and economically buoyant city centre with an enhanced sense of place (*Aberdeen SUMP, ACC December 2019).

3.3.65 The vision is supported by the following objectives:

1. Support delivery of the CCMP by contributing to the regeneration of the city centre and developing a network of streets that prioritise the movement of people over the movement of vehicles, whilst maintaining necessary and efficient access for business and industry.
2. Minimise the adverse environmental impacts of transport in the city centre and incorporate green infrastructure into new transport schemes wherever practicable.
3. Ensure that the city centre is accessible to, and safe for, all and is resilient to the effects of climate change.
4. Encourage and enable more walking and cycling in the city centre, particularly through the provision of more and better infrastructure.
5. Improve the public transport experience to, from and within the city centre, particularly in terms of achieving shorter and more reliable journey times.
6. Improve connectivity between key destinations in and around the city centre by sustainable modes of transport.
7. Support and encourage all vehicular journeys within the city centre to be undertaken in low emission vehicles.
8. Raise awareness of opportunities for travel to, from and within the city centre by clean and sustainable forms of transport, including the potential for multimodal journeys.

3.3.66 The following outcomes are anticipated:

1. A more pedestrian- and cycle-friendly city centre;
2. A city centre that prioritises the movement of people over the movement of vehicles;
3. Improved air quality in the city centre;
4. Reduced carbon dioxide (CO_2) emissions;
5. A city centre that is accessible to all;
6. A safer city centre;
7. Increased mode share for active travel to, from and within the city centre;
8. Increased mode share for public transport to, from and within the city centre;
9. Shorter public transport journey times and improved journey time reliability through the city centre; and

10. An increase in the proportion of vehicular journeys in the city centre undertaken by low-emission or emission-free vehicles.

3.3.67 The SUMP outlines a number of key infrastructure improvements and supporting measures to help realise its vision and objectives and these are closely aligned with CCMP proposals. The SUMP has been approved by elected members and it is considered important that any LEZ option does not directly contradict the SUMP proposals and, as with the CCMP, where additional mitigation is identified as being required as part of any LEZ option, that option should be informed by the SUMP interventions.

Aberdeen Sub Area Model (ASAM)

3.3.68 There is a three tier hierarchy of transport models in Scotland. Transport Scotland, via Land Use and Transport Integration in Scotland (LATIS), has developed national Land Use (TELMoS) and Transport (TMfS) models. These are supported by regional transport models and there are currently regional models covering Aberdeen & Shire, Glasgow, Edinburgh and Inverness city regions. The final tier is local traffic models and there are a number of such models within the Aberdeen City and Shire area.

3.3.69 The Aberdeen Sub Area Model (ASAM) is a strategic multi-modal transport model covering the main roads and public transport networks within Aberdeen and Aberdeenshire (and parts of Moray and Angus).

3.3.70 The model was originally developed in 2002 to support the design and appraisal of the AWPR and was last updated in 2014. With the AWPR fully open in February 2019, there was a requirement to update the base model to reflect the resultant change in traffic and travel patterns.

3.3.71 A 2019 ASAM model is therefore currently being developed to provide detailed evidence to consider options for a number of North East projects and inform the necessary stages of the business case development. The ASAM19 will inform and assess future iterations of the statutory Regional Transport Strategy and Development Plans.

3.3.72 Although currently under development, consideration will being given as to how ASAM19 can support the development of the LEZ in Aberdeen. The previous ASAM variant (ASAM14) is available for use in the interim if required to support the LEZ development prior to ASAM19 being available.

Aberdeen City Centre Microsimulation Model

3.3.73 In 2019, Aberdeen City Council commissioned the development of a traffic microsimulation model of Aberdeen City Centre for the purpose of assessing road network options associated with the development of a LEZ in Aberdeen. The initial Base Model development (ACCPM19) is detailed in the report '*Aberdeen City Centre Paramics Model Upgrade 2019*' (SYSTRA Ref: GB01T19F42/2, October 2020). The ACCPM19 road network description is shown in Figure 3.7.

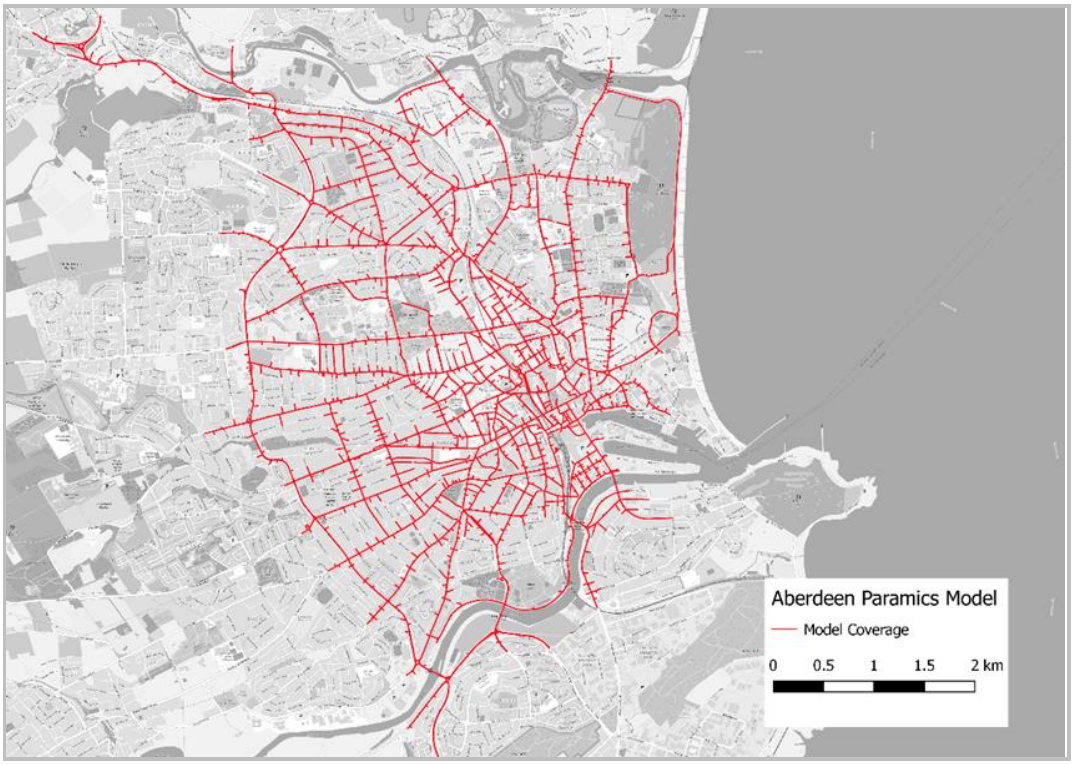

Figure 3.7 : ACCPM19 – Network Coverage

3.3.74 The ACCPM19 is capable of assessing a range of transport interventions associated with the implementation of the Low Emission Zone in Aberdeen City Centre, as identified through this study, along with traffic management measures related to assessment of any future city centre developments. Outputs from the ACCPM19 will contribute to the evidence base required appraisal of LEZ options (See Chapters 12 and 14). It is anticipate that the implementation of the LEZ will not be undertaken in isolation but form part of a package of measures to reduce traffic and prioritise the movement of sustainable transport modes, including elements of the SUMP, revised network hierarchy, and City Centre Masterplan proposals.

3.3.75 The ACCPM19 will be utilised as part of a suite of models to quantify the impact of LEZ options considered. The suite of models each have a role in the assessment as follows:

- ACCPM19 - Traffic Impacts (flows, journey times, bus journey times, queueing)
- ASAM – Public transport demand, wider traffic impacts, longer-term land-use impacts in city centre and wider area, longer-term changes in trip making patterns
- Air Quality Model (SEPA) – NMF AQ model scenarios, using outputs from the ACCPM form relevant scenarios where required.

Aberdeen Air Quality Model (National Modelling Framework)

3.3.76 The Scottish Environmental Protection Agency (SEPA) undertake air quality modelling on behalf of Transport Scotland, under the National Modelling Framework (NMF) as detailed in paragraph 3.2.14 above.

3.3.77 Traffic Data collated in May 2019 was used to update the existing 2017 Aberdeen ADMS (Atmospheric Dispersion Modelling System) air pollution model. The model update was undertaken in 2019 to include the impact of the AWPR. As noted in Section 3.3.75, traffic outputs from the City Centre Microsimulation model (traffic flows & speeds) are fed into the ADMS, which then converts the data into traffic emission levels throughout the modelled network.

3.3.78 The NMF forms a crucial strand of evidence in developing options for Aberdeen LEZ. High level scenario testing is undertaken as part of the NLEF Stage 2 Assessment and is detailed in Chapter 5.

3.4 Committed Infrastructure

3.4.1 It is important that any major committed infrastructure for Aberdeen City Centre is considered when developing options for Aberdeen's LEZ. The following current infrastructure is proposed for the City Centre:

- South College St Junction Improvements project – Due to be in place by Autumn 2021
- Berryden Corridor Improvements - Originally proposed for completion by 2020, now expected 2023
- Union Terrace Gardens – Completion proposed by late 2021/early 2022

3.4.2 These committed infrastructure projects, along with any others that may be committed by ACC in the interim period between writing and model testing, such as the committed roads hierarchy changes, will be included as part of a future year Reference Case traffic model. This will ensure that any benefits or dis-benefits to traffic volumes, speeds or air quality from the infrastructure are reflected in any LEZ option testing required as part of the detailed appraisal (see Chapter 9 for details).

3.5 Committed Developments

3.5.1 As with committed infrastructure, it is important that cognisance is taken of any committed developments that might impact on air quality and in turn influence the shape of any LEZ.

3.5.2 There is currently one potential development at Broadford Works, Maberly Street, where approval was granted in September 2016 for a major mixed use development on a brownfield site close to the city centre and the Berryden corridor. The proposed development comprises 890 residential units (apartments for rent and student accommodation), cafes and bars, a nursery and office, retail and leisure facilities and 400 car parking spaces. The development has the potential to increase congestion and adversely affect air quality both in the vicinity of the proposed residential properties and the wider area. An air quality assessment was undertaken as part of a previous planning application and did not predict a significant adverse impact or risk of exceedance of the air quality objectives, however the 2016 application was approved subject to a further air quality assessment. The condition also requires mitigation measures should there be a significant adverse impact on air quality. At the time of writing, there is currently no further progress, to date, with this development.

3.6 Current ACC/Nestrans Studies

3.6.1 Existing studies in and around Aberdeen city centre have the potential to complement the development of a LEZ and vice versa and it is important that consideration is taken of current studies to ensure this is the case, where possible. ACC and Nestrans studies currently being undertaken include:

- Electric Vehicle (EV) Framework was approved at the City Growth and Resources Committee in February 2021 and outlines where future EV infrastructure should be located as well as what additional supporting actions the council and partners could deliver in order to support the further take up and accelerate the take up of EVs
- Several multi-modal transport studies:
  - Wellington Road Corridor in the south of Aberdeen. Option development and modelling was undertaken in 2019, with option appraisal following thereafter.

This will be supported by public and stakeholder engagement at key stages of the process with a STAG Stage 2 due to be complete in 2021.

- A944/B9119 Westhill to Aberdeen City Centre. A STAG-based option appraisal was completed in 2020 and will be subject to more detailed appraisal and design work in 2021 and 2022
- Park and Ride from Ellon to Robert Gordon University (via Ellon Road, King Street, City Centre, Holborn Street). A STAG-based option appraisal due for completion 2021.
- Several STAG based options appraisal due for completion in 2022 including A96 Inverurie to Aberdeen, A947 Dyce to Aberdeen, A93 Banchory to Aberdeen
- Aberdeen to Laurencekirk Multimodal Study with Case for Change completed

4. AIR QUALITY IN ABERDEEN

4.1 Introduction

4.1.1 The National Low Emission Framework (NLEF) is used to build a suitable evidence-base to assess all potential LEZ options against. NLEF is a two stage process consisting of the following elements:

- Stage 1 – Screening
- Stage 2 – Assessment

4.1.2 This chapter details the Stage 1 Screening of Aberdeen's LAQM and builds an evidence base to assist in the appraisal and implementation of Aberdeen's LEZ through the NLEF Stage 2 Assessment.

4.1.3 NLEF Guidance describes the following key steps that should be undertaken as part of the Stage 1 Screening exercise:

- Review of information on the main sources of poor air quality and other contributing factors within each AQMA.
- Analysis of existing data including air quality, traffic and environmental data as well as information on existing and future action planning measures across all local authority functions which seek to address or are likely to contribute to improving air quality
- Conduct the NLEF stage one screening process
- Record the results of the screening process and the decision as to whether proposed measures are sufficient or whether any AQMA requires to progress to a stage two assessment.

4.1.4 NLEF guidance states that there is no requirement for local authorities to collect new data or information during the screening stage of the appraisal process. Existing air quality information, including data produced as part of the annual review and assessment process and air quality action plans, should be used in the screening assessment. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. As of 2016, a requirement of LAQM process is the delivery of Annual Progress Reports (APR) to summarise the work being undertaken by the local authority to improve air quality and report any progress that has been made. The APRs provide extensive detail on existing air quality issues in Aberdeen, the level of success from the LAQM measures and provide a key source of information for the NLEF process.

4.1.5 As such, this chapter will review and collate data and information from the following sources:

- Air Quality Action Plan 2011 (Aberdeen City Council, January 2011)
- 2019 Air Quality Annual Progress Report (APR) for Aberdeen City Council (Aberdeen City Council, June 2019)
- 2020 Air Quality Annual Progress Report (APR) for Aberdeen City Council (Aberdeen City Council, June 2020)

4.1.6 The results and findings of the 2019 APR (note, the 2019 APR reports on the 2018 air quality monitoring dataset) was summarised in the first interim NLEF Stage 2 Report (June 2020) and the subsequent LEZ option development and analysis was undertaken utilising this 2018 air quality dataset. The 2020 APR (2019 air quality dataset) was published in June 2020, after the first interim NLEF Stage 2 Report had been finalised. The 2019 air quality monitoring dataset is now summarised in this chapter, after the 2018 summary,

and is shown to be comparable to 2018 data confirming the focus of the LEZ remains the same.

4.2 Aberdeen Air Quality Management Area

4.2.1 In 2001 ACC declared part of the City Centre (Union Street and Market Street) an Air Quality Management Area (AQMA) due to predicted exceedances of the annual mean national air quality objective for nitrogen dioxide (NO_2). The AQMA was extended in 2003 to include adjoining roads. In 2004, the Detailed Assessment indicated potential exceedances of the annual mean objective for particulate matter (PM_{10}) and an AQMA was declared for PM_{10} covering the same area. In 2005 the AQMA for NO_2 and PM_{10} was further extended to include additional adjoining city centre roads.

4.2.2 Two further AQMAs were declared in 2008, again due to exceedances of the NO_2 and PM_{10} annual mean objectives, for the Anderson Drive/Haudagain roundabout/Auchmill Road corridor and the Wellington Road corridor (Queen Elizabeth Bridge/Balnagask Road), the latter also including the 24 hour mean objective for PM_{10}.

4.2.3 The City Centre AQMA and the Anderson Drive AQMA were further amended in 2018 and the three current AQMAs for NO_2 and PM_{10} as declared by ACC are shown in Figure 4.1 to Figure 4.3.

Figure 4.1: Aberdeen City Centre AQMA for NO_2 and PM_{10}

Figure 4.2 : Anderson Drive AQMA for NO_2 and PM_{10}

Figure 4.3 : Wellington Road AQMA for NO_2 and PM_{10}

4.3 Air Quality Action Plan

Ongoing monitoring of NO_2 and PM_{10} concentrations in Aberdeen since ACC first declared an AQMA in the city in 2001 confirmed the need for continuance of the AQMAs and the legal requirement on ACC to publish the Air Quality Action Plan (Aberdeen City Council, January 2011).

4.3.1 The AQAP showed NO_2 concentrations in excess of the mandatory annual mean limit value existed at a number of the main roads and junctions in Aberdeen. The main areas of concern, where concentrations were well in excess of the annual mean limit value,

were Haudagain roundabout, Union Street, and Market Street. Exceedances of the hourly averaged limit value were also measured on Union Street and Market Street. The AQAP also confirmed PM_{10} concentrations were in excess of the Scottish annual mean objective at numerous locations including Market Street, Union Street and Wellington Road. At the time of publishing in 2011, the AQAP suggested that in the most polluted areas, traffic emission reductions of the order of 50-75% would be required for compliance with the mandatory NO_2 annual mean limit value.

4.3.2 The AQAP summarised the source apportionment work carried out by ACC in 2009 and 2010 to assess the source contribution to overall pollutant concentrations. Source apportionment studies of oxides of nitrogen (NO_x) and PM_{10} highlighted the following key findings:

- For NO_x, road traffic is the greatest single contributor, whereas for PM_{10} background sources account for the greatest proportion of total emissions.
- With regards to NO_x, cars, despite making up the greatest proportion of the traffic, are generally responsible for the least emissions. However for PM_{10}, cars are responsible for a far greater proportion of the total emissions.
- The results for Union Street indicate that for NO_x, buses are the single greatest contributor (65%), but for PM_{10} the bus contribution is smaller (34%), and the car contribution is greatest (44%).
- For Wellington Road, HGV emissions contribute to the greatest extent, and to a lesser extent the same is true for Market Street.
- For the Haudagain roundabout, cars contribute more significantly to the total, particularly with regards PM_{10} and $PM_{2.5}$.

4.3.3 The 2011 AQAP recommended a number of measures, grouped into 6 categories, to improve air quality. The majority are concerned with reducing the impact of transport emissions, identified as the main cause of the air quality problem in Aberdeen, and are detailed in Table 4.1.

Table 4.1 : 2011 AQAP Measures

Ref.	2011 AQAP Measure
1	MODAL SHIFT & INFLUENCING TRAVEL CHOICE
1.1	Increase Bus Use
1.2	Improve Cycling & Walking Provision
1.3	Travel Plans
1.4	Improve public awareness of air quality issues
1.5	Car Clubs / Car Pool Schemes
1.6	Crossrail
1.7	Rail Freight
2	LOWER EMISSIONS & CLEANER VEHICLES
2.1	Green Vehicle procurement & Fuel/Charging Infrastructure
2.2	Eco-driving
2.3	Emissions Testing & Idling Enforcement
2.4	Taxis
2.5	Low Emission Zone
3	ROAD INFRASTRUCTURE
3.1	Pedestrianisation
3.2	Road Building / Junction Alterations
4	TRAFFIC MANAGEMENT
4.1	Intelligent Transport System (ITS)
4.2	High Occupancy Vehicle (HOV) Lane
4.3	Freight and Commercial Vehicle Access
5	PLANNING & POLICIES
5.1	Produce Supplementary Planning Guidance
5.2	Integration of AQAP with Local Transport Strategy (LTS) and Regional Transport Strategy (RTS)
5.3	Integration of AQAP with Health and Transport Action Plan (HTAP)
5.4	Road Hierarchy
5.5	Car Parking Policies
5.6	National Lobbying
6	NON-TRANSPORT MEASURES
6.1	Control Biomass Installations
6.2	Industry Permitting
6.3	Tree Planting
6.4	Shipping

4.3.4 Since the introduction of the AQAP in 2011 there has been significant reductions in traffic emissions. The APRs provide detailed updates on the implementation of the proposed measures and appraise their delivery and impact in improving air quality in the AQMAs. The NLEF guidance advises the AQAP measures already implemented by the local authority and their expected impacts on the levels of AQO exceedance should be reviewed during the NLEF Stage 1 Screening. However, as this has been comprehensively undertaken by Aberdeen City Council in the 2020 APR (and in previous years), this task is not undertaken in detail in this NLEF Stage 1 Report. Instead, cognisance of the implemented measures is taken when undertaking the LEZ option development and appraisal.

4.4 Analysis of 2018 Air Quality Monitoring Data

4.4.1 The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. As of 2016, a requirement of the LAQM process is the delivery of Annual Progress Reports (APR) to summarise the work being undertaken by the local authority to improve air quality and report any progress that has been made.

4.4.2 The APRs provide extensive detail on existing air quality issues in Aberdeen, the level of success from the proposed LAQM measures and provide a key source of information for the NLEF evidence base and LEZ option development process. ACC have produced APRs for 2016 to 2019 and the results and findings of the 2019 Air Quality Annual Progress Report (APR) for Aberdeen City Council are summarised here.

4.4.3 It should be noted that the 2019 APR reports on the 2018 (full calendar year) air quality monitoring dataset and, at the time of writing the first interim NLEF Stage 2 Report (June 2020), it was the most up to date fully ratified dataset. The 2020 APR is now available and summarised in Section 4.5 below.

4.4.4 ACC undertook automatic (continuous) monitoring at 6 sites during 2018:

- Union Street
- Market Street
- Anderson Drive
- Wellington Road
- King Street
- Errol Place

4.4.5 The automatic monitoring sites at Union Street, Market Street, Anderson Drive and Wellington Road are located within AQMAs.

4.4.6 ACC undertook non-automatic (passive diffusion tube) monitoring of NO_2 at 70 sites during 2018. All monitoring site locations (continuous and passive) are shown in Figure 4.4.

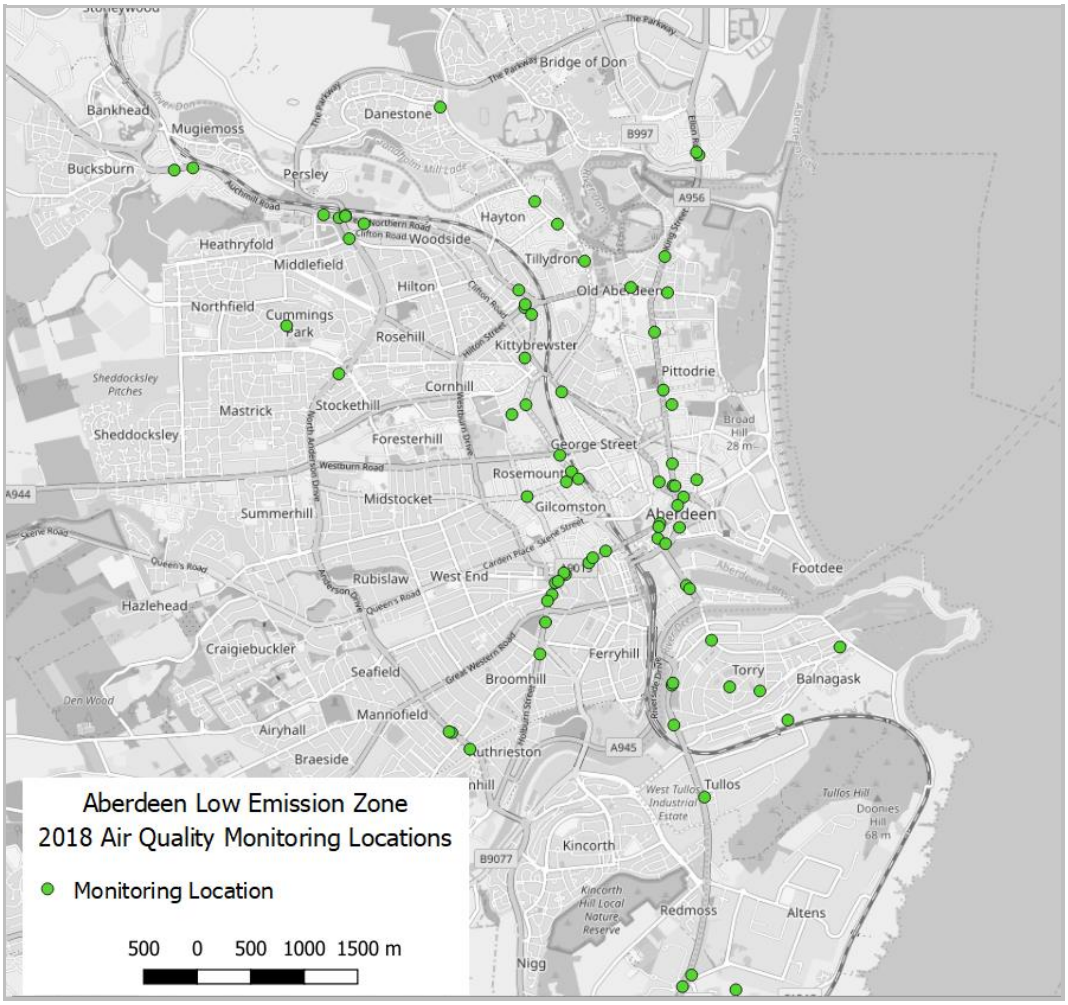

Figure 4.4 : ACC 2018 Monitoring Locations

Nitrogen Dioxide (NO_2)

4.4.7 The 2019 APR provided the full ratified and adjusted 2018 dataset for monthly means for automatic monitoring sites and diffusion tubes.

4.4.8 The report states all automatic monitoring site data in 2018 was comparable to 2017 levels and that concentrations at all automatic sites were below the annual mean air

quality objective of 40 µg/m^3, the first time this has occurred in the last 5 years. Data from the diffusion tube network suggest that exceedances of the annual mean objective occurs in the city centre AQMA and the Anderson Drive AQMA.

4.4.9 Nitrogen dioxide levels at monitoring locations outside the AQMAs remain well below the annual mean objective except for Skene Square where diffusion tube data suggest levels continue to be just below/on the threshold of the annual mean objective. Major transportation infrastructure measures with an anticipated completion date in 2023 will be implemented around Berryden Road and the Skene Square area to improve travel connectivity, reduce congestion and impact on air quality at this location. An air quality assessment undertaken in 2017 predicted the scheme would not lead to exceedances of the air quality objectives outside the existing AQMAs.

4.4.10 The locations where 2018 annual mean concentrations of NO_2 are recorded as greater than 36 µg/m^3 is detailed in Table 4.2 alongside the annual mean concentrations recorded from 2014 to 2017. Note concentrations greater than 36 µg/m^3 are presented as locations that may be in risk of future exceedance. The cells highlighted in grey are the locations where the AQO of 40 µg/m^3 was exceeded.

Table 4.2 : Annual Mean Concentrations of NO_2 greater than 36 µg/m^3

Site ID	Site Name/Location	AQMA	Annual mean NO2 concentration (µg/m3)				
			2014	2015	2016	2017	2018
DT11	105 King Street	City Centre	55.3	54.4	51.1	48.1	48.0
DT10	184/192 Market Street	City Centre	53.9	56.1	54.1	47.6	47.0
DT9	39 Market Street	City Centre	57.5	50.9	50.2	47.9	46.0
DT29	469 Union Street	City Centre	57.9	58.2	48.8	42.7	45.0
DT12	40 Union Street	City Centre	51.3	49.8	48.9	45.9	44.0
DT17	43/45 Union Street	City Centre	55.0	51.8	46.7	42.8	44.0
DT82	7 Virgina Street	City Centre	0.0	0.0	0.0	0.0	44.0
DT39	819 Great Northern Road	Anderson Dr	63.8	54.2	47.4	45.4	43.0
DT30	335 Union Street	City Centre	53.4	50.9	46.5	41.9	41.0
DT19	468 Union Street	City Centre	51.4	53.3	45.4	40.9	40.0
DT33	16 East North Street	City Centre	44.5	46.4	43.1	40.4	40.0
DT73	61 Skene Square	No	0.0	0.0	0.0	39.7	40.0
CM5	Wellington Road	Wellington Rd	48.0	40.0	46.0	39.0	39.0
DT18	14 Holburn Street	City Centre	47.5	50.2	48.5	41.6	39.0
CM2	Union Street	City Centre	47.0	46.0	43.0	40.0	38.0
DT16	1 Trinity Quay	City Centre	48.6	45.4	43.8	37.4	37.0
DT25	21 Holburn Street	City Centre	40.5	50.3	42.8	37.1	37.0
DT77	27 Skene Square	No	0.0	0.0	0.0	0.0	37.0
DT22	104 King Street	City Centre	45.2	44.1	39.3	36.2	36.0
Total No. Sites > 40 µg/m3			**16**	**15**	**15**	**11**	**9**

source: 2019 Air Quality Annual Progress Report (APR) for Aberdeen City Council

4.4.11 In total, there are 9 locations where annual mean concentrations of NO_2 exceed the AQO of 40 µg/m^3 and a further 10 sites where annual mean concentrations of NO_2 exceed 36 µg/m^3. Table 4.2 shows that the total number of exceedance locations in the city have reduced each year from 2014 (16 locations) to 2018 (9 locations).

4.4.12 Figure 4.5 shows the locations where annual mean concentrations of NO_2 were recorded as greater than 36 µg/m^3 in 2018.

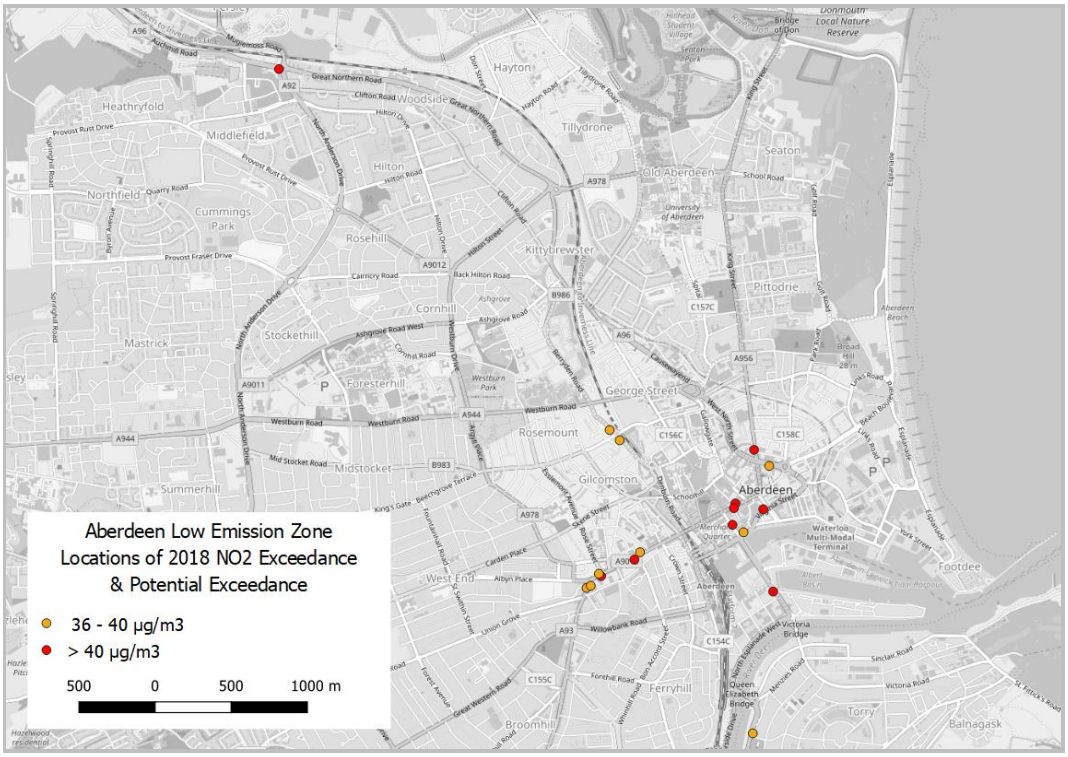

Figure 4.5: 2018 Annual Mean Concentrations of NO_2 greater than 36 µg/m³ (City Wide)

4.4.13 The primary exceedance locations of NO_2 are shown to be within the city centre AQMA as shown in detail in Figure 4.6

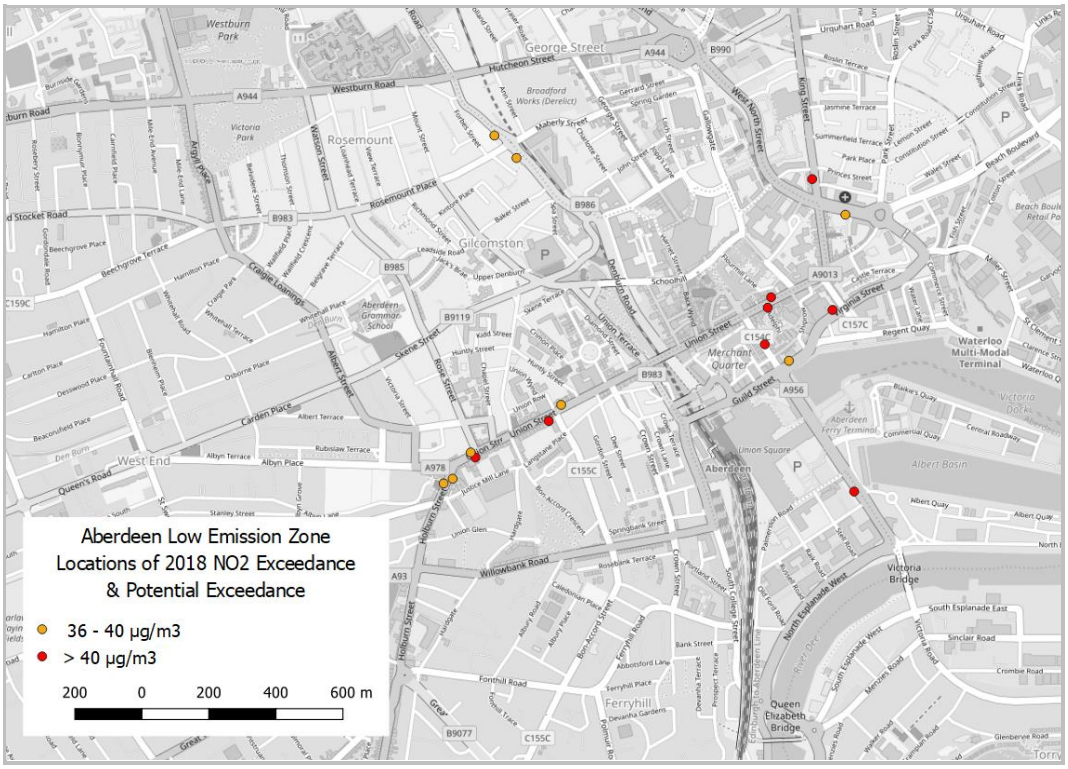

Figure 4.6 : 2018 Annual Mean Concentrations of NO_2 greater than 36 µg/m3 (City Centre AQMA)

4.4.14 The 2019 APR also compares the continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of *200µg/m³, not to be exceeded more than 18 times per year* and reports that no exceedances of the hourly mean objective were identified at automatic monitoring locations in 2018.

Particulate Matter (PM_{10})

4.4.15 The 2019 APR reports that no exceedances of the PM_{10} annual mean objective (18 µg/m^3) or 24 hour mean objective (50 µg/m^3 not to be exceeded more than 7 times per year) were observed at any of the continuous monitoring sites in 2018. The 24 hour mean objective has been met at all monitoring sites for the last 3 years.

4.4.16 Due to compliance with the 24 hour mean objective in the Anderson Drive AQMA for a number of years the AQMA order for this area was amended in October 2018 to remove the 24 hour mean.

Particulate Matter ($PM_{2.5}$)

4.4.17 As of the 1st of April 2016, the Scottish Government introduced the World Health Organisation guideline value for $PM_{2.5}$ into Scottish legislation with an annual mean objective 10µg/m^3 to be achieved by 2020. Scottish local authorities are now required to include $PM_{2.5}$ in the LAQM review and assessment process.

4.4.18 There are 5 continuous monitoring sites measuring $PM_{2.5}$ levels in Aberdeen City and no exceedances of the annual mean were recorded at any of the continuous monitoring sites in 2018.

4.5 Analysis of 2019 Air Quality Monitoring Data

4.5.1 The summary below shows the area of focus for the LEZ in Aberdeen (the city centre AQMA) remains the same, when assessed using either 2018 or 2019 datasets with the general trends in air quality observed to shown to be comparable.

Nitrogen Dioxide (NO_2)

4.5.2 The 2020 APR provided the full ratified and adjusted 2019 dataset for monthly means for automatic monitoring sites and diffusion tubes.

4.5.3 The report states all automatic monitoring site data in 2019 was comparable to 2017 and 2018 levels and that concentrations at all automatic sites were below the annual mean air quality objective of 40 µg/m^3 for the second year running. Generally, NO_2 levels monitored across the Aberdeen were marginally lower than previous years. The report states data from the diffusion tube network was comparable to 2017 and 2018 and that exceedances of the annual mean objective occurs in the city centre AQMA only.

4.5.4 As in 2018, 2019 NO_2 levels at monitoring locations outside the AQMAs remain well below the annual mean objective except for Skene Square where diffusion tube data suggest levels continue to be just below the threshold of the annual mean objective. Major transportation infrastructure measures with an anticipated completion date in 2023 will be implemented around Berryden Road and the Skene Square area to improve travel connectivity, reduce congestion and impact on air quality at this location.

4.5.5 The locations where 2019 annual mean concentrations of NO_2 are recorded as greater than 36 µg/m^3 is detailed in Table 4.2 alongside the annual mean concentrations recorded from 2015 to 2018. Again, concentrations greater than 36 µg/m^3 are presented as locations that may be in risk of future exceedance. The cells highlighted in grey are the locations where the AQO of 40 µg/m^3 was exceeded.

Table 4.3 : Annual Mean Concentrations of NO_2 greater than 36 µg/m³

Site ID	Site Name/Location	AQMA	Annual mean NO2 concentration (µg/m3)				
			2015	2016	2017	2018	2019
DT10	184/192 Market Street	City Centre	56.1	54.1	47.6	47.0	47.0
DT11	105 King Street	City Centre	54.4	51.1	48.1	48.0	45.0
DT9	39 Market Street	City Centre	50.9	50.2	47.9	46.0	44.0
DT12	40 Union Street	City Centre	49.8	48.9	45.9	44.0	43.0
DT17	43/45 Union Street	City Centre	51.8	46.7	42.8	44.0	43.0
DT19	468 Union Street	City Centre	53.3	45.4	40.9	40.0	43.0
DT29	469 Union Street	City Centre	58.2	48.8	42.7	45.0	42.0
DT82	7 Virgina Street	City Centre	0.0	0.0	0.0	44.0	42.0
DT30	335 Union Street	City Centre	50.9	46.5	41.9	41.0	39.0
DT18	14 Holburn Street	City Centre	50.2	48.5	41.6	39.0	39.0
DT16	1 Trinity Quay	City Centre	45.4	43.8	37.4	37.0	39.0
DT73	61 Skene Square	No	0.0	0.0	39.7	40.0	38.0
DT77	27 Skene Square	No	0.0	0.0	0.0	37.0	38.0
DT39	819 Great Northern Road	Anderson Dr	54.2	47.4	45.4	43.0	37.0
CM2	Union Street	City Centre	46.0	43.0	40.0	38.0	36.0
DT33	16 East North Street	City Centre	46.4	43.1	40.4	40.0	35.0
CM5	Wellington Road	Wellington Rd	40.0	46.0	39.0	39.0	35.0
DT25	21 Holburn Street	City Centre	50.3	42.8	37.1	37.0	35.0
DT22	104 King Street	City Centre	44.1	39.3	36.2	36.0	34.0
Total No. Sites > 40 µg/m3			**15**	**15**	**11**	**9**	**8**

source: 2020 Air Quality Annual Progress Report (APR) for Aberdeen City Council

4.5.6 In total, there are 8 locations where annual mean concentrations of NO_2 exceed the AQO of 40 µg/m³ (down 1 from 2018) and a further 7 sites where annual mean concentrations of NO_2 exceed 36 µg/m³ (down 3 from 2018). Table 4.2 shows that the total number of exceedance locations in the city are continuing to reduce each year. From 2018, there are three locations where annual mean concentrations of NO_2 have increased in 2018, namely 468 Union Street (DT19), 1 Trinity Quay (DT16) and 27 Skene Square (DT77).

4.5.7 Figure 4.7 shows the locations where annual mean concentrations of NO_2 were recorded as greater than 36 µg/m³ in 2019.

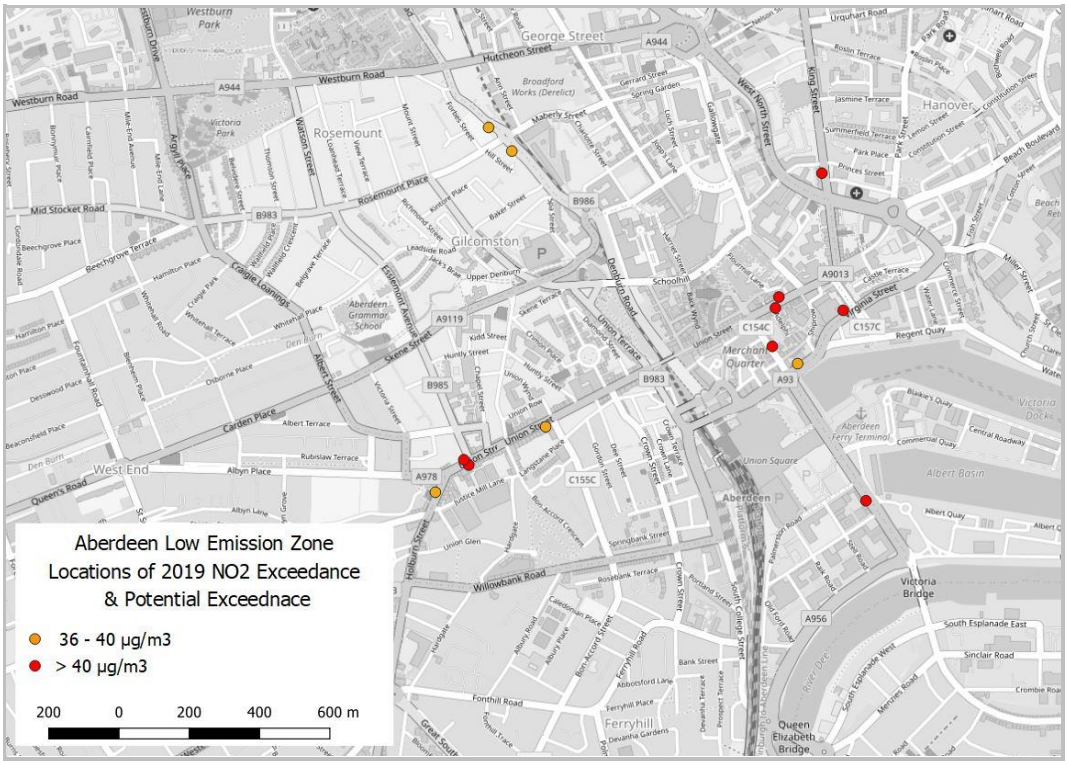

Figure 4.7: 2019 Annual Mean Concentrations of NO_2 greater than 36 µg/m³ (City Wide)

4.5.8 The 2020 APR also compares the continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of *200µg/m³, not to be exceeded more than 18 times per year* and reports that no exceedances of the hourly mean objective were identified at automatic monitoring locations in 2019, in line with 2018.

Particulate Matter (PM_{10})

4.5.9 The 2019 APR reports that no exceedances of the PM_{10} annual mean objective (18 µg/m³) or 24 hour mean objective (50 µg/m³ not to be exceeded more than 7 times per year) were observed at any of the continuous monitoring sites in 2018. This is in line with 2018 where the 24 hour mean objective has been met at all monitoring sites for the last 4 years.

Particulate Matter ($PM_{2.5}$)

4.5.10 There are 5 continuous monitoring sites measuring $PM_{2.5}$ levels in Aberdeen City and no exceedances of the annual mean were recorded at any of the continuous monitoring sites in 2019, in line with 2018.

4.6 Focus of Aberdeen's LEZ

4.6.1 The observed 2018 and 2019 air quality data (detailed in Section 4.4 and 4.5) clearly demonstrate that the City Centre AQMA experiences the highest number of exceedances and the highest level of exceedances for the NO_2 objective.

4.6.2 In 2018 there was one exceedance of the NO_2 objective in the Anderson Drive AQMA, at Haudagain roundabout but this has fallen below the legal threshold in 2019 for the first time since monitoring began in 2009. Transport studies also highlight the committed Haudagain Roundabout improvement scheme is anticipated to address congestion issues at this location with expected positive benefits for air quality. There are no current exceedances of the air quality legal limits in the Wellington Road AQMA.

4.6.3 The current observed air quality data has therefore identified that a LEZ may be an appropriate tool to tackle air quality problems for the Aberdeen City Centre AQMA only and this is therefore the focus of the NLEF appraisal for Aberdeen's LEZ.

4.7 LEZ Vehicle Compliance in Aberdeen

4.7.1 Transport Scotland commissioned Automatic Number Plate Recognition (ANPR) surveys in May 2019 to inform the characteristics of the vehicle fleet in Aberdeen. Each surveyed vehicle type was identified in the DVLA database to classify the following characteristics:

- Vehicle make and model
- Fuel type
- Euro class
- CO2 Band
- Actual CO2 emission value

4.7.2 This information allowed detailed modelling of the vehicle fleet in the Aberdeen NMF air quality model. The data also identifies the proportion of vehicles considered compliant or non-compliant with the LEZ regulations. This information is crucial in developing and appraising options for a LEZ as it informs the total number of vehicles required to find alternative routes to avoid the LEZ penalty and can help identify whether a particular option is feasible or not.

4.7.3 In line with the Transport (Scotland) Act, the vehicle compliance for LEZ is:

- Euro 6/VI for diesel vehicles
- Euro 4/IV for petrol vehicles

- Euro 6/VI for heavy-duty diesel engine vehicles including older retrofitter vehicles improved to Euro 6/VI standard

4.7.4 The proportion of non-compliant vehicles in Aberdeen, based on 2019 survey data is shown in Table 4.4.

Table 4.4 : LEZ non-compliant vehicle proportions

Fuel Type	Car	LGV	HGV
Non-compliant diesel	26.3%	59.7%	27.0%
Non-compliant petrol	3.9%	0.1%	0.0%
Total non-compliant	30.3%	59.8%	27.0%

4.7.5 It should be noted that if and when a LEZ is enforced in Aberdeen, the total number of non-compliant vehicles is likely to have reduced, primarily due to normal fleet improvements as drivers replace their vehicles but also from potential behaviour changes such as a switch to more sustainable modes of transport and increased working from home practices. Although difficult to accurately predict the level of compliance of Aberdeen's future vehicle fleet, SEPA will utilise the UK Government's Emission Factor Toolkit (EFT) to best forecast compliance levels in any future year modelling using the NMF. All detailed modelling of LEZ options in the traffic and air quality modelling will therefore adopt forecast predictions of compliance. The levels of adopted future vehicle compliance is summarised in Chapter 12.

5. THE NATIONAL MODELLING FRAMEWORK

5.1 Introduction

5.1.1 The Cleaner Air for Scotland Strategy (CAFS) provided a commitment to develop a National Modelling Framework (NMF) to provide a standardised approach to modelling air quality to support the consideration of LEZs in Scotland. The NMF ensures that the analysis and generation of evidence to support decision-making in the LEZ development process is consistent across those local authorities undertaking a NLEF Stage 2 assessment.

5.1.2 The NMF air quality modelling is undertaken by SEPA who support local authorities throughout a Stage 2 assessment and the LEZ decision-making process. Modelling results presented in this report have therefore been provided by SEPA in line with the NMF. Full details of the development and applications of the NMF Aberdeen City Air Quality Model will be published in a NMF evidence report, currently in preparation by SEPA.

5.1.3 It should be noted that the existing Aberdeen NMF Model currently focuses on modelled NOx and NO_2 as the key pollutant of interest for Aberdeen. Other pollutants, such as PM_{10}, $PM_{2.5}$ or CO_2 will be modelled at a later date if required. As noted in Chapter 4, there are no recorded monitored exceedances of PM_{10} or $PM_{2.5}$ in the 2018 air quality data for Aberdeen however any reduction in NO_2 as a result of the LEZ will also result in a reduction in PM_{10} or $PM_{2.5}$. Analysis of only NOx and NO_2 modelled outputs from the Aberdeen NMF Model are therefore considered suitable for this stage in the development of Aberdeen's LEZ.

5.1.4 The base year for the Aberdeen NMF Model is 2019 as it has been developed using detailed traffic data and vehicle emission factors for 2019 for the road network shown in Figure 5.1. An annual-average traffic speed is assigned to each road link in the model, and applies to all vehicle types on that stretch of road using speed information derived from Automatic Traffic Counter data and Speed Limit information. During the development of the model, the observed annual average NO_2 concentrations from six automatic monitor and 70 diffusion tube locations in the city (Figure 5.1.), as published in the *2019 Annual Progress Report for Aberdeen City Council (ACC, June 2019)* were compared to the model predictions at these locations to evaluate model performance. The model shows reasonable agreement with most monitors for 2018. Based on the information shown in the maps/plots below, monitoring data from a subset of the diffusion tubes and automatic monitors located in the City Centre were selected for further analysis (as detailed in Section 5.2).

5.1.5 Figure 5.1 shows the extents of the Aberdeen NMF model and modelled annual average NO_2 ($\mu g/m^3$) concentrations at the automatic monitors (squares) and diffusion tubes (crosses) for the 2019 base run. Concentrations below the $40\mu g/m^3$ objective are marked in blue and those exceeding $40\mu g/m^3$ standard are shown in pink.

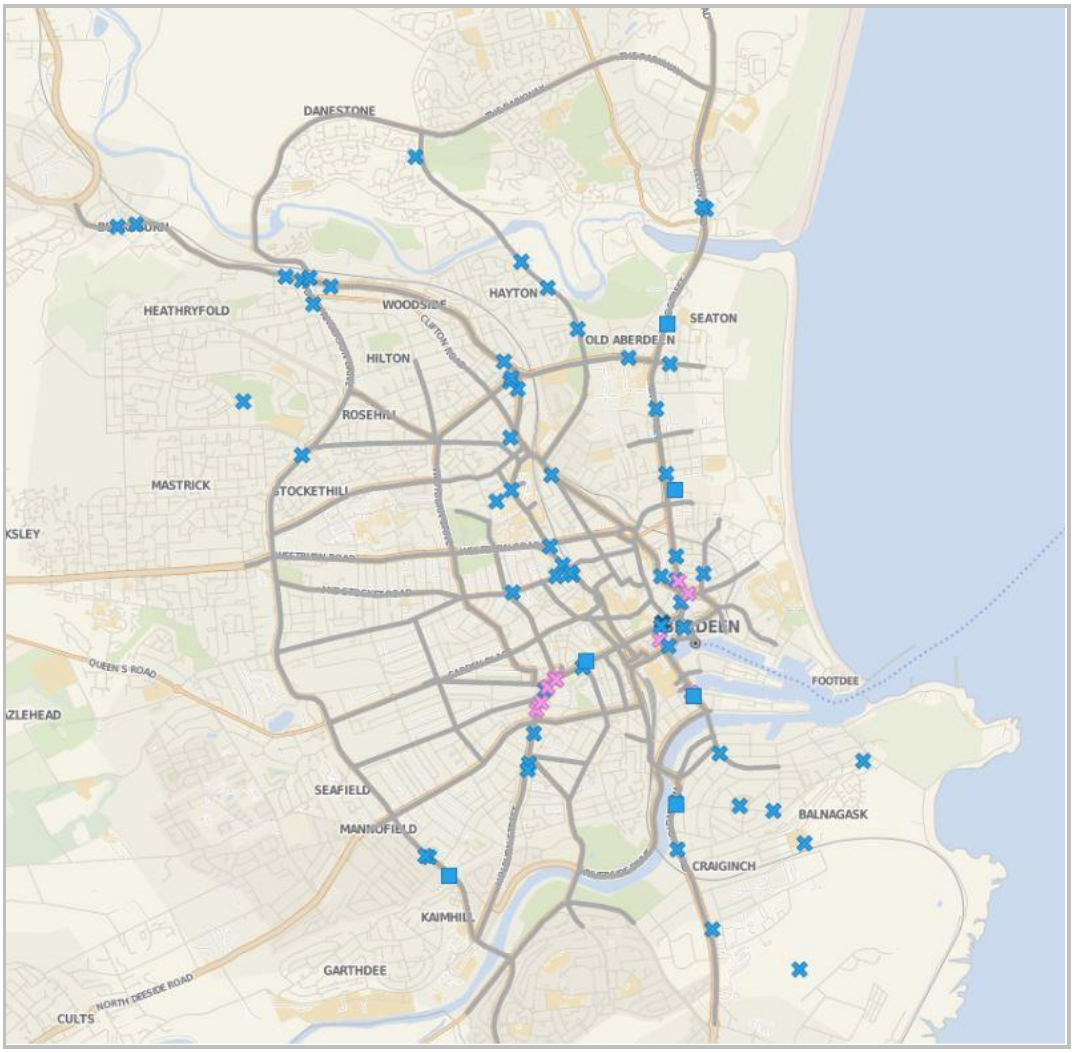

Figure 5.1 : NMF Aberdeen City Model monitoring locations(source: NMF Spotfire App)

5.1.6 The LEZ emission standards under The Transport (Scotland) Act are Euro VI/6 for all diesel vehicles and Euro 4 for petrol vehicles. The Aberdeen NMF Model has been run for five high level LEZ scenarios to estimate likely changes to air quality to inform the option generation process. For each scenario the fleet has been adjusted for the specified vehicle type to bring it up to a 100% compliance with the LEZ standard with the Euro class mix for the other vehicle types remaining unchanged as follows:

- Scenario 1 – All buses Euro VI
- Scenario 2 – All diesel cars Euro 6
- Scenario 3 – All HGVs Euro VI
- Scenario 4 – All LGVs Euro 6
- Scenario 5 – All petrol cars Euro 4

5.1.7 By running these scenarios, the impact of any smaller LEZ option area and any combination of vehicle type restrictions can be inferred for its likely impacts on air quality and this is critical in the LEZ option development and appraisal process. In theory, any number of potential LEZ options can be assessed using a combination of the five scenarios.

5.1.8 In support of the NLEF appraisal, two streams of analysis have been undertaken for all five high level model scenarios and presented in the Sections below:

- model predictions with observed data gathered at the 'real world' automatic monitors and diffusion tubes located in the city centre (Figure 5.1)
- model predictions at more than 4000 roadside points located across the whole of the city (Figure 5.5)

5.2 Analysis of NO_2 at Automatic Monitors and Diffusion Tubes Locations

5.2.1 The Aberdeen NMF Model was run to predict the annual average NO_2 concentrations at all of the automatic monitoring and diffusion tubes sites (Figure 5.1) across the city to assess the air quality situation in 2019 (base run) and then run again for each of the 5 scenarios above. The percentage reduction in total network wide modelled NO_2 between each scenario and the 2019 base run was then calculated. The reductions in NO_2 vary by location and are dependent on factors such as total vehicle flow and proportions of vehicle types on specific modelled links. To illustrate this, the minimum, average and maximum percentage modelled reductions in NO_2 across all automatic monitoring and diffusion tube site locations has been calculated for each scenario and is presented in Table 5.1. The range of percentage reductions at all 2018 exceedance locations is also presented in Table 5.2.

Table 5.1 : Min, Ave and Max percentage reduction by vehicle type

Vehicle Type	% reduction in modelled NO2 from 2019 Base NMF		
	Minimum	Average	Maximum
Bus	-1.7%	-6.3%	-14.7%
Diesel Car	-0.9%	-2.2%	-4.0%
HGV	-0.5%	-1.7%	-4.6%
LGV	-0.3%	-0.9%	-1.5%
Petrol Car	0.0%	-0.1%	-0.1%

5.2.2 The high level Aberdeen NMF Model results show that if all buses in Aberdeen were of Euro VI standard there would be an average 6.3% predicted reduction in total network wide NO_2 across all on-street monitoring locations and that this reduction is greater than any other individual vehicle type. The impact of this reduction varies between a 1.7% and 14.7% reduction depending on model location.

5.2.3 The restriction of diesel cars in a network wide scenario results in an average 2.2% decrease in total network wide modelled NO_2, in line with the bus reduction, and this reduction varies between 0.9% and 4.0% depending on model location.

5.2.4 The addition of HGVs to a network wide scenario results in an average 1.7% reduction in modelled NO_2 while the introduction of LGVs results in an average 0.9% reduction in modelled NO_2. The addition of petrol cars predicts average reductions of less than approximately 0.1%.

5.2.5 Comparisons of modelled NO_2 at on-street monitoring locations and at modelled roadside points indicates that improvements to engine types of Aberdeen's bus fleet will bring the biggest improvements to air quality in Aberdeen and that improvements to all vehicle types, particularly to diesel cars and HGVs, will contribute to air quality improvements.

5.3 Modelled reduction in NO_2 applied to 2018 observed air quality data

5.3.1 As noted above, modelled NO_2 levels at all of Aberdeen's automatic monitoring stations and diffusion tube sites were extracted for the five scenarios and the percentage change from the base run was then calculated. To understand the impact the inclusion of a particular vehicle type may have as part of any LEZ option, the percentage changes were applied to the corresponding observed on-street levels from the 2018 air quality dataset as reported by ACC in the 2019 Annual Progress Report (Aberdeen City Council, June 2019).

5.3.2 The 2019 APR reports on the 2018 air quality monitoring dataset and at the time of this NMF analysis (in first interim Stage 2 Report) it was the most recent fully ratified dataset available. The 2019 air quality dataset is now available and as noted in Chapter 4, this dataset was shown to be comparable to 2018 data. The NMF analysis presented in this

chapter is therefore considered valid and there is no requirement to undertake further NMF modelling using the 2019 dataset at this stage.

5.3.3 The observed 2018 locations of exceedance (greater than the 40 µg/m^3) in annual mean concentrations of NO_2 are detailed in Table 5.2 and shown in Figure 12.5. Note all locations with annual mean concentrations greater than 36 µg/m^3 are also presented as they are considered to be within a 10% margin of error range from on-street monitoring data therefore are potential locations that may be in exceedance of the legal limit. The percentage reduction in modelled NO_2 per scenario at these locations for the five scenarios are shown in Table 5.2.

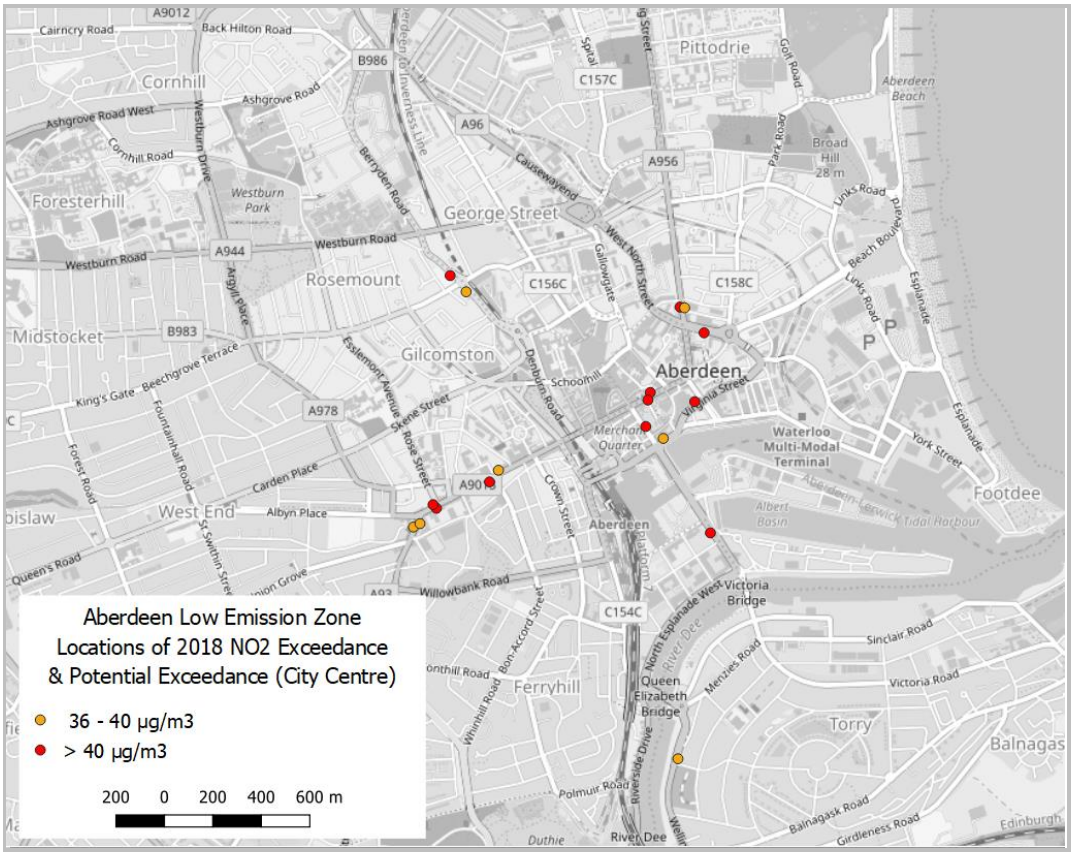

Figure 5.2 : Locations of 2018 Annual Mean Concentrations of NO_2 greater than 36 µg/m3

Table 5.2 : Modelled % reduction in NO_2 (NMF All Roads Scenarios)

Site ID	Site Name	2018 Observed	2019 Modelled (Base)	Sc1 Bus	Sc2 Diesel Car	Sc3 HGV	Sc4 LGV	Sc5 Petrol Car
DT11	105 King St	48	29.8	-3%	-1%	-1%	0%	0%
DT10	184/192 Market St	47	41.8	-5%	-3%	-5%	-2%	0%
DT9	39 Market St	46	42.1	-13%	-3%	-2%	-1%	0%
DT29	469 Union St	45	43.6	-13%	-4%	-1%	-1%	0%
DT12	40 Union St	44	45.1	-15%	-3%	-1%	-1%	0%
DT17	43/45 Union St	44	28.8	-3%	-1%	-1%	0%	0%
DT82	7 Virgina St	44	30.5	-2%	-1%	-1%	0%	0%
DT30	335 Union St	41	27.3	-3%	-1%	-1%	0%	0%
DT19	468 Union St	40	40.1	-11%	-3%	-1%	-1%	0%
DT33	16 East North St	40	40.1	-3%	-3%	-4%	-1%	0%
DT73	61 Skene Sq	40	33.2	-5%	-3%	-1%	-1%	0%
DT18	14 Holburn St	39	26.7	-2%	-1%	-1%	0%	0%
CM2	Union St	38	37.5	-11%	-3%	-1%	-1%	0%
DT16	1 Trinity Quay	37	33.0	-3%	-2%	-2%	-1%	0%
DT25	21 Holburn St	37	42.2	-8%	-4%	-1%	-1%	0%
DT77	27 Skene Sq	37	27.6	-2%	-1%	-1%	0%	0%
DT22	104 King St	36	41.6	-8%	-3%	-4%	-1%	0%

5.3.4 It should be noted, prior to any analysis of the results in Table 5.2, that all results are based on modelled predictions and there may be some model locations where modelled NO_2 does not closely match observed NO_2. The reason for this and the considered

suitability of the model as a tool to assess the impact of LEZs will be detailed in SEPA's NMF evidence report. Whilst the above analysis is useful exercise and guide to the impact of each vehicle in a LEZ, the approach is subject to the uncertainties in the modelling and diffusion tube measurements. Whilst the model is considered to be performing well it does not mean that there will be good agreement between modelled and observed annual average NO_2 concentrations at all locations. This can be due to many reasons including uncertainties due to fleet composition, traffic speed, complex air flow patterns and other factors that the model is unable to replicate due to street detail that is not incorporated in the model.

5.3.5 Of particular note here is predicted reduction in modelled NO_2 at adjacent monitoring locations, for example 40 Union Street and 43/45 Union Street. Observed annual mean NO_2 levels are relatively close (both sites 44µg/m^3) but the model predicts reductions of 15% at 40 Union Street and 3% at 43/45 Union Street for the bus only scenario. These sites are located close together but at opposite sides of Union Street with similar bus movements and therefore the modelled reduction would be expected to be similar. Analysis of NMF Base NO_2 shows the modelled NO_2 at 40 Union Street closely reflects observed levels (within 3%) but that modelled NO_2 at 43/45 Union Street is approximately 30% lower than observed. At other locations where modelled NO_2 in the base run does not closely match observed, the predicted reductions in NO_2 by vehicle type are similarly low. It can therefore be suggested for these results that each vehicle type may bring greater reductions in NO_2 than shown in Table 5.2 for some locations, however no adjustments are made for this observation.

5.3.6 The percentage reductions in modelled NO_2 in the five scenarios was then applied to the 2018 observed dataset to inform the likely impact of a LEZ on existing exceedance locations and assist the LEZ development process with the results shown in Table 5.3.

Table 5.3 : Modelled % reduction in NO_2 applied to 2018 observed data (µg/m^3)

Site Name	2018 Observed	Sc1 Bus	Sc2 Diesel Car	Sc3 HGV	Sc4 LGV	Sc5 Petrol Car
105 King St	48	46.8	47.5	47.4	47.8	48.0
184/192 Market St	47	44.7	45.6	44.8	46.3	47.0
39 Market St	46	40.1	44.8	45.3	45.5	46.0
469 Union St	45	39.3	43.4	44.5	44.5	45.0
40 Union St	44	37.5	42.7	43.4	43.5	44.0
43/45 Union St	44	42.9	43.6	43.6	43.8	44.0
7 Virgina St	44	43.3	43.5	43.4	43.8	44.0
335 Union St	41	39.9	40.6	40.8	40.9	41.0
468 Union St	40	35.6	38.7	39.6	39.6	39.9
16 East North St	40	38.7	39.0	38.5	39.6	39.9
61 Skene Sq	40	38.1	39.0	39.6	39.6	39.9
14 Holburn St	39	38.2	38.5	38.8	38.9	39.0
Union St	38	34.0	37.0	37.6	37.7	38.0
1 Trinity Quay	37	36.0	36.3	36.2	36.7	37.0
21 Holburn St	37	33.9	35.5	36.4	36.5	37.0
27 Skene Sq	37	36.2	36.5	36.8	36.8	37.0
104 King St	36	33.2	35.1	34.6	35.6	36.0

5.3.7 Grey cells in Table 5.3 show locations where the modelled reductions do not predict a sufficient reduction in NO_2 for observed levels to fall below 40 µg/m^3. Yellow cells show locations where levels of NO_2 are predicted to be between 36 µg/m^3 and 40 µg/m^3.

5.3.8 The high level Aberdeen NMF Model results above show that improving the bus fleet to Euro VI standard buses in Aberdeen brings the largest reduction in network wide NO_2, and that this reduction is significantly more than any other individual vehicle type. Table 5.3 shows however, that 6 sites do not have a sufficient reduction in NO_2 to fall below 40

µg/m³ and a further 7 sites are calculated to have between 36 µg/m³ and 40 µg/m³. These locations are shown in Figure 5.3.

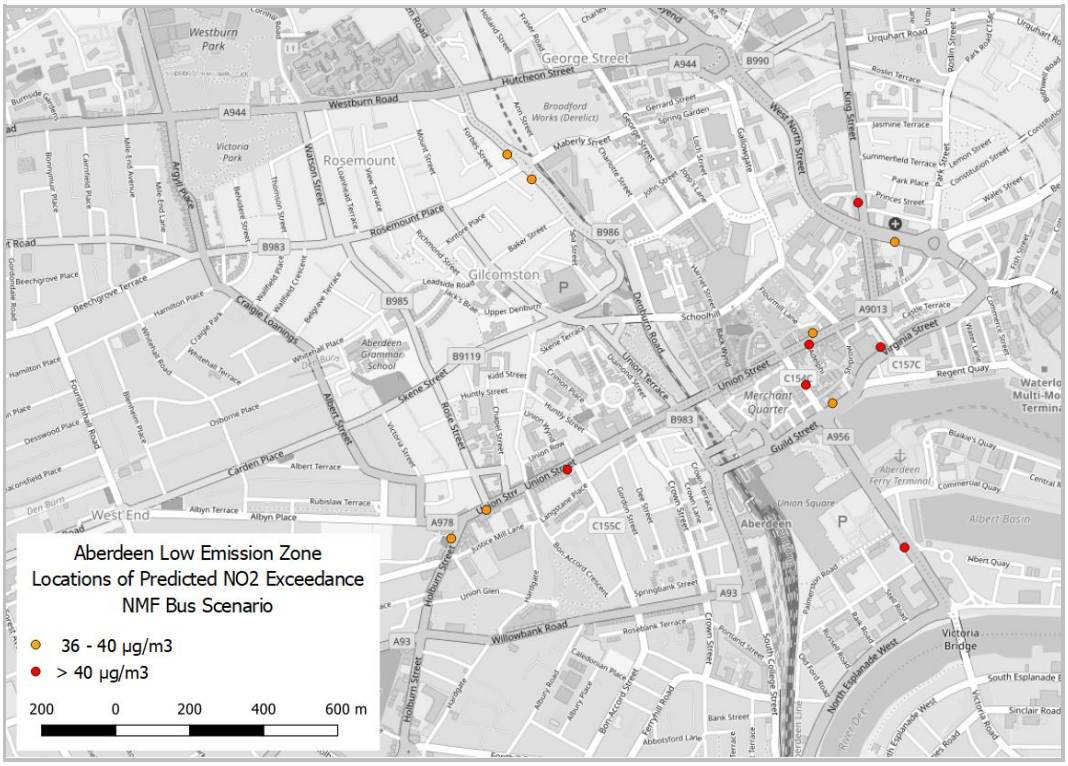

Figure 5.3 : Locations of predicted NO_2 greater than 36 µg/m³ – Bus only

5.3.9 All other individual vehicle type scenarios result in smaller percentage reductions in NO_2 concentrations. However, the reductions from each individual scenario can be combined to explore the additional percentage reductions that could be achieved from a multi-vehicle LEZ, with the following specific scenarios examined:

- Bus and Diesel Car
- Bus, Diesel Car and HGV
- Bus, Diesel Car, HGV and LGV
- All vehicles (Bus, Diesel Car, HGV, LGV and Petrol Car Euro 4)

5.3.10 The calculated percentage reductions from the combined scenarios, applied to the 2018 observed dataset are shown in Table 5.4

Table 5.4 : Combined modelled % reduction in NO_2 applied to 2018 observed data (µg/m³)

Site Name	2018 Observed	Bus Only	Bus & Diesel Car	Bus, Diesel Car & HGV	Bus, Diesel Car, HGV & LGV	All Vehicles
105 King St	48.0	46.8	46.3	45.7	45.5	45.5
184/192 Market St	47.0	44.7	43.3	41.2	40.5	40.4
39 Market St	46.0	40.1	38.9	38.2	37.7	37.6
469 Union St	45.0	39.3	37.7	37.2	36.6	36.6
40 Union St	44.0	37.5	36.3	35.7	35.2	35.1
43/45 Union St	44.0	42.9	42.5	42.1	41.9	41.9
7 Virgina St	44.0	43.3	42.8	42.2	42.0	41.9
335 Union St	41.0	40.0	39.5	39.3	39.2	39.2
468 Union St	40.0	35.6	34.3	33.9	33.4	33.4
16 East North St	40.0	38.7	37.7	36.2	35.7	35.7
61 Skene Sq	40.0	38.1	37.1	36.7	36.4	36.3
14 Holburn St	39.0	38.2	37.8	37.6	37.4	37.4
Union St	38.0	34.0	33.0	32.6	32.2	32.2
1 Trinity Quay	37.0	36.0	35.3	34.5	34.2	34.2
21 Holburn St	37.0	33.9	32.5	31.9	31.4	31.4
27 Skene Sq	37.0	36.2	35.8	35.6	35.4	35.4
104 King St	36.0	33.2	32.3	30.9	30.5	30.5

5.3.11 The combined modelled percentage reductions show that the addition of diesel cars to the bus only scenario predicts an additional 2 sites will fall below 40 µg/m³ but that there will be 4 locations where NO_2 is predicted to be remain above 40 µg/m³. The subsequent addition of HGVs, LGVs and finally petrol cars does not result in any additional locations predicted to fall below 40 µg/m³. The remaining exceedance locations from these scenarios is shown in Figure 5.4.

Figure 5.4 : Locations of predicted NO_2 greater than 36 µg/m³ – Bus & diesel car

5.4 Analysis of Modelled NO_2 at Model Roadside Locations

5.4.1 In addition to the analysis of modelled NO_2 reduction at the monitoring locations, the Aberdeen NMF Model also predicts NOx and NO_2 levels at more than 4000 roadside points across the road network. These have been set up along the pavement edge along both sides of every road link in the model as shown in Figure 5.5. This network of 'virtual

monitoring locations' allows the potential benefits to air quality to be assessed over a larger area of the city than that represented by the current monitoring locations. Figure 5.5 below shows the output from the base run for 2019 and provides a picture of current air quality across the whole of the city. Each roadside point is represented by a coloured dot, with the colour indicating modelled annual average NO_2 concentrations. Concentrations below the 40µg/m^3 objective are marked in blue and those exceeding 40µg/m^3 standard are shown in pink. Those points exceeding 55µg/m^3 are shown in black.

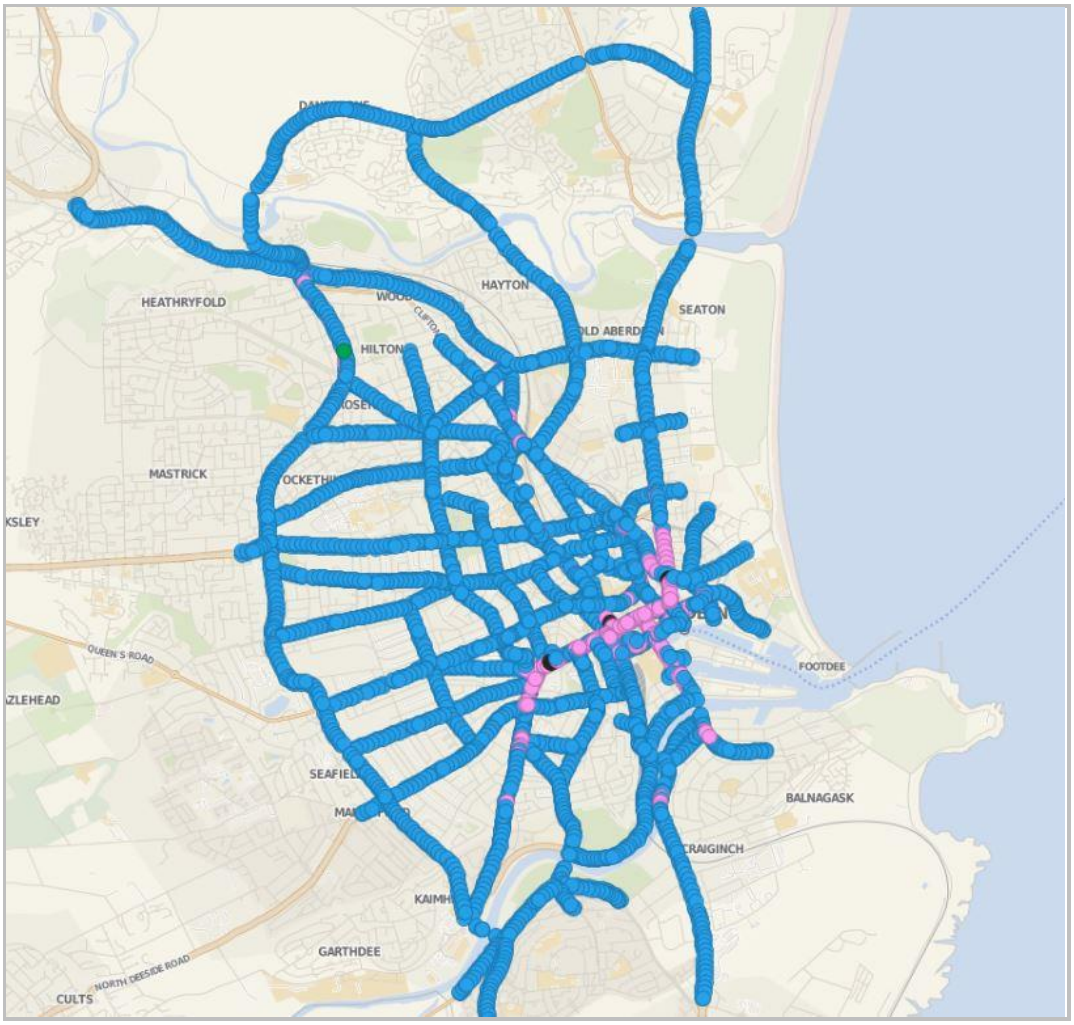

Figure 5.5 : Modelled roadside annual average NO_2 (µg/m^3) concentrations (2019 base NMF Model).

5.4.2 Comparing the total number of roadside points where NO_2 levels are greater than 40µg/m^3 for each scenario provides an indication of the likely improvement each scenario has on predicted levels of NO_2. This information is key to identifying LEZ options. The total number of roadside points where NO_2 is greater than 40µg/m^3 for the Aberdeen NMF Model base run and each model scenario are summarised in Table 5.5

Table 5.5 : Roadside points with modelled NO_2 > 40µg/m^3

NMF Scenario	Total No. of RPs Citywide	RPs > 40µg/m^3 Citywide	% difference from Base
Base	4089	226	-
All Buses at Euro VI	4089	119	-47%
All Diesel Cars at Euro 6	4089	175	-23%
All HGVs at Euro VI	4089	187	-17%
All LGVs at Euro 6	4089	205	-9%
All Petrol Cars > Euro 4	4089	224	-1%
All Vehicles to LEZ Standard	4089	24	-89%

5.4.3 The model predicts that if all buses were Euro VI standard, there would be a 47% reduction in modelled roadside points where NO_2 is predicted to be greater than 40µg/m^3. Bringing all vehicles to LEZ standard, there would be a 89% reduction modelled roadside points where NO_2 is predicted to be greater than 40µg/m^3. The modelling therefore shows that an all vehicle LEZ would result in a significant reduction in NO_2 but this would not result in all modelled locations falling below the legal limit of 40µg/m^3.

5.4.4 The city centre currently experiences the highest number of NO_2 exceedances scattered throughout the area and the highest levels of exceedance. The predicted annual average NO_2 concentrations at several roadside points exceed 55 µgm^{-3} with the highest predicted NO_2 concentration of 64.60 µgm^{-3} at a roadside point located on King Street. Figure 5.6, Figure 5.7 and Figure 5.8 demonstrate the modelled improvement in air quality for the 2019 baseline (Figure 5.6), a fully compliant bus fleet (Figure 5.7) and the scenario where all vehicle types achieve the LEZ standard (Figure 5.8). Each roadside point is represented by a coloured dot, with the colour indicating modelled annual average NO_2 concentrations. Concentrations below the 40µg/m^3 objective are marked in blue and those exceeding 40µg/m^3 standard are shown in pink. Those points exceeding 55µg/m^3 are shown in black.

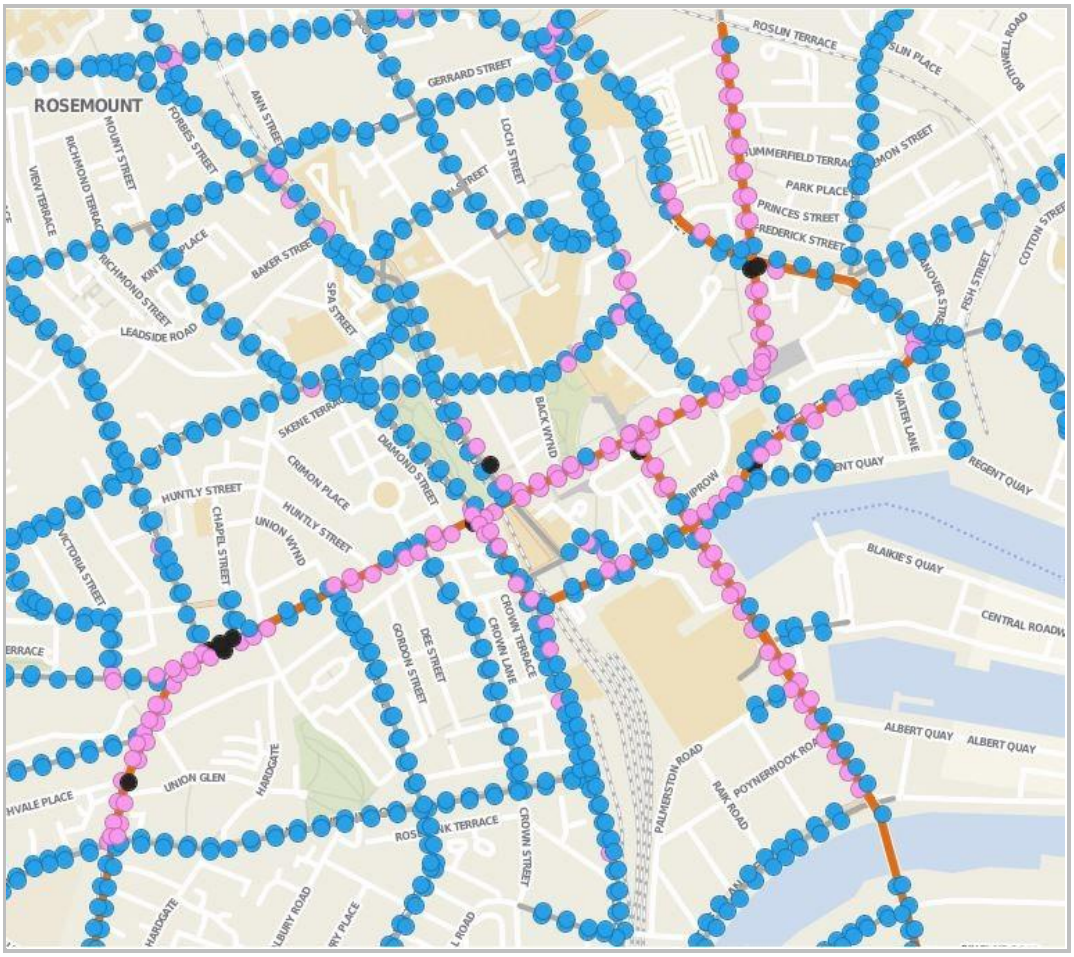

Figure 5.6 : Modelled roadside annual average NO_2 (µg/m³) concentrations (2019 base NMF Model)

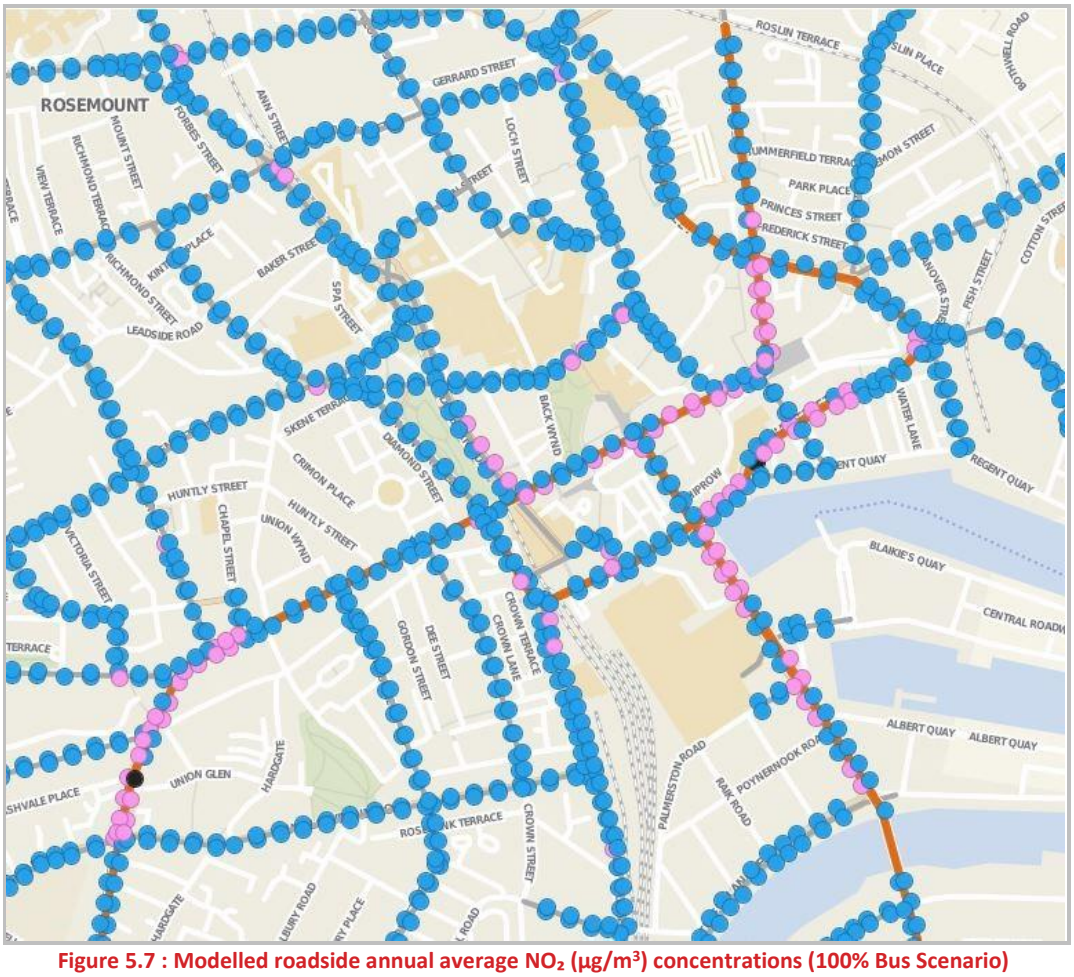

Figure 5.7 : Modelled roadside annual average NO_2 (µg/m³) concentrations (100% Bus Scenario)

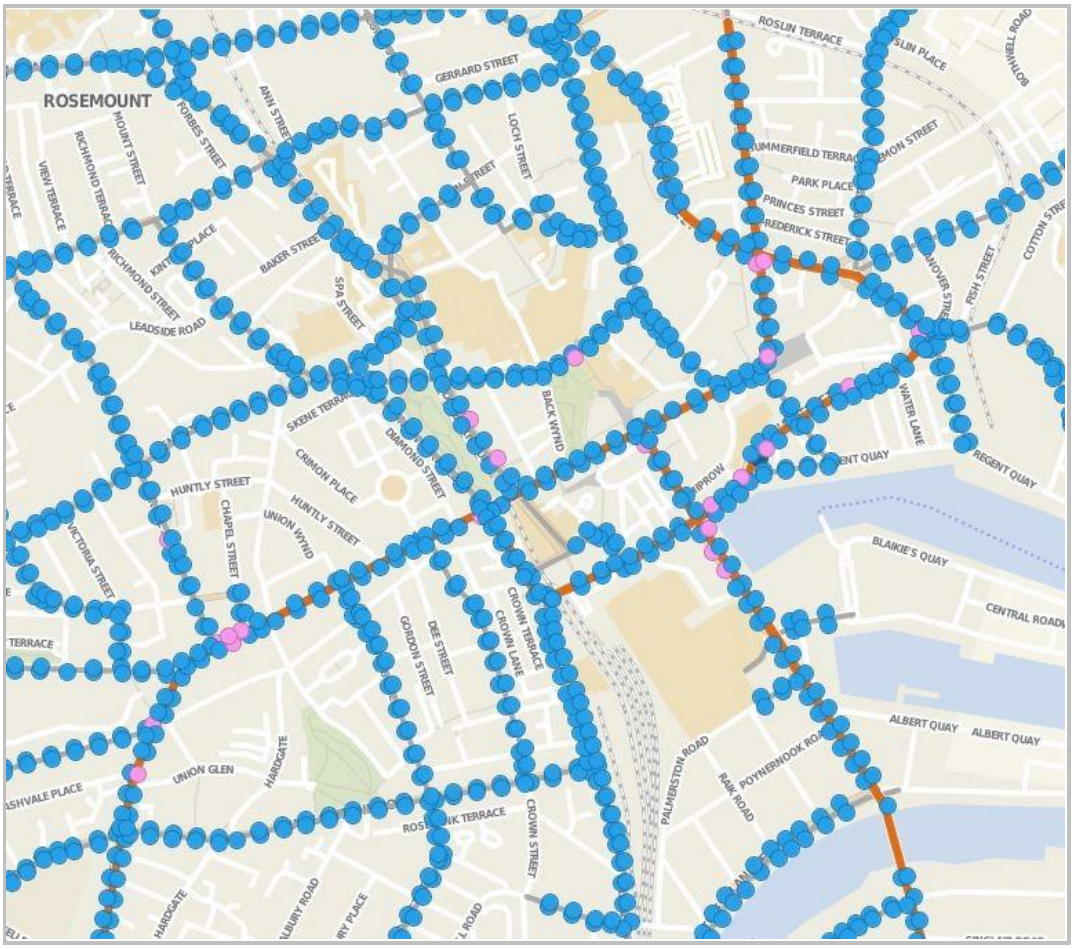

Figure 5.8 : Modelled roadside annual average NO_2 (µg/m³) concentrations (All Vehicle Scenario)

5.4.5 The Aberdeen NMF model has been used to explore the relative contribution of different vehicle sources to the annual average total NOx concentration at the roadside points. Figure 5.9 highlights the road links (in black) where the predicted contribution to total NOx for buses exceeds 40% and is higher than the contribution from the other vehicle types for the base run. Virtually all of Union Street is highlighted with between 40% and 60% of total NOx originating from this vehicle type. Diesel cars and LGVs are the next major contributors to the annual average total NOx along these roads with diesel cars contributing 30% NOx. HGVs and petrol cars make much smaller contributions to the annual average total NOx.

Figure 5.9 : Links (in black) where predicted contribution to NOx by buses is > 40% (base run)

5.4.6 In contrast, Figure 5.10 below shows a selection of roads highlighted (black) located in the city centre where the fleet composition differs to that on Union Street with diesel cars the

dominant source of NOx (>40%) followed by LGVs (20%) with a reduced contribution from buses. HGVs make a more significant contribution to annual average total NOx (20%) particularly along roads such as Virginia Street and Market Street that provide access to the harbour area.

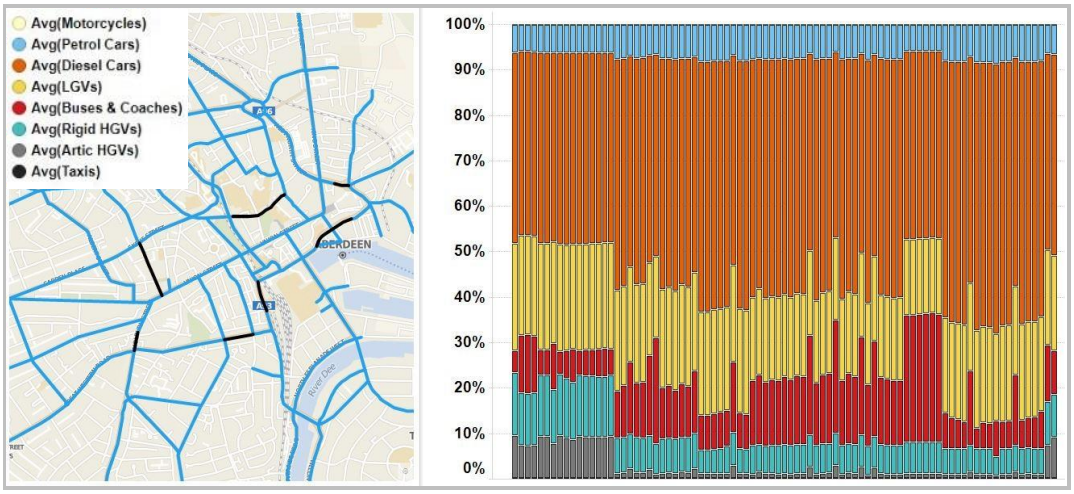

Figure 5.10 : Links (in black) where predicted contribution to NOx by diesel cars is > 40% (base run)

5.5 Key findings from the NMF High Level Scenario Testing

5.5.1 The City Centre AQMA, in particular the Union Street, Holburn Street and King Street corridor currently experiences the highest number of NO_2 exceedances. The biggest emitters along these roads through the city centre are buses. These streets are lined with high buildings that can be described as narrow and deep "street canyons" which can trap air pollution close to ground level.

5.5.2 The high level Aberdeen NMF Model results show that should all buses meet the Euro VI standard, this would bring the largest single reduction in NO_2 network-wide and that this reduction is significantly more than any other vehicle type would provide. This suggests that a LEZ for Aberdeen is likely to have to include buses in order for a LEZ to achieve its air quality objective.

5.5.3 When applying modelled NO_2 reductions from the bus only scenario to 2018 observed exceedance locations however, the Aberdeen NMF Model predicts there to be 6 locations still exceeding 40 µg/m^3 and a further 7 sites between 36 µg/m^3 and 40 µg/m^3. This result suggest that while a Euro VI bus fleet would bring the largest reduction in NO_2, this alone is not sufficient in addressing all exceedances in Aberdeen.

5.5.4 Whilst buses dominate emissions along the Union Street, Holburn Street and King Street corridor diesel cars are the primary contributors to annual average total NOx elsewhere. LGVs are the third largest contributor with other Goods Vehicles adding smaller amounts. By combining the percentage reduction in NO_2 from all vehicles being of LEZ standard, it can be inferred that an all vehicle LEZ does not bring a sufficient enough reduction in NO_2 to allow a LEZ alone to tackle all air quality exceedances. It can therefore be suggested at this stage, prior to any LEZ option development that a LEZ for Aberdeen will have to include all vehicle types and have to be delivered with traffic management measures if all exceedances of the air quality objectives are to be addressed.

6. KEY EVIDENCE TO INFORM ABERDEEN'S LEZ DEVELOPMENT

6.1 Introduction

6.1.1 The assessment and appraisal process to develop Aberdeen's LEZ is following the National Low Emission Framework (NLEF) guidance, a two stage process consisting of the following elements:

- Stage 1 – Screening
- Stage 2 – Assessment

6.1.2 The NLEF Stage 1 screening should review Aberdeen's Local Air Quality Management and build an evidence base to assist in the decision of whether a LEZ is appropriate for an AQMA and subsequently inform the appraisal and implementation of Aberdeen's LEZ through the Stage 2 Assessment process. Transport Scotland have advised Aberdeen City Council (ACC) that the NLEF Stage 1 is not formally required as Aberdeen are committed to delivering a LEZ for the city, as a result of the Scottish Government commitment.

6.1.3 While no formal screening outcome is required, the key stage of compiling the evidence base to support the LEZ option development and appraisal has been undertaken in Chapters 1.1.9, 4 and 5. It is crucial to Stage 2 of the NLEF appraisal that there is full understanding of the existing air quality problems in Aberdeen and that all relevant regional and local plans, policies and strategies that may influence or be influenced by a LEZ in Aberdeen have been reviewed.

6.2 Key findings from the Evidence Base

6.2.1 There are three existing AQMAs in Aberdeen: the City Centre, Anderson Drive and Wellington Road. Analysis of the current observed air quality dataset confirmed that a LEZ is an appropriate tool to tackle air quality problems for the Aberdeen City Centre AQMA only and this should therefore be the focus of the NLEF option appraisal process.

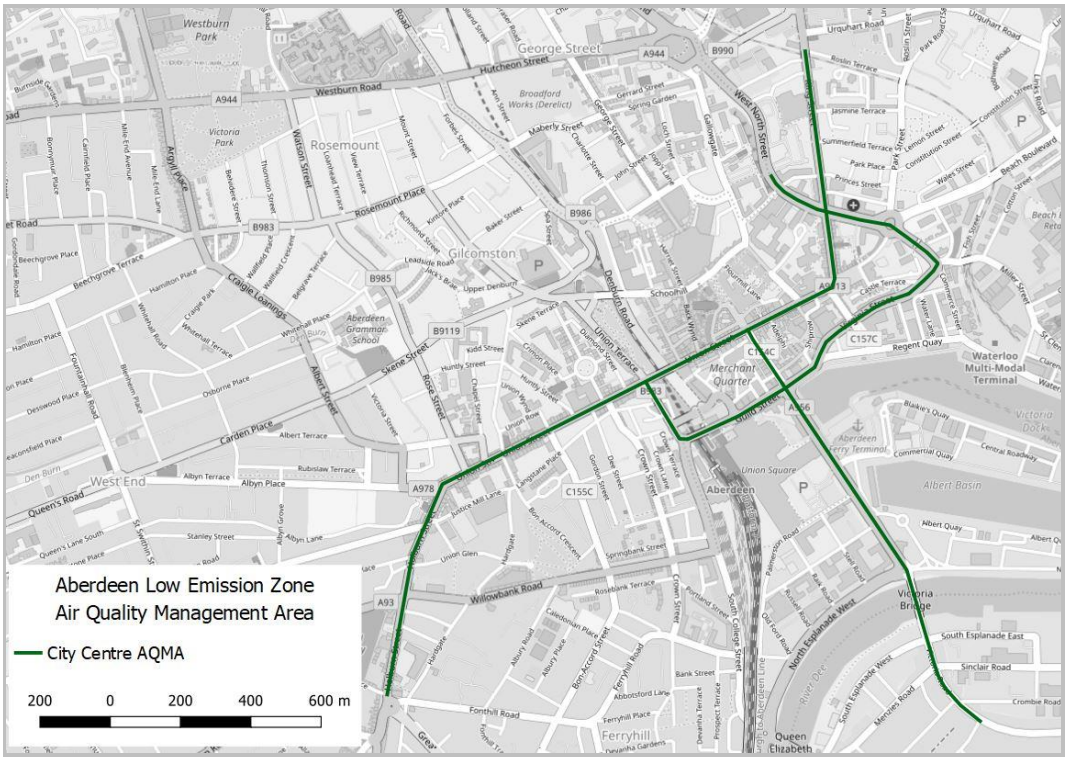

Figure 6.1: Aberdeen City Centre AQMA for NO_2 and PM_{10}

6.2.2 In the city centre AQMA there are 8 locations where observed annual mean concentrations of NO_2 exceed the AQO of 40 µg/m^3 and a further 9 sites where annual

mean concentrations of NO_2 exceed 36 µg/m^3. The high level NMF air quality modelling results in Chapter 5 show that improving the bus fleet to Euro VI standard buses in Aberdeen brings the largest reduction in network wide NO_2, and that this reduction is significantly more than any other individual vehicle type. However this improvement is not, in itself, enough to remove all air quality exceedances.

6.2.3 Furthermore, the NMF air quality modelling has shown that if all vehicles in Aberdeen (city wide and regardless of potential LEZ options area) were compliant with LEZ emission standards, this measure would also not be enough to address all exceedance locations, although it must be noted that those remaining exceedances are significantly reduced from current levels closer to legal limits.

6.2.4 In order to tackle all air quality exceedance locations, it is therefore anticipated that the LEZ should be delivered with additional complimentary traffic management interventions such as junction re-design, bus priority measures or road closures.

6.2.5 The Aberdeen City Centre Paramics model (developed as part of the wider LEZ assessment work) is utilised to test the preferred LEZ options and help identify where complimentary measures are required (Chapters 12 to 14).

6.2.6 The Aberdeen LEZ and any complimentary traffic management measures should align with the existing transport policy landscape in Aberdeen. As reviewed in Chapter 1.1.9, key Aberdeen policies and strategies that may shape the final LEZ option(s) are:

- Aberdeen Local Transport Strategy (2016)
- Aberdeen City Centre Masterplan (CCMP)
- North East Scotland Roads Hierarchy Study
- Aberdeen City Sustainable Urban Mobility Plan (SUMP)

6.2.7 Of particular relevance is the optimum delivery programme for the CCMP proposals identified through a detailed Paramics model testing process in 2016 and the reasoning for the implementation order being proposed. Although the delivery of the CCMP is subject to change, any LEZ option should not contradict the proposals identified by previous studies without providing the rationale for doing so.

7. OBJECTIVES OF ABERDEEN LOW EMISSION ZONE

7.1 Introduction

7.1.1 NLEF Guidance states that "*the starting point for the stage two assessment process will be to define the objectives for the potential LEZ, taking account of the pollutant(s) of concern and with regard to any available information on source apportionment that identifies particular vehicle types that are a significant contributor to any air quality exceedances"* (NLEF, 2019).

7.1.2 The Aberdeen Low Emission Zone Project Group meeting on 14th November 2019 agreed the following principles to help devise the objectives of Aberdeen's Low Emission Zone:

- The principal aim of the LEZ is to improve air quality in Aberdeen and achieve air quality standards (as specified in the Transport (Scotland) Act)
- An individual health objective should not be set given the difficulty in obtaining baseline health information of the population and measuring any resultant health benefits directly as a result of the LEZ
- Protection of and improvements to health will be an outcome of improvements to air quality
- The introduction of a LEZ should not be to the detriment of the city's economic or social inclusion objectives
- The LEZ should aim to positively impact on the city economy, access to active travel options and changes in mode-share, city placemaking, social equality, tourism, and sustainable development and the LEZ objectives should reflect this.

7.1.3 The Aberdeen LEZ is required to sit within a well-established transport policy landscape. It is required to complement the vision and objectives of the wider policies and strategies including:

- National Transport Strategy 2
- Regional Transport Strategy 2040
- Aberdeen Local Transport Strategy (2016)
- Aberdeen City Centre Masterplan
- North East Scotland Roads Hierarchy Study
- Aberdeen City Sustainable Urban Mobility Plan

7.1.4 These policies and strategies are detailed in Chapter 3 and it is important that these policies help shape the LEZ objectives and in turn the LEZ option(s).

7.1.5 The Aberdeen LEZ is expected to positively impact on air quality in Aberdeen, thereby enhancing and complimenting common aspirations for the city, namely:

- Improved air quality and the environment
- Enhanced accessibility and permeability for sustainable transport
- A safe and secure transport system
- A transport system that facilitates healthy and sustainable living
- Promotion of the city centre as an accessible destination
- Continued sustainable economic growth in the City

7.1.6 While the objectives for the LEZ can be refined over time to better target emerging issues and policies it is important that the initial LEZ objectives have longevity and be futureproofed to any changes in the LEZ size, scope or location.

7.2 Objectives of Aberdeen's Low Emission Zone

7.2.1 Objectives were developed by the Aberdeen LEZ Project Group, comprising representatives of ACC, Aberdeenshire Council, Nestrans, NHS Grampian, Transport Scotland, SEPA and SYSTRA. Two primary objectives were identified to reflect that the principal aim of a LEZ is to improve air quality and a requirement within the Transport (Scotland) Act that a LEZ should contribute towards the climate change targets (towards net zero by 2045) set out in the Climate Change (Scotland) Act 2009.

7.2.2 The objectives for Aberdeen's Low Emission Zone were approved at the City Growth and Resources Committee meeting on 5th December 2019, in the light of the context set out above.

7.2.3 Aberdeen's Low Emission Zone will:

Improve air quality in Aberdeen by reducing harmful emissions from transport and delivering on the Scottish Government's statutory air quality objectives.

Support climate change targets by reducing road transport's contribution to emissions.

7.2.4 It is recognised that a LEZ can help realise wider benefits beyond air quality improvement, but that these are influenced by many other factors and not solely or directly attributable to a LEZ. Therefore the following supplementary objectives for Aberdeen's Low Emission Zone have been identified:

- Protect public health and wellbeing;
- Support local and regional transport strategies by contributing to the development of a vibrant, accessible, and safe city centre, where the volume of non-essential traffic is minimised and active and sustainable transport movements are prioritised; and
- Contribute to ongoing transformational change in Aberdeen, helping promote the city as a desirable place to live, visit and invest in.

8. LEZ OPTION GENERATION

8.1 Introduction

8.1.1 NLEF is objective-led and consistent with the principles of Scottish Transport Appraisal Guidance (STAG). The starting point for the Stage 2 assessment is to define the objectives for the potential LEZ to inform the LEZ option generation, sifting and development. STAG states:

"The purpose of Option Generation, Sifting and Development is to derive a range of options which should provide the solution/s to meet the Objectives and alleviate the problems identified. It is vital to derive options which fully reflect the range available and at this early phase in the process, this exercise should not be constrained."

8.1.2 Chapter 4 identified the existing air quality problems and issues in Aberdeen, and the LEZ objectives have been derived such that any options that satisfy these objectives will address the current air quality issues in the city.

8.1.3 Following STAG principles, an unconstrained option generation exercise is first undertaken to allow all possible options to be considered and open to appraisal. This is likely to result in a large number of potential options that required sifting, refinement and high level appraisal to ensure they were suitable to be progressed to detailed appraisal and testing.

8.1.4 STAG emphasises that option generation, sifting and development should be carried out in a logical, transparent and therefore auditable manner. As such, the steps undertaken for Aberdeen's LEZ options development are as follows:

- **Option Generation**
  - Define suitable LEZ areas
  - Combine with possible LEZ vehicle restrictions to create long list of LEZ options
- **Option Sifting**
  - Screen against LEZ air quality objective
  - Screen against feasibility, affordability and public acceptability
  - Screen against all LEZ objectives
- **Option Development**
  - Undertake high level qualitative appraisal
  - Define emerging options for detailed appraisal

8.1.5 At suitable stages in the assessment process, options that fail the screening criteria are removed and not progressed in the appraisal process. Prior to starting each appraisal step, and in line with STAG, options can be rationalised at suitable points in the appraisal to give a more succinct set of options. The options remaining at the end of the full high level appraisal process are taken forward for detailed appraisal.

8.1.6 STAG guidance suggests a high level assessment of all options against their feasibility, affordability and public acceptability is undertaken as an initial screening method. However, no assessment against public acceptability or affordability is made at this stage of the interim NLEF appraisal due to the minimal option detail, lack of public consultation (as this stage) and unknown future funding and operating costs. The NLEF appraisal will conclude process will identify a set of detailed options for public and stakeholder consultation, and thereafter an assessment against public acceptability and affordability will be undertaken.

8.1.7 In addition to feasibility, an assessment of the logic of each proposed LEZ option boundary is undertaken as a screening method. Each option is therefore broadly assessed against:

- Feasibility – a preliminary assessment of the feasibility of implementation and operation of an option as well as any cost, timescale or deliverability risks associated with the operation of the option.
- Logical Boundary – consideration of geographically distinct areas to influence the understanding of the LEZ boundary such as key roads and junction and allowance for logical alternative routes for non-compliant vehicles.

8.1.8 Where required, the options are assessed using a seven-point assessment scale, in line with STAG, and as detailed in Figure 8.1. The STAG Technical Database suggests that qualitative information on impacts is all that is required at the option generation and development stage, but where available, quantitative information can be provided, as informed by the NMF results in Chapter 5.

Major negative impacts	Moderate negative impacts	Minor negative impacts	No benefit or impact	Minor benefit	Moderate benefit	Major benefit
---	--	-	0	+	++	+++

Figure 8.1 : STAG Seven-point assessment scale

8.2 Areas for a Low Emission Zone

8.2.1 The NLEF guidance states that:

"The indicative boundary of potential options for consideration should be defined at the outset, taking account of local circumstances. Potentially, more than one boundary may be considered. For example, the AQMA boundary or one which covers just a few streets with the highest concentrations of air pollutants."

8.2.2 In accordance with NLEF guidelines, the area for consideration will be informed by:

1. the area of exceedance of air quality objectives and the main sources of pollutants
2. geographically discrete areas, such as a town centre and other areas which are well defined (e.g. within an inner ring road)
3. features that may influence enforcement (e.g. an outer ring-road with junctions leading into exceedance areas, key access points such as bridges)
4. mapped emissions by vehicle type in order to identify areas where options are likely to be most effective. Mapping bus routes, taxi ranks and/or residential and commercial land-uses will be useful.
5. air quality along any such alternative routes to determine if they could be at risk of new exceedances as a result of displaced traffic
6. the potential need to allow vehicles to divert onto alternative routes to avoid the area of the LEZ

8.2.3 The initial option generation exercise will primarily consider points 1 to 4 in the NLEF guidance. Points 5 and 6 will inform the more detailed qualitative appraisal of emerging LEZ options, as described in Chapter 9.

8.2.4 The size and extent of areas should be designed to meet the objectives that have been set for the LEZ but there is likely to be a range of other issues that will require to be considered such as access, traffic management and the effect on surrounding roads and existing ACC strategies, such as the City Centre Masterplan, the Sustainable Urban Mobility Plan and the North East Scotland Roads Hierarchy Study (Chapter 3).

8.2.5 Following this NLEF guidance, the LEZ option generation exercise was started where the potential area of the LEZ was the only consideration. By excluding vehicle restrictions from the exercise, a wide-ranging (and unconstrained) option list could be developed. For

example, an all vehicle LEZ or a bus only LEZ will significantly influence the practicality or feasibility of an LEZ option and in turn the areas that can be considered.

8.2.6 As noted in Chapter 4, the area for a LEZ in Aberdeen focusses on the City Centre AQMA only.

8.2.7 Table 8.1 details all the areas considered and provides a link to a plan of each area detailed in Appendix A.

Table 8.1 : Aberdeen LEZ areas for consideration

LEZ Area Option	Description and development narrative
Option 1 Central Union Street	Central section of Union Street from Bridge Street to Market Street. The option cuts the centre of Union Street and although it covers a limited area, it may change through-routeing thereby addressing additional areas of air quality concern
Option 2 Union Street	Full length of Union Street. The option targets the key city centre route and the numerous air quality exceedances. It is a key bus corridor and any reduction in traffic resulting from a LEZ may improve air quality and facilitate improvements to bus provision and services.
Option 3 Union Street, Market Street & King Street	Union Street from Bridge Street to King Street, south of East North Street. The option extends Option 1 to capture exceedance locations on Market Street and Union Street and may influence routeing around King Street and East & West North Street
Option 4 Holburn Street, Union Street and King Street	Holburn Street, north of A93 to King Street, south of East North Street. A combination of Option 2 and Option 3, this option targets a key strategic route and adjacent exceedance locations
Option 5 City Centre Core	Holburn Street, north of A93 to King Street, south of East North Street and Market Street, north of Guild Street. Similar to Option 4, the option extends to the south to capture potential exceedance locations on the north end of Holburn Street while potentially influencing the western strategic routeing in the city
Option 6 City Centre AQMA	The option area covers the entire city centre AQMA. The LEZ is focused in the AQMA area and it is considered intuitive for a LEZ to follow an established air quality intervention area
Option 7 City Centre Masterplan	The city centre masterplan is a key ACC policy and the LEZ should complement this. This option has therefore been devised to mirror the established city centre masterplan area
Option 8 City Centre Exceedances	Option 7 (CCMP) does not encompass all exceedance locations and therefore Option 8 is devised as the minimum area covering all exceedances and potential exceedances of the NO_2 annual mean air quality objective

LEZ Area Option	Description and development narrative
Option 9 Holburn Street to Mounthooly roundabout	The option is devised to closely follow the key strategic routes of Holburn St, Willowbank Rd, South College St, Guild St, Virginia St, West North St, Hutcheon St, Skene Sq and Skene St. This allows for viable alternative routes for non-compliant vehicle while covering key exceedance locations
Option 10 Union Street with extended boundary	The option is devised to cover the same exceedances as Union St option (Option 2) but is bound by clearly defined roads to provide viable alternative routes for non-compliant vehicles
Option 11 Westburn Road/Hutcheon St to Willowbank Road	Area bound by Westburn Rd/Hutcheon St, West North St, Virginia St, Guild St, Willowbank Rd, Holburn St, Albert St, Argylle Pl, this option extends Option 10 to the west to include Gilcomston and Rosemount while still being bound by viable alternative routes
Option 12 Westburn Road/Hutcheon St to the River Dee	This option extends Option 11 to the south to capture a wider area including exceedance locations on Market Street
Option 13 City Centre Exceedances with extended boundary	This option is devised to cover all the air quality exceedances as per Option 8 but is bound by clearly defined roads to provide viable alternative routes for non-compliant vehicles
Option 14 City Centre Exceedances with additional extended boundary	The option extends the Option 13 to include Argyll Pl and Albert St and further influence strategic routeing on the western side of the city centre
Option 15 City Centre Masterplan with extended boundary	The option was developed from Option 7 to cover the proposed city centre masterplan area but is bound by clearly defined roads to provide viable alternative routes for non-compliant vehicles
Option 16 City Cordon	Area bounded by the River Don, Anderson Drive and River Dee and devised to provide a wide area option encompassed by these key strategic routes.

8.2.8 At this stage, all areas considered are not fully defined in scope and are open to adjustment and variation as the appraisal process develops. The appraisal process may result in multiple variants of each option that include or exclude some areas or sections of road as details of the impacts of each option emerge.

8.2.9 A high level assessment was made on each of these areas to assess whether they would likely be feasible and logical (as defined in 8.1.7) if adopted as a Low Emission Zone as shown in Table 8.2.

Table 8.2 : Aberdeen LEZ Area Screening

LEZ Area	Feasible	Logical	Progress in appraisal
Central Union Street	Yes	No	No
Union Street	Yes	No	No
Union Street, Market Street & King Street	Yes	Yes	**Yes**
Holburn Street, Union Street and King Street	Yes	No	No
City Centre Core	Yes	No	No
City Centre AQMA	Yes	No	No
City Centre Masterplan	Yes	No	No
City Centre Exceedances	Yes	No	No
Holburn Street to Mounthooly roundabout	Yes	Yes	**Yes**
Union Street with extended boundary	Yes	Yes	**Yes**
Westburn Road/Hutcheon St to Willowbank Road	Yes	Yes	**Yes**
Westburn Road/Hutcheon St to the River Dee	Yes	Yes	**Yes**
City Centre Exceedances with extended boundary	Yes	Yes	**Yes**
City Centre Exceedances with additional extended boundary	Yes	Yes	**Yes**
City Centre Masterplan with extended boundary	Yes	Yes	**Yes**
Inner City Cordon	No	Yes	No

8.2.10 Eight initial areas are not considered to meet both initial screening criteria and therefore are removed from the appraisal process. Table 8.3 details the LEZ option areas removed and the rationale for doing so.

Table 8.3 : Aberdeen LEZ areas removed from consideration

LEZ Area Option	Rationale for rejection
Option 1 Central Union Street	Too limited in scope, may be considered unambitious and unlikely to meet LEZ objectives
Option 2 Union Street	LEZ of Union Street only requires illogical LEZ boundary that would not easily be understood/communicated to public
Option 4 Holburn Street, Union Street and King Street	As the Union Street only option, this area requires an illogical LEZ boundary that would not easily be understood/communicated

LEZ Area Option	Rationale for rejection
Option 5 City Centre Core	Illogical LEZ boundary that would not easily be understood/communicated
Option 6 City Centre AQMA	Illogical LEZ boundary, particularly on the north side though this could be extended to simplify geography
Option 7 City Centre Masterplan	Needs to be better defined to include re-routeing options but the adopted boundary is accepted council strategy and therefore forms part of another option
Option 8 City Centre Exceedances	Area to cover all exceedances only with minimal coverage results in illogical boundary being adopted
Option 16 City Cordon	Likely to be difficult to enforce with large residential land-use, many internal-internal LEZ trips, large camera network and not likely to be publicly acceptable.

8.2.11 Eight initial areas are considered to meet both initial screening criteria and therefore progress to the next stage in the appraisal process.

8.3 Vehicle Restriction and Air Quality Objective

8.3.1 The eight areas considered potentially suitable as a Low Emission Zone were combined with one vehicle type restriction and assessed against their likely impact on the LEZ air quality objective (objective 1): *To improve air quality in Aberdeen by reducing harmful emissions from transport and delivering on the Scottish Government's statutory air quality objectives.*

8.3.2 This assessment is informed by the National Modelling Framework analysis detailed in Chapter 5. As noted, the NMF outputs comparisons assess changes in NO_2 and screening is therefore informed by differences in NO_2 only.

8.3.3 Although the air quality modelling identified that addressing emissions from a single vehicle type is insufficient in tackling all air quality exceedances, this initial appraisal considered only one vehicle restriction at a time to reduce the complexity of impacts and allow a suitable appraisal to be undertaken on the impacts of each vehicle class on its own. Five possible non-compliant vehicles were defined, in line with the high NMF results in Chapter 5, as follows:

- Bus (pre-Euro VI)
- Diesel Car (pre-Euro 6)
- HGV (pre-Euro VI)
- LGV (pre-Euro VI)
- Petrol Car (pre-Euro 4)

8.3.4 The Transport (Scotland) Act defines the national standard of non-compliant vehicle for a LEZ to be Euro VI for diesel HGVs/buses, Euro 6 for diesel vehicles and Euro 4 for petrol vehicles.

8.3.5 The combination of eight option areas and five vehicle type restrictions results in 40 LEZ options at the start of the appraisal process.

8.3.6 A high level appraisal of the 40 LEZ options was undertaken using a seven-point assessment scale against their likely impact on the air quality objective. This appraisal was informed by the NMF results, with a +3 score representing the highest impact option relative to all 40 options listed for appraisal. By restricting non-compliant vehicles from

an area of the city, all 40 potential LEZ options will at least bring a neutral impact on air quality and therefore all options score at least 0 on the seven-point scale. At this stage, the assessment does not include the re-routing of non-compliant vehicles and the potential to move air quality problems outside the LEZ. The assessment of the 40 LEZ options is shown in Table 8.4

Table 8.4 : Appraisal of area and 1 vehicle restriction

Ref No.	LEZ Area	LEZ Restriction	AQ Objective
1	Union Street, Market Street & King Street	Bus	+
2	Holburn Street to Mounthooly roundabout	Bus	++
3	Union Street with extended boundary	Bus	++
4	Westburn Road/Hutcheon St to Willowbank Road	Bus	++
5	Westburn Road/Hutcheon St to the River Dee	Bus	++
6	City Centre Exceedances	Bus	++
7	City Centre Exceedances with extended boundary	Bus	++
8	City Centre Masterplan with extended boundary	Bus	++
9	Union Street, Market Street & King Street	Diesel Car	0
10	Holburn Street to Mounthooly roundabout	Diesel Car	0
11	Union Street with extended boundary	Diesel Car	0
12	Westburn Road/Hutcheon St to Willowbank Road	Diesel Car	+
13	Westburn Road/Hutcheon St to the River Dee	Diesel Car	+
14	City Centre Exceedances	Diesel Car	+
15	City Centre Exceedances with extended boundary	Diesel Car	+
16	City Centre Masterplan with extended boundary	Diesel Car	+
17	Union Street, Market Street & King Street	HGV	0
18	Holburn Street to Mounthooly roundabout	HGV	0
19	Union Street with extended boundary	HGV	0
20	Westburn Road/Hutcheon St to Willowbank Road	HGV	0
21	Westburn Road/Hutcheon St to the River Dee	HGV	0
22	City Centre Exceedances	HGV	0
23	City Centre Exceedances with extended boundary	HGV	0
24	City Centre Masterplan with extended boundary	HGV	0
25	Union Street, Market Street & King Street	LGV	0
26	Holburn Street to Mounthooly roundabout	LGV	0
27	Union Street with extended boundary	LGV	0
28	Westburn Road/Hutcheon St to Willowbank Road	LGV	0
29	Westburn Road/Hutcheon St to the River Dee	LGV	0
30	City Centre Exceedances	LGV	0
31	City Centre Exceedances with extended boundary	LGV	0
32	City Centre Masterplan with extended boundary	LGV	0
33	Union Street, Market Street & King Street	Petrol Car	0
34	Holburn Street to Mounthooly roundabout	Petrol Car	0
35	Union Street with extended boundary	Petrol Car	0
36	Westburn Road/Hutcheon St to Willowbank Road	Petrol Car	0
37	Westburn Road/Hutcheon St to the River Dee	Petrol Car	0
38	City Centre Exceedances	Petrol Car	0
39	City Centre Exceedances with extended boundary	Petrol Car	0
40	City Centre Masterplan with extended boundary	Petrol Car	0

8.3.7 The NMF scenario results show that including buses in a LEZ would bring the largest benefit in NO_2 reduction, both in terms of level of reduction and area influenced by improved air quality. A bus only LEZ does not however result in all 2018 NO_2 exceedance locations falling below 40 µg/m^3, and therefore each bus option scores +2 in the seven-point scale in all options, with the exception of the Union Street, Market Street and King Street option (Ref No .1) that does not capture all city bus services and therefore scores +1. All other options capture all bus routes serving the city centre and therefore the full benefit shown in the NMF results is realised with the remaining options.

8.3.8 The NMF scenario results show that the next largest impact on modelled NO_2 is from diesel cars but that their inclusion in a LEZ will bring minor benefit city wide with moderate benefit at certain key locations. A LEZ that only excludes non-compliant diesel cars will not, on its own, bring large enough benefit to be considered a viable stand-alone option. The NMF results infer that those option areas that encompass the majority of exceedance locations (Ref No. 12-16) can be considered to result in a score of +1 (minor benefit). Options that include only some of the exceedance locations are shown to have little impact and score 0.

8.3.9 The NMF results show a LEZ with only non-compliant HGVs, LGVS or petrol cars does not, on its own, bring enough benefit to be considered to have a positive score on the seven-point scale and is awarded a neutral score.

8.3.10 The NMF results and high level appraisal detailed in Table 8.4 can be summarised as follows:

- Improvements to the bus fleet brings the largest reduction in modelled NO_2 and should be included in any LEZ option for Aberdeen
- The inclusion of diesel cars (in addition to buses) would allow exceedances to fall closer to air quality standards
- HGVs, LGVs and petrol cars do not bring sufficient benefit on their own to be included in any LEZ, but do bring some further pollution benefits to an LEZ which includes buses.

8.3.11 Based on these conclusions, the list of options containing only one vehicle restriction was adjusted so that each option contained a bus vehicle restriction to reflect a more realistic LEZ for Aberdeen. The options were then re-assessed using the same seven-point assessment against their likely impact on the air quality objective, as shown in Table 8.5.

Table 8.5 : Appraisal of area and bus focussed vehicle restriction

Ref No.	LEZ Area	LEZ Restriction	AQ Objective
1	Union Street, Market Street & King Street	Bus	+
2	Holburn Street to Mounthooly roundabout	Bus	++
3	Union Street with extended boundary	Bus	++
4	Westburn Road/Hutcheon St to Willowbank Road	Bus	++
5	Westburn Road/Hutcheon St to the River Dee	Bus	++
6	City Centre Exceedances	Bus	++
7	City Centre Exceedances with extended boundary	Bus	++
8	City Centre Masterplan with extended boundary	Bus	++
9	Union Street, Market Street & King Street	Bus & Diesel Car	+
10	Holburn Street to Mounthooly roundabout	Bus & Diesel Car	++
11	Union Street with extended boundary	Bus & Diesel Car	++
12	Westburn Road/Hutcheon St to Willowbank Road	Bus & Diesel Car	+++
13	Westburn Road/Hutcheon St to the River Dee	Bus & Diesel Car	+++
14	City Centre Exceedances	Bus & Diesel Car	+++
15	City Centre Exceedances with extended boundary	Bus & Diesel Car	+++
16	City Centre Masterplan with extended boundary	Bus & Diesel Car	+++
17	Union Street, Market Street & King Street	Bus & HGV	+
18	Holburn Street to Mounthooly roundabout	Bus & HGV	++
19	Union Street with extended boundary	Bus & HGV	++
20	Westburn Road/Hutcheon St to Willowbank Road	Bus & HGV	++
21	Westburn Road/Hutcheon St to the River Dee	Bus & HGV	++
22	City Centre Exceedances	Bus & HGV	++
23	City Centre Exceedances with extended boundary	Bus & HGV	++
24	City Centre Masterplan with extended boundary	Bus & HGV	++
25	Union Street, Market Street & King Street	Bus & LGV	+
26	Holburn Street to Mounthooly roundabout	Bus & LGV	++
27	Union Street with extended boundary	Bus & LGV	++
28	Westburn Road/Hutcheon St to Willowbank Road	Bus & LGV	++
29	Westburn Road/Hutcheon St to the River Dee	Bus & LGV	++
30	City Centre Exceedances	Bus & LGV	++
31	City Centre Exceedances with extended boundary	Bus & LGV	++
32	City Centre Masterplan with extended boundary	Bus & LGV	++
33	Union Street, Market Street & King Street	Bus & Petrol Car	+
34	Holburn Street to Mounthooly roundabout	Bus & Petrol Car	++
35	Union Street with extended boundary	Bus & Petrol Car	++
36	Westburn Road/Hutcheon St to Willowbank Road	Bus & Petrol Car	++
37	Westburn Road/Hutcheon St to the River Dee	Bus & Petrol Car	++
38	City Centre Exceedances	Bus & Petrol Car	++
39	City Centre Exceedances with extended boundary	Bus & Petrol Car	++
40	City Centre Masterplan with extended boundary	Bus & Petrol Car	++

8.3.12 Clearly all options now bring a higher benefit to air quality with the inclusion of buses in every option. The NMF results infer that the Union Street, Market Street and King Street option (Ref No. 1, 9, 17, 25 & 33) would not impact on a number of key exceedance locations with several bus routes not entering the LEZ area. For this reason, these options are removed from the appraisal process.

8.3.13 The high level appraisal also clearly identifies that a number of scenarios return very similar scores, notably the bus plus HGVs, LGVs and petrol cars. At this stage in the appraisal process, these options can be combined (with diesel cars) to create a set of all vehicle LEZ options with the remaining high level appraisal process considering the combined benefits and dis-benefits of such options. As such, options 17 to 40 are replaced with 7 all vehicle options (with the Union Street, Market Street, King Street option also removed as noted above).

8.3.14 This assessment and subsequent rationalisation results in 21 options progressing to the next stage of the high level appraisal process.

8.4 Feasibility and Logic Assessment

8.4.1 A further high level assessment was made on each of the 21 remaining options to assess whether they would likely be feasible and logical if adopted as a Low Emission Zone, with the results shown in Table 8.6. Note, a similar assessment was undertaken at the start of the appraisal process but without any vehicle type restrictions, purely to assess the suitability of a particular LEZ area, whereas the assessment at this stage is informed by each vehicle type restriction. Again, the assessment is made using the seven-point scale and if any one of these criteria scores zero or less the option is not considered suitable to progress in the appraisal process.

8.4.2 Table 8.6 shows the appraisal results of the 21 options against logic and feasibility.

Table 8.6 : Appraisal against feasibility, affordability and public acceptability

Ref No.	LEZ Area	LEZ Restriction	Feasible	Logical	Progress in appraisal
1	Holburn Street to Mounthooly roundabout	Bus	+++	++	Yes
2	Union Street with extended boundary	Bus	+++	+	Yes
3	Westburn Road/Hutcheon St to Willowbank Road	Bus	+++	0	No
4	Westburn Road/Hutcheon St to the River Dee	Bus	+++	0	No
5	City Centre Exceedances	Bus	+++	0	No
6	City Centre Exceedances with extended boundary	Bus	+++	0	No
7	City Centre Masterplan with extended boundary	Bus	+++	0	No
8	Holburn Street to Mounthooly roundabout	Bus & Diesel Car	++	++	Yes
9	Union Street with extended boundary	Bus & Diesel Car	++	++	Yes
10	Westburn Road/Hutcheon St to Willowbank Road	Bus & Diesel Car	+	-	No
11	Westburn Road/Hutcheon St to the River Dee	Bus & Diesel Car	+	-	No
12	City Centre Exceedances	Bus & Diesel Car	+	+	Yes
13	City Centre Exceedances with extended boundary	Bus & Diesel Car	+	-	No
14	City Centre Masterplan with extended boundary	Bus & Diesel Car	+	+	Yes
15	Holburn Street to Mounthooly roundabout	All Vehicle	++	++	Yes
16	Union Street with extended boundary	All Vehicle	++	++	Yes
17	Westburn Road/Hutcheon St to Willowbank Road	All Vehicle	+	-	No
18	Westburn Road/Hutcheon St to the River Dee	All Vehicle	+	-	No
19	City Centre Exceedances	All Vehicle	+	+	Yes
20	City Centre Exceedances with extended boundary	All Vehicle	+	-	No
21	City Centre Masterplan with extended boundary	All Vehicle	+	+	Yes

8.4.3 All bus only options are considered fully feasible as they can be enforced either through a network of cameras located on fixed route bus routes. However, five options (Ref No. 3 – 7) are not considered logical options as bus only LEZs due to their geographical extents with all five of these options including areas where no bus services operate. Options 1 and 2 capture 100% of bus routes servicing Aberdeen city centre, and while options 3 – 7 also capture all bus services, they are considered unnecessarily large as bus only options and are not progressed in the appraisal process.

8.4.4 Two bus and diesel car options (Ref No. 8 & 9) score +2 for logic and feasibility. Both options are bounded by major roads allowing for logical mapping and understanding of the option, the ability for non-compliant drivers to route around or away from the LEZ, and provide suitable locations for camera enforcement. Two further options score +1 for logic and feasibility (Ref No. 12 & 14) and both of these options include parts of major roads, cutting them at key junctions to allow suitable alternative routeing for non-compliant vehicles. While considered feasible and logical they would likely be more difficult to implement and understand due to their more abstract shape and area coverage.

8.4.5 The remaining three bus and diesel car options score positively for feasibility (all +1) but receive a score of -1 for logic. All three options include areas that are predominately residential, such as Rosemount and Ferryhill, where there are no existing exceedances of the air quality objectives. The areas were devised through the unconstrained option generation process but the addition of private vehicles (diesel cars) to the option mean residents living in the LEZ area will be restricted from using their vehicles if they are non-compliant to tackle an issue that is not specific to their immediate localised area. For this

reason, these options are not considered logical and are not progressed in the option appraisal process.

8.4.6 The seven all vehicle options score similarly to the bus and diesel car options for the same reasons with options 17, 18 and 20 not considered suitable to progress to further appraisal.

8.5 LEZ Options for Detailed Appraisal

8.5.1 In line with STAG, options can be rationalised at suitable points in the appraisal to give a more succinct set of options and this is undertaken here with options that return positive scores but display similar characteristics, impacts and benefits.

8.5.2 Both bus only options return the same score for feasibility, primarily due to the fixed route of the bus services and the similar enforcement requirements, while option 1 scores higher in logic appraisal. Analysis of the city centre bus routes show that both options capture the same bus services and that the additional area encompassed by option 2 brings no additional benefit as a LEZ. As such, option 2 is not progressed in the appraisal process as a bus only option.

8.5.3 The feasibility and logic appraisal identifies that the bus and diesel car and all vehicle options return similar scores. At this stage in the appraisal process, these options can be combined to create a set of four all vehicle LEZ options. Should the options progress to detailed appraisal, the impact of individual vehicles included in a particular LEZ will be assessed and this will inform the final vehicle restrictions of the LEZ if it is recommended for consultation.

8.5.4 The high level appraisal and rationalisation of the option list has therefore returned five emerging LEZ options to progress to detailed appraisal. At this stage, and as the number of options has reduced from 40 to 5, the opportunity is taken to rename the option area to a more descriptive and succinct list.

8.5.5 The five emerging options progressed to detailed appraisal, and links to each option drawing, is detailed in Table 8.7.

Table 8.7 : LEZ option list after feasibility and logic appraisal

Ref No.	LEZ Option	LEZ Restriction	Drawing Reference
1	Union Street Area	Bus	Appendix B, B1
2	Union Street Area	All Vehicle	Appendix B, B2
3	Union Street & George Street Area	All Vehicle	Appendix B, B3
4	City Centre Air Quality Exceedance	All Vehicle	Appendix B, B4
5	City Centre Masterplan	All Vehicle	Appendix B, B5

9. DETAILED LEZ OPTION ANALYSIS

9.1 Introduction

9.1.1 The high level appraisal process identified five options that satisfied the LEZ Objectives and were considered feasible and logical.

9.1.2 The NLEF guidance indicates that the LEZ area for consideration will be informed by:

1. the area of exceedance of air quality objectives and the main sources of pollutants
2. geographically discrete areas, such as a town centre, or other areas which are well defined (e.g. within an inner ring road)
3. features that may influence enforcement (e.g. an outer ring-road with junctions leading into exceedance areas, key access points such as bridges)
4. mapped emissions by vehicle type in order to identify areas where options are likely to be most effective. Mapping bus routes, taxi ranks and/or residential and commercial land-uses will be useful
5. air quality along any such alternative routes to determine if they could be at risk of new exceedances as a result of displaced traffic
6. the potential need to allow vehicles to divert onto alternative routes to avoid the area of the LEZ.

9.1.3 The initial option generation exercise (Chapter 8) broadly considered these points, in particular points 1-4. The next stage in the LEZ option development is to consider these in more detail and clearly define the boundary and predicted impacts of each emerging option in order to recommend LEZ Options for detailed traffic and air quality modelling and public and stakeholder consultation.

9.1.4 In defining the detail of each emerging option, it is likely that a number of option variants will result from the process. The five options for detailed appraisal are shown in Table 9.1.

Table 9.1 : LEZ option for detailed appraisal

Option Number	LEZ Option	LEZ Restriction	Drawing Reference
1	Union Street Area	Bus	Appendix B, B1
2	Union Street Area	All Vehicle	Appendix B, B2
3	Union Street & George Street Area	All Vehicle	Appendix B, B3
4	City Centre Air Quality Exceedance	All Vehicle	Appendix B, B4
5	City Centre Masterplan	All Vehicle	Appendix B, B5

9.1.5 Option 1 was defined as the most suitable area to capture all bus services and, crucially, be directly expanded in its scope to include all vehicles without changing its boundary to create Option 2. Option 3 extends the proposed LEZ area to the north to include the George Street area and encompass more of the CCMP and SUMP areas while still being defined by geographically visual key routes to give a logical LEZ with viable alternative routes. Option 4 was defined to encompass all locations where annual mean NO_2 were greater than the legal limit (> 40 µg/m^3). Option 5 mirrors the existing CCMP and SUMP boundaries, with adjustments to allow suitable alternative routes, to provide a LEZ option that fully complements these existing key ACC strategies.

9.1.6 Each option and its variant will be assessed for its likely impact on the local transport network and its likely operational needs. This analysis may result in some of the five

emerging options being considered unsuitable and they will be removed from further appraisal. The option generation and high level sifting identified four potential all vehicle LEZ. Although these cover different areas, there are considerations common to all options:

- Impact on Air Quality
- Re-routeing of non-compliant vehicles
- Access to city centre car parks
- Access to resident and business parking

9.1.7 The high level NMF analysis (Chapter 5) concluded that a LEZ delivered on its own (and of any size and vehicle type restrictions) was not enough, in itself, to tackle all locations of air quality exceedance. To achieve compliance with air quality standards in Aberdeen, complimentary traffic management measures are likely to be required.

9.1.8 NLEF Guidance states that "*it may be more appropriate to address the issue (air quality exceedance) by identifying additional location specific measures to be implemented through the AQAP, potentially through consideration of local transport measures. In this situation, the additional measures should be identified…along with a description of the likely contribution to removing exceedances". (NLEF, 2019).*

9.1.9 The Aberdeen LEZ and any complimentary traffic management measures should align with the existing transport policy landscape in Aberdeen and each option will be appraised against this. As reviewed in Chapter 3, key Aberdeen policies and strategies that may shape the final LEZ option(s) are:

- Aberdeen City Centre Masterplan (CCMP)
- Aberdeen City Sustainable Urban Mobility Plan (SUMP)
- North East Scotland Roads Hierarchy Study

9.1.10 In line with NLEF Guidance there is a requirement for detailed modelling using the NMF Aberdeen City Air Quality Model and the 2019 Aberdeen City Centre Paramics microsimulation traffic model (ACCPM19). The results from this chapter will inform if the LEZ option(s) to be tested in detail. The ACCPM19 will be utilised to test the preferred LEZ option(s) and help identify where complimentary measures are required.

9.2 LEZ Option 1: Union Street Area Bus Only

9.2.1 The option generation exercise identified that an area covering the full length of Union Street and the immediate surrounding area as a suitable area for a bus only LEZ and this is shown in Figure 9.1.

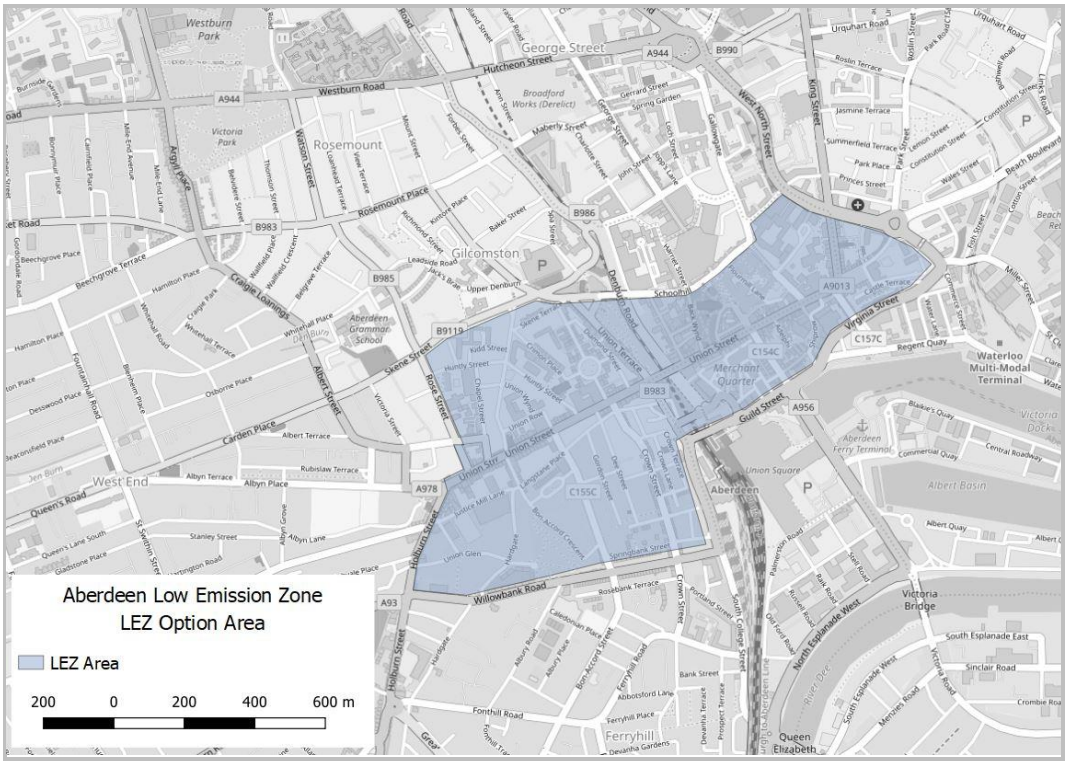

Figure 9.1 : Option 1 – Union Street Area Bus Only LEZ

9.2.2 As a bus only LEZ, it is important to understand the key bus movements and routes that will be impacted by LEZ Option 1. This analysis was undertaken using SEPA's bus operator tool that has been developed as part of the NMF using fleet information and data from all local operators to assist with the implementation of Aberdeen's LEZ. The tool maps all bus routes serving the city and provides frequency and euro class of each timetabled bus service.

9.2.3 Analysis of all city bus routes, using SEPA's bus operator tool, confirmed that the proposed area for Option 1 would capture all scheduled bus services operating in the city. There are 10 key entry and exit points for local bus service routes, as shown in Figure 9.2, on Union Street West, Union Terrace, Crown Street, Denburn Road/Wapping Street, Guild Street/Bridge Street, Market Street, Broad Street, Union Street East.

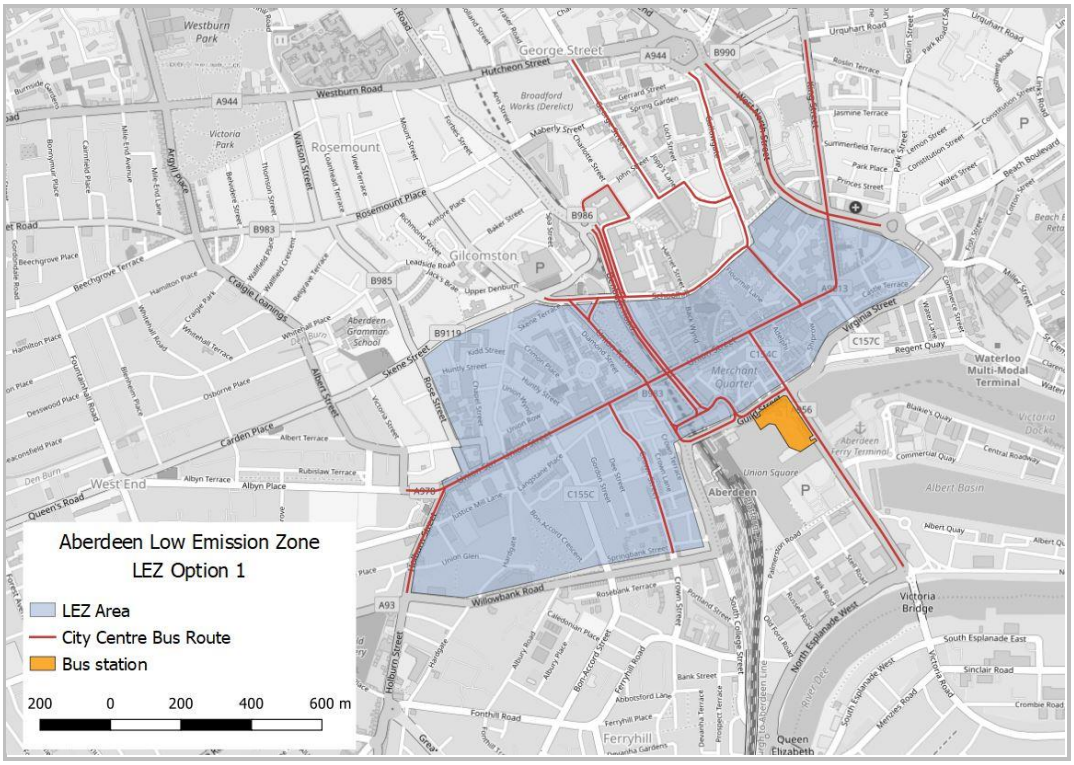

Figure 9.2 : City Centre Bus Routes

9.2.4 The initial option area however, does not include Aberdeen Bus Station, located at the corner of Market Street and Guild Street, as shown in Figure 9.2. The bus station has access and egress from Market Street and an exit only on to Guild Street however analysis of bus services that operate at the bus station shows that all local services and the majority of inter-city services to and from the bus station route though the proposed LEZ area, via Union Street and Market Street (north of Guild St) or Denburn Road. It may however be desirable to alter the initial LEZ option area to include the bus station, to ensure that operators do not alter service routes such that they can avoid the LEZ but maintain access to the bus station. Conversely, it may be desirable to exclude the bus station to allow strategic bus services that connect Aberdeen with other regions to serve Aberdeen without being impacted by LEZ restrictions, however this would require the alteration of routes as all current strategic services route via Union Street and Market Street (north) to access the bus station. Consultation with bus operators will be crucial to provide further information on the acceptability of such options. Cognisance of the access arrangements to the bus station must be considered for any LEZ that includes bus restrictions.

9.2.5 There are two possible bus only LEZ option variants that include one access (Option 1A) or both accesses (Option 1B) for Aberdeen bus station is shown in Figure 9.3 and Figure 9.4

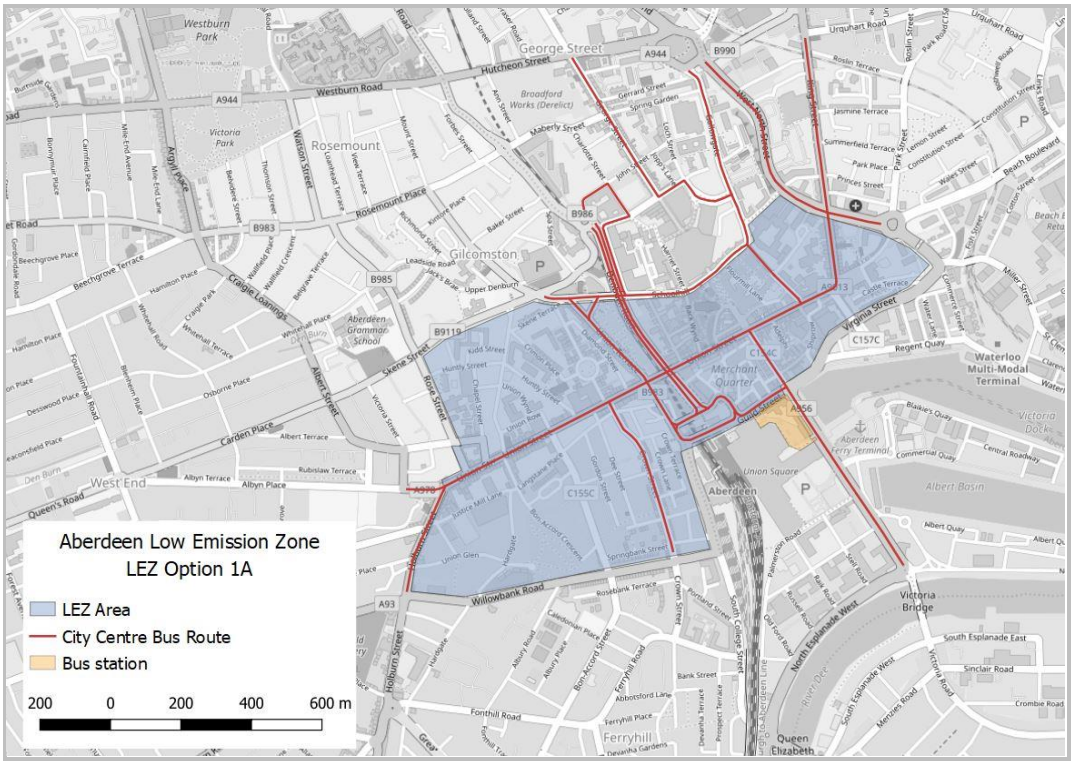

Figure 9.3 : Option 1A – Union Street Area Bus Only LEZ including Guild Street bus station exit

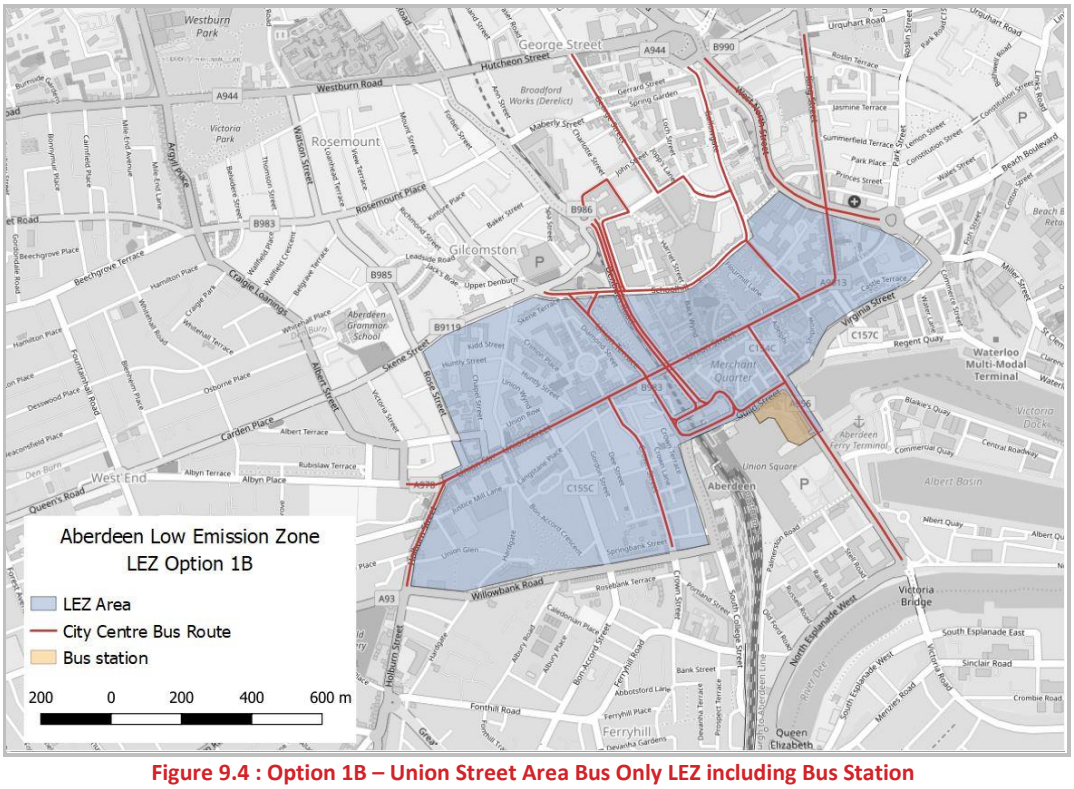

Figure 9.4 : Option 1B – Union Street Area Bus Only LEZ including Bus Station

9.2.6 The entry/exit locations shown in Figure 9.2 could possibly serve as locations for LEZ camera enforcement and signage, however it is likely that there will also be a requirement to have camera coverage on all entry and exit points to the proposed LEZ area to capture non-timetabled services buses such as tour buses, community buses or school buses. Aberdeen train station is situated adjacent to the bus station and its main access points may be impacted by this bus only LEZ option. While this will not impact non-bus vehicles from drop-off, pick-up or parking, it will potentially impact non-timetabled rail replacement bus services and consultation with Network Rail and ScotRail will be important to understand their needs and any potential operational impacts.

9.2.7 Analysis of the NMF high level scenario modelling shows that improving the bus fleet to Euro VI brings about the largest single difference in tackling exceedances of the air quality standards. The predicted reductions in NO_2, as informed by the 2019 NMF Base scenario, are shown in Table 9.2. Grey cells show locations where the modelled reductions do not predict a sufficient reduction in NO_2 for observed levels to fall below 40 µg/m^3. Yellow cells show locations where levels of NO_2 are predicted to be between 36 µg/m^3 and 40 µg/m^3.

Table 9.2 : Predicted Reduction in 2018 NO_2 Levels (Annual Mean/µg/m^3) – Option 1

Site ID	Site Name	2018 Observed NO2	% NO2 reduction	Option 1 predicted NO2
DT11	105 King Street	48	-3%	47
DT10	184/192 Market Street	47	-5%	45
DT9	39 Market Street	46	-13%	40
DT29	469 Union Street	45	-13%	39
DT12	40 Union Street	44	-15%	38
DT17	43/45 Union Street	44	-3%	43
DT82	7 Virgina Street	44	-2%	43
DT30	335 Union Street	41	-3%	40
DT19	468 Union Street	40	-11%	36
DT33	16 East North Street	40	-3%	39
DT73	61 Skene Square	40	-5%	38
DT18	14 Holburn Street	39	-2%	38
CM2	Union Street	38	-11%	34
DT16	1 Trinity Quay	37	-3%	36
DT25	21 Holburn Street	37	-8%	34
DT77	27 Skene Square	37	-2%	36
DT22	104 King Street	36	-8%	33

9.2.8 The NMF analysis shows that Option 1 does not tackle all air quality exceedances and the predicted locations of air quality exceedances of annual mean for NO_2 remaining if all buses are of Euro VI standard is shown in Figure 9.5.

9.2.9 The options was devised to capture all bus services operating in the city and as an individual bus service would be required to be compliant to enter the LEZ area, the benefit in reduced emissions from each vehicle will be seen across the entire bus network as each bus travels along its timetabled route (i.e. outside and inside the LEZ area).

9.2.10 That the option does not encompass all exceedance locations therefore is not the critical factor in defining the bus only option area but rather that the area captures all bus services, which Option 1 is shown to do.

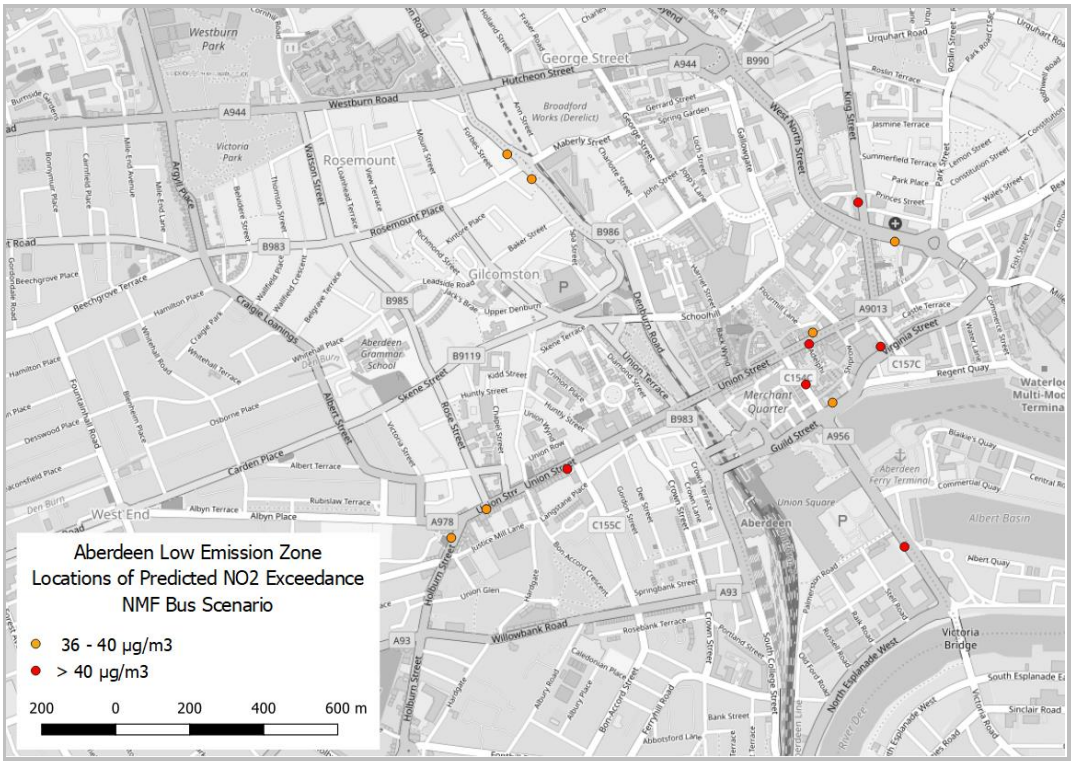

Figure 9.5 : Locations of predicted NO_2 greater than 36 µg/m^3 – NMF bus only scenario

9.2.11 The NMF analysis has also shown that an all vehicle LEZ does not address all the remaining exceedances and that further traffic management interventions are required to deliver a complimentary package to address all air quality exceedances (see Section 9.3 below). As noted, these interventions should take cognisance of existing ACC strategies, including the City Centre Masterplan (CCMP) and Roads Hierarchy Study. The City Centre Masterplan is the key ACC strategy for Aberdeen City Centre development and it proposes a number of transport interventions to improve bus movements in the city, as shown in Figure 9.6. It is recommended that detailed traffic and air quality modelling is undertaken in the first instance to show if delivering a bus only LEZ (improving all bus services to Euro VI standard) together with complimentary mitigation addresses additional air quality exceedances.

9.2.12 It is therefore important that any bus only LEZ option does not contradict the public transport proposals in the City Centre Masterplan and does not result in future difficulties in delivery of either the LEZ or Masterplan proposals. The City Centre Masterplan proposal for improvements to public transport accessibility include the reclassification of the following roads to bus, taxi and cycle only:

- Phase 1: Broad Street between Schoolhill and Queen Street (now on-street and bus/cycle only)
- Phase 2: Market Street between Union Street and Guild Street
- Phase 2: Guild Street between Market Street and Bridge Street
- Phase 2: Bridge Street between Wapping Street and Union Street
- Phase 3: Union Street between Crown Street and King Street

9.2.13 A summary of these interventions and the optimum phased delivery is provided in the policy framework review in Chapter 3. Traffic model testing in 2016 (*Aberdeen city Centre Masterplan Testing – Phase 2 & 3, April 2016, SIAS Ref. 77953*) also concluded CCMP Phase 2 proposals should be delivered with the re-design and optimisation of key junctions and the closure of Wapping Street between the Trinity Centre car park and Guild Street, forming an area known as Station Gateway.

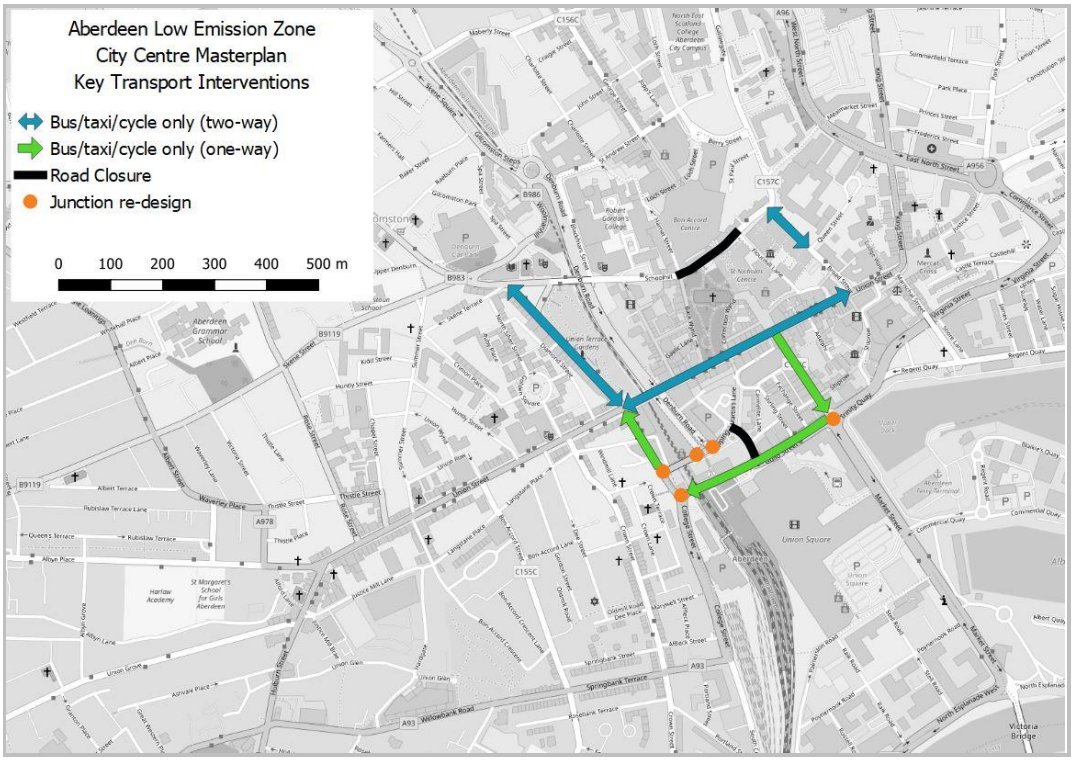

Figure 9.6 : City Centre Masterplan – Key Transport Interventions

9.2.14 The remaining locations of exceedances in Option 1 with 100% of buses at Euro VI are shown above. However it is considered highly likely that the addition of the Phase 2 and/or Phase 3 CCMP measures to Option 1 would reduce levels of NO_2 on Union Street and Market Street, north of Guild Street, to levels below the legal limits due to the decreased traffic flow on these routes (as bus, taxi and cycle only corridors). However, the 2016 Testing Report concluded this would significantly increase traffic volumes on adjacent strategic routes, such as Virginia Street and West and East North Street, thereby potentially increasing NO_2 (and other pollutant) levels. It is therefore essential that the traffic model testing programme is designed to fully quantify these assumptions to inform the final NLEF appraisal of LEZ options.

9.2.15 While it is not crucial to the operation of a bus only LEZ, it is considered desirable where possible, that its area encompasses the key CCMP public transport proposals. The initial option developed during the option generation exercise (Figure 9.1.) does not include Guild Street, a key public transport location and focus of the CCMP, and as such, is removed from further appraisal and not recommended for testing or consultation.

9.2.16 Based on the above bus route analysis, consideration of Aberdeen bus station location and cognisance of the City Centre Masterplan proposals, two options are considered as viable LEZ bus only options to be progressed in the appraisal process:

- Option 1A – Union Street Area including Guild Street and bus station exit
- Option 1B – Union Street Area including Guild Street, Market Street and Aberdeen bus station

9.3 All Vehicle LEZ – Impacts on Air Quality and Emissions

9.3.1 Analysis of the NMF high level scenario modelling concluded that an all vehicle city-wide LEZ (i.e. regardless of area size) would not directly address all locations of NO_2 annual mean exceedances (Chapter 4). The four all vehicle LEZ options identified during the option generation exercise do not cover a city-wide area and therefore their impacts on air quality exceedances will be different but impacts of each scenario can be inferred from the same high level NMF results.

9.3.2 The predicted reductions in annual mean NO_2 levels resulting from Option 2, 3, 4 and 5, as informed through the NMF high level scenario modelling, are shown in Table 9.3. Grey cells show locations where the modelled reductions do not predict a sufficient reduction in NO_2 for observed levels to fall below 40 µg/m³. Yellow cells show locations where levels of NO_2 are predicted to be between 36 µg/m³ and 40 µg/m³. Note that this analysis does not include the impacts on NO_2 levels resulting from any rerouting of non-compliant vehicles that may occur in each option. It should also be noted that these locations are single monitoring (automatic monitors or diffusion tube) locations and may represent a small or large area of exceedance. Modelling the impacts on these monitoring locations and adjacent model kerbside locations (as described in Chapter 5) gives a clearer demonstration of the extend of the exceedance area and any recommended options resulting from this detailed appraisal will undergo detailed traffic and air quality modelling to fully quantify the impacts on air quality, including the impacts from rerouting of non-compliant vehicles.

Table 9.3 : Predicted Reduction in 2018 NO_2 Levels (Annual Mean µg/m³) – Options 2 to 5

Site ID	Site Name	2018 Observed NO2	Predicted NO2 Levels			
			Option 2	Option 3	Option 4	Option 5
DT11	105 King Street	48	48.0	48.0	45.5	45.5
DT10	184/192 Market Street	47	47.0	47.0	40.4	40.4
DT9	39 Market Street	46	37.6	37.6	37.6	37.6
DT29	469 Union Street	45	36.6	36.6	36.6	36.6
DT12	40 Union Street	44	35.1	35.1	35.1	35.1
DT17	43/45 Union Street	44	41.9	41.9	41.9	41.9
DT82	7 Virgina Street	44	44.0	44.0	41.9	41.9
DT30	335 Union Street	41	39.2	39.2	39.2	39.2
DT19	468 Union Street	40	33.4	33.4	33.4	33.4
DT33	16 East North Street	40	40.0	40.0	35.7	35.7
DT73	61 Skene Square	40	40.0	40.0	40.0	40.0
DT18	14 Holburn Street	39	39.0	39.0	39.0	37.4
CM2	Union Street	38	32.2	32.2	32.2	32.2
DT16	1 Trinity Quay	37	37.0	37.0	34.2	34.2
DT25	21 Holburn Street	37	37.0	37.0	37.0	31.4
DT77	27 Skene Square	37	37.0	37.0	37.0	37.0
DT22	104 King Street	36	36.0	36.0	30.5	30.5
Number of receptors inside LEZ option			**7**	**7**	**13**	**15**
% Reduction from 2018 observed levels			**-6.0%**	**-6.0%**	**-9.4%**	**-10.4%**

9.3.3 Option 2 and Option 3 encompass 7 monitoring locations and do not include the two highest observed NO_2 diffusion tube concentrations (105 King Street and 184/192 Market Street). Option 4 includes 13 out of 17 monitoring locations of NO_2 exceedance and Option 5 includes 15 monitoring locations with both options encompassing the 10 highest diffusion tube concentrations of NO_2.

9.3.4 In all four all vehicle LEZ options, the NMF predicts there to be four monitoring locations where annual mean levels of NO_2 will exceed the limit of 40 µg/m³, however in Option 2 and Option 3, only Site DT17 43/45 Union Street is located inside the proposed LEZ area and therefore the three sites outside the area are unchanged. Options 4 and 5 encompass all four remaining exceedance locations, and although NO_2 levels drop, they still exceed 40 µg/m³.

Key Point: The NMF results therefore suggest that no matter what the shape and vehicle included in the LEZ area, the same air quality exceedances will remain and that the wider impacts of each option must be considered to assess their suitability as LEZ options.

9.4 All Vehicle LEZ - Vehicle Routeing and Non-Compliant Vehicles

9.4.1 A key consideration for a LEZ is the impact of non-compliant vehicle rerouting that can result from restrictions in entering the LEZ area. Aberdeen's road network is such that all the proposed all vehicle LEZ options would impact a number of key strategic movements through the city. The key routes in the city centre that are likely to be impacted by all of the four proposed LEZ options are shown in Figure 9.7. On each route, the total two-way 12 hour (07:00-19:00) flow for Cars, light goods vehicles (LGVs) and heavy goods vehicles (HGVs) is presented in Table 9.5, alongside the corresponding non-compliant vehicles, at intervals along each route. The key routes identified are existing key routes and do not account for any reclassification as defined in the Roads Hierarchy Study. The impact of the proposed changes to Aberdeen's road hierarchy on each LEZ option is examined in Section 9.9.

9.4.2 The analysis undertaken in this section examines the approximate total number of non-compliant vehicles currently on-street based on 2019 traffic survey data. The proportion of non-compliant vehicles city-wide in Aberdeen is calculated using the ANPR analysis as detailed Section 4.6.1 and summarised in Table 9.4.

Table 9.4 : LEZ non-compliant vehicle proportions city-wide in Aberdeen

Fuel Type	Car	LGV	HGV
Non-compliant diesel	26.3%	59.7%	27.0%
Non-compliant petrol	3.9%	0.1%	0.0%
Total non-compliant	30.3%	59.8%	27.0%

9.4.3 It should be noted that if and when an all vehicle LEZ is enforced in Aberdeen, the total number of non-compliant vehicles is likely to have reduced, primarily due to normal fleet improvements as drivers replace their vehicles but also from potential behaviour changes resulting from the act of implementation and associated awareness raising of a LEZ. This could include a switch to more sustainable modes of transport and increased working from home practices. Although very difficult to accurately predict the level of compliance of Aberdeen's future vehicle fleet, SEPA utilise the UK Government's Emission Factor Toolkit (EFT) to best forecast compliance levels in any future year modelling using the NMF. All detailed modelling of LEZ options in the traffic and air quality modelling will therefore adopt forecast predictions of compliance but at this stage of the NLEF appraisal, only the current levels of non-compliant vehicles, using existing data, are assessed, and cognisance of this should be taken when interpreting the data.

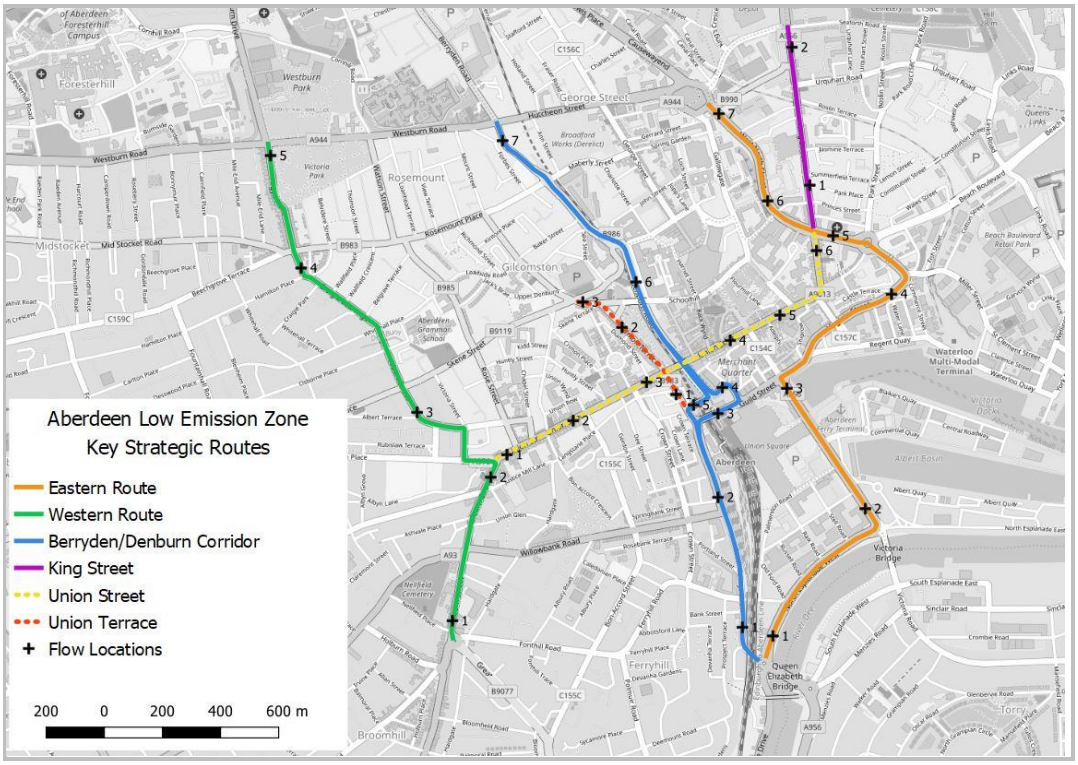

Figure 9.7 :Aberdeen City Centre Key Routes

Table 9.5 : Aberdeen City Centre Key Routes – Total Two-Way Traffic Flow (07:00-19:00)

Route	Location	All Vehicles				Non-compliant vehicles			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total
Western Corridor	1	9598	1312	340	11250	2906	784	92	3782
	2	10008	1346	356	11710	3030	805	96	3931
	3	962	72	8	1042	291	43	2	336
	4	5782	648	168	6598	1750	387	45	2183
	5	7352	829	178	8359	2226	496	48	2769
Denburn Corridor	1	8935	1335	470	10740	2705	798	127	3630
	2	10035	1368	478	11881	3038	818	129	3985
	3	7106	795	382	8283	2151	475	103	2730
	4	7740	930	378	9048	2343	556	102	3001
	5	8116	986	346	9448	2457	590	93	3140
	6	10669	1335	265	12269	3230	798	72	4100
	7	11660	1569	987	14216	3530	938	266	4734
Eastern Corridor	1	14906	2338	1557	18801	4513	1398	420	6331
	2	16932	3391	2733	23056	5126	2028	738	7891
	3	19415	3385	2750	25550	5878	2024	742	8644
	4	14062	2360	1781	18203	4257	1411	481	6149
	5	11155	1736	1581	14472	3377	1038	427	4842
	6	8955	1350	698	11003	2711	807	188	3707
	7	11048	1579	905	13532	3345	944	244	4533
Union Street	1	10268	1425	268	11961	3108	852	72	4033
	2	8164	1189	334	9687	2472	711	90	3273
	3	8705	1369	385	10459	2635	819	104	3558
	4	8708	1373	1489	11570	2636	821	402	3859
	5	6895	1121	489	8505	2087	670	132	2890
	6	7125	1137	508	8770	2157	680	137	2974
Union Terrace	1	2687	351	209	3247	813	210	56	1080
	2	4836	691	256	5783	1464	413	69	1946
	3	5966	569	95	6630	1806	340	26	2172
King Street	1	6181	1127	1275	8583	1871	674	344	2889
	2	6205	1105	1178	8488	1878	661	318	2857

9.4.4 The impacts on vehicle routeing for each of the four all vehicle LEZ options will be different and each option will be looked at in turn in Section 9.5 and Section 9.6. This may inform changes to the option boundary and ultimately provide rationale for recommending an option or not for detailed testing. All references to vehicle numbers in the analysis below is two-way 12 hour flow between 07:00 and 19:00.

9.4.5 The Western route (Holburn Street to Argyll Place) and Eastern route (North Esplanade West, Market Street, Virginia Street, Commerce Street, West North Street) and King Street are not included in the proposed Option 2 and Option 3 areas. The Eastern Route and King Street is encompassed in the Option 4 and Option 5 areas and Option 5 also includes the Western Route. In all options, regardless of whether a route is inside or outside the LEZ area, all routes are likely to experience a change in traffic flow from non-compliant vehicles for all or part of the routes shown.

9.4.6 In all LEZ options, the level of this change depends on a two key factors:

- the level of access to and from Denburn Road (central route) as controlled by the LEZ boundary and permitted by the LEZ option restrictions (detailed in Section 9.5)
- the route and destination of trips on internal routes and at the key access points of the LEZ, particularly on high volume routes such as Union Street, Bridge Street/Union Terrace and Market Street (detailed in Section 9.6)

9.4.7 All LEZ options progressed to detailed testing using the Paramics traffic model will undertake full analysis of non-compliant rerouting. To inform this appraisal of the LEZ options prior to traffic model availability, the likely impact of changes in routeing or destinations of non-compliant vehicles can be assessed through analysis of 2019 traffic survey data.

9.5 All Vehicle LEZ – Denburn Road Access

9.5.1 The inclusion or exclusion of Denburn Road is key to the operation and impact of each LEZ option. Denburn Road is a north-south dual carriageway running below the city centre, rather than through it, with very little placemaking value and reduced likelihood to the public from emission exposure (i.e. no adjacent pedestrian walkway). It may therefore be considered suitable to exclude Denburn Road from a LEZ to provide an alternative route for non-compliant vehicles, moving them from locations of current high pollution levels and public exposure. Conversely however, it is recognised that a desired impact of a LEZ would be to remove non-compliant vehicles completely from key routes in the city and not provide an alternative route to accommodate them. Each all vehicle option therefore is examined in turn to assess the likely impacts of Denburn Road being included or excluded in the option area, as informed by the 2019 traffic survey data detailed in Table 9.5 above. The analysis is based on existing (2019) traffic volumes and does not account for any changes to levels of vehicle compliance when a LEZ is likely to be enforced (e.g. in 3 or 4 years), for the reasons noted above, with detailed traffic and air quality modelling incorporating fleet projections in all LEZ options taken forward for testing.

9.5.2 Denburn Road runs north-south below Union Street between Guild Street and Woolmanhill/Skene Square and can be either be included or fully or partially excluded from each LEZ, depending on the exact geometry area boundary. Traffic data shows there to be approximately 3000 to 4000 non-compliant vehicles (cars, LGVs and HGVs) on Denburn Road in 2019, between Woolmanhill and Guild Street. If Denburn Road is included in a LEZ option, these non-compliant vehicles will be required to choose alternative routes (assuming they remain on the network), such as the Eastern and Western routes, and this may increase congestion and pollution levels on these and other routes and may lead to increased locations of air quality exceedance.

9.5.3 Option 2, covering the Union Street Area, and its key strategic routes and access points, is shown in Figure 9.8 and Option 3, covering the Union Street and George Street Area, and its key strategic routes and access points, is shown in Figure 9.9. Option 3 extends the Option 2 area to the north to encompass the George Street area but essentially Option 3 and Option 2 are bound by the same key routes and have many of the same key internal routes.

9.5.4 Option 2 and Option 3, as originally derived, will prevent all non-compliant vehicles from using Denburn Road.

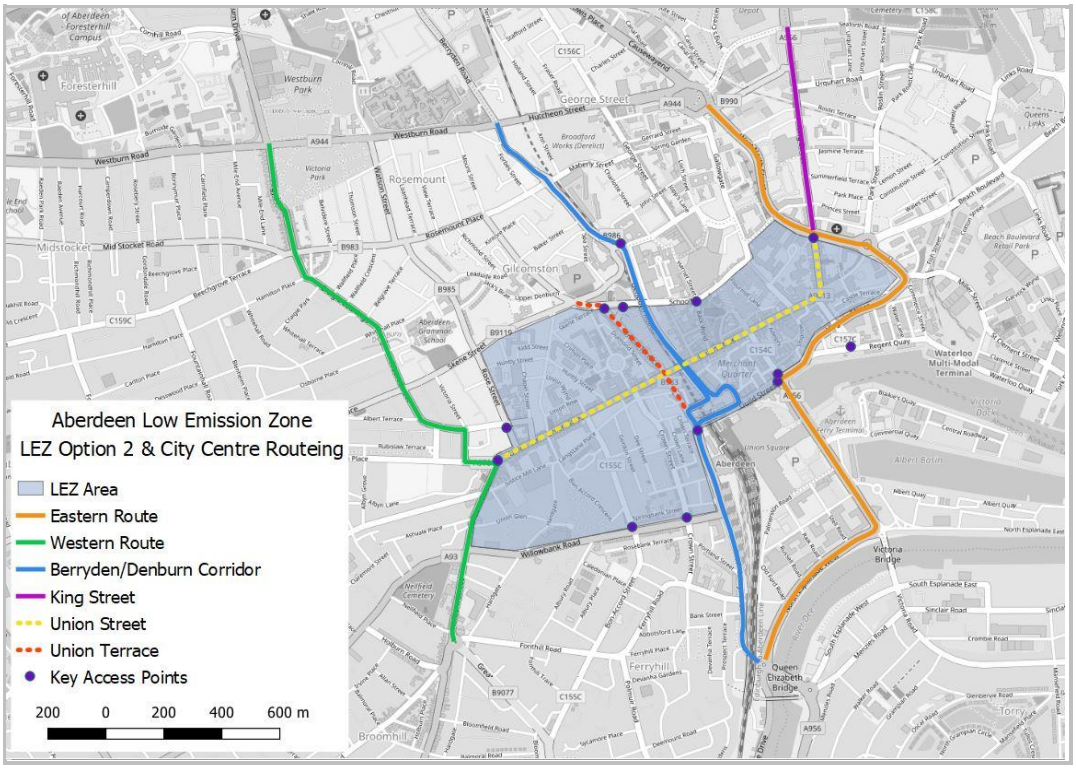

Figure 9.8 : Option 2 Key Routes and Access Points

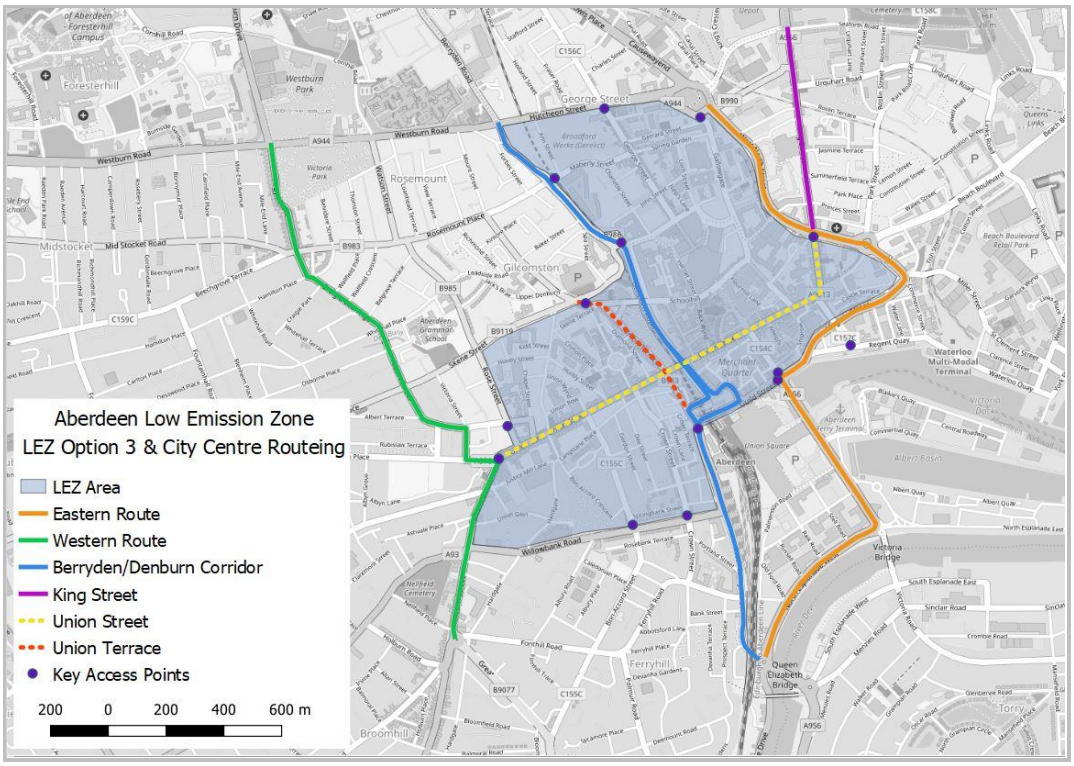

Figure 9.9 : Option 3 Key Routes and Access Points

9.5.5 There are two option variants that could provide full or partial access on Denburn Road and reduce the impact of any rerouting non-compliant vehicles. Option 2B, in Figure 9.10, excludes the Guild Street, Bridge Street, Wapping Street gyratory to provide full northbound and southbound movements on Denburn Road, as per the current road network. Option 3B, in Figure 9.11, can be defined to similarly exclude the gyratory and provide full northbound and southbound movements on Denburn Road.

9.5.6 In both Option 2B and Option 3B, this would mean that no non-compliant vehicles would be required to reroute from Denburn Road to alternative routes and the corridor may provide additional accessibility required by the restrictions to routes inside the LEZ (e.g. Union Street)

Figure 9.10 : Option 2B – NB & SB Denburn Road access (All Vehicle LEZ)

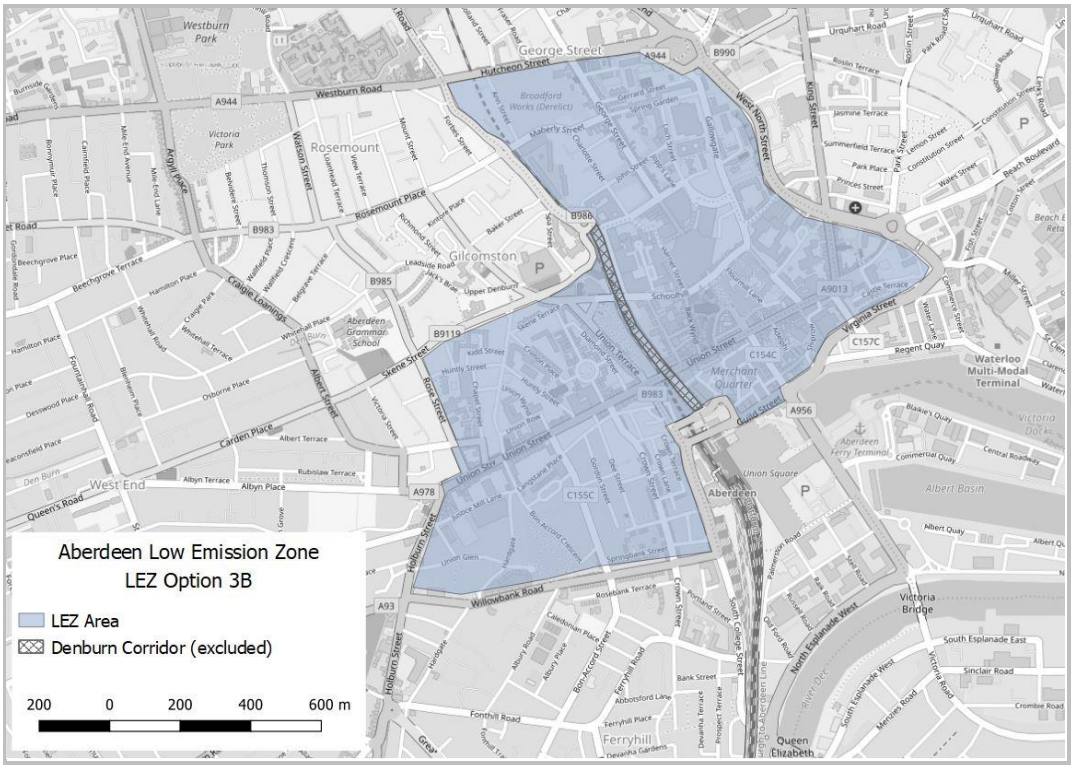

Figure 9.11 : Option 3B – NB & SB Denburn Road access (All Vehicle LEZ)

9.5.7 A different option variant, Option 2C, in Figure 9.12, and Option 3C, in Figure 9.13, could exclude only Bridge Street and Wapping Street between Bridge Street and the Trinity Centre car park to allow northbound access to Denburn Road from the wider network while providing continued all direction access to the Trinity Centre car park and possibly local access to minor streets.

9.5.8 It may be possible to re-design the junction operations at the Bridge Street/Wapping Street and Denburn Road/Wapping Street junctions to allow southbound access from Denburn Road to South Market Street. This would likely require reductions in traffic flow and alterations to priorities at these and other adjacent junctions as was tested in 2016 CCMP testing programme (*Aberdeen city Centre Masterplan Testing – Phase 2 & 3, April 2016, SIAS Ref. 77953*). Any proposed junction changes will require new detailed traffic modelling using the update Paramics traffic to assess the feasibility of such a change together with the introduction of a LEZ and forecast levels of vehicle compliance.

Figure 9.12 : Option 2C – NB & partial SB Denburn Road access (All Vehicle LEZ)

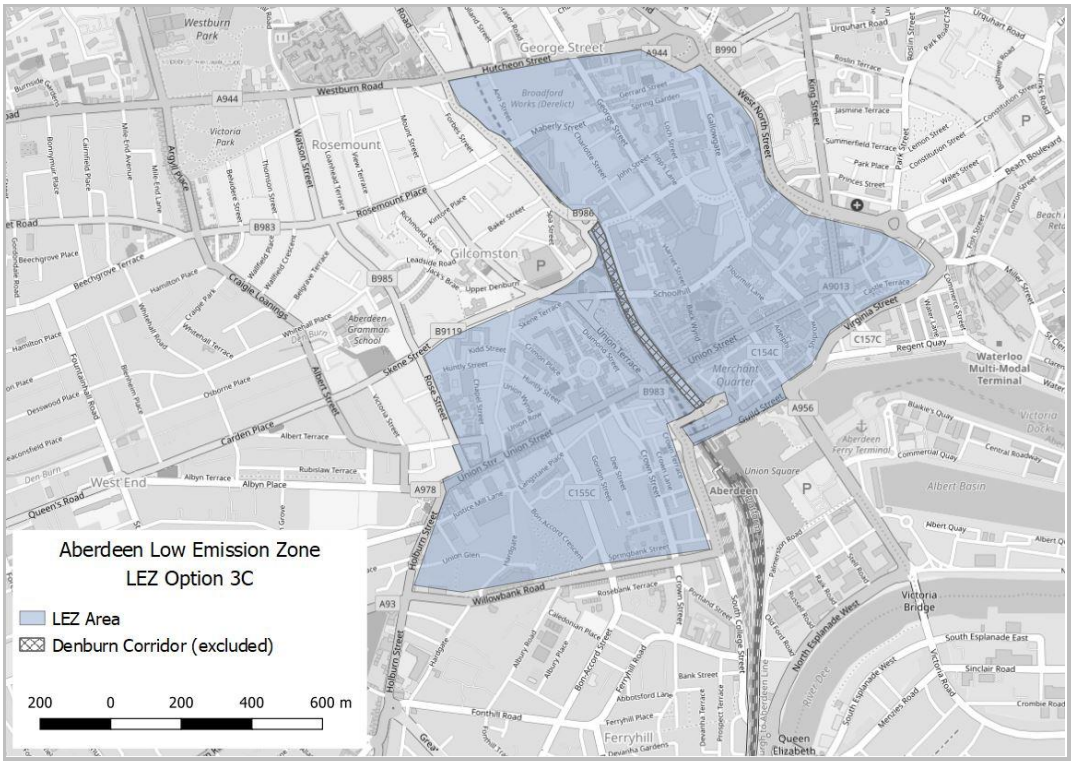

Figure 9.13 : Option 3C – NB & partial SB Denburn Road access (All Vehicle LEZ)

9.5.9 Option 4, was devised to provide a LEZ option that encompassed all existing air quality exceedance locations in the Aberdeen city centre and is shown in Figure 9.14 with the key strategic routes and access points.

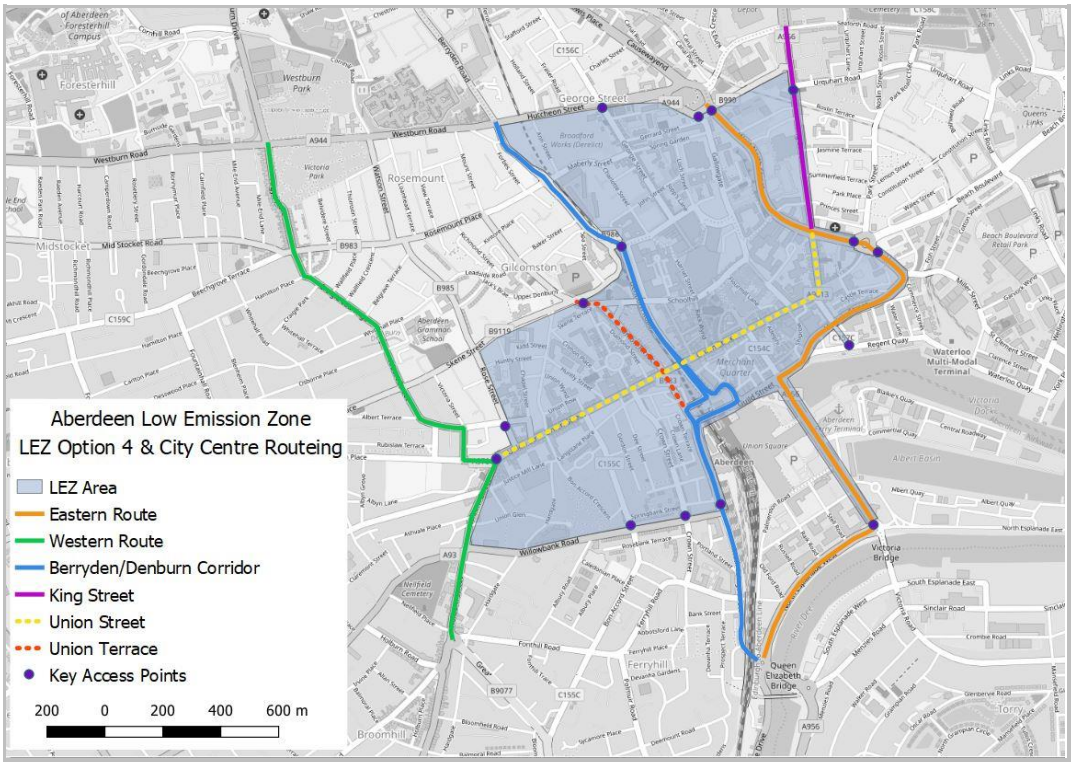

Figure 9.14 : Option 4 Key Routes and Access Points

9.5.10 Option 5, was devised to provide a LEZ option that closely aligned with the City Centre Masterplan boundary and encompassed all existing air quality exceedance locations in the Aberdeen city centre and is shown in Figure 9.15, with the key strategic routes and access points.

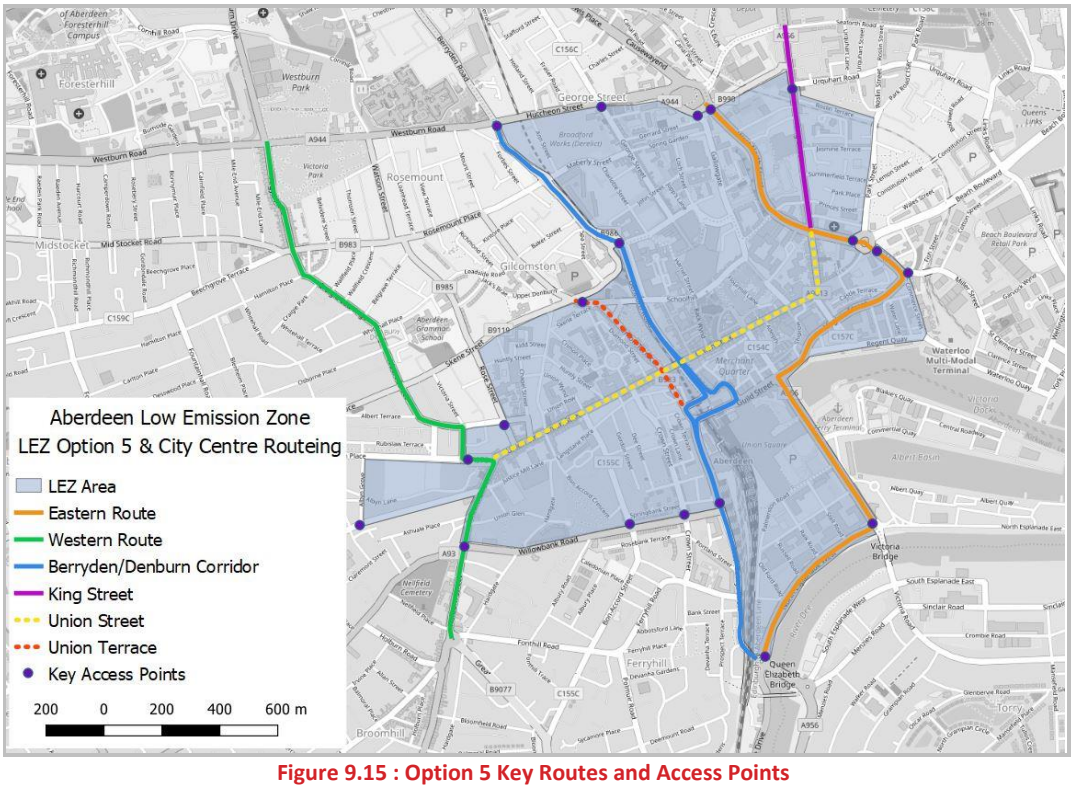

Figure 9.15 : Option 5 Key Routes and Access Points

9.5.11 Option 4 and Option 5 extend the Option 3 area to the east and south to include West North Street, King Street (south of Urquhart Road), Commerce Street, Virginia Street and Market Street.

9.5.12 Option 5 covers a similar area to Option 4 but extends further west to include the north of Holburn Street and south to include North Esplanade West.

9.5.13 In Option 4 and Option 5, the Eastern route (North Esplanade, Market Street, Virginia Street, Commerce Street North West Street) is included in the option area and traffic data analysis shows this is a high volume route with between 10,000 and 26,000 vehicles (total all vehicle two-way flow between 07:00 and 19:00) recorded at chosen locations along the length of the route. Both options encompass King Street, another key high volume route with approximate 8500 vehicles (total all vehicle two-way flow between 07:00 and 19:00) recorded along the length of the route.

9.5.14 These options do not offer any option variants to exclude the Eastern Route or King Street and therefore all non-compliant vehicles will be required to reroute to alternative routes. The number of non-compliant vehicles, recorded in 2019, on the Eastern Route range from approximately 3,400 to 8,600 vehicles and approximately 2,800 on King Street (total two-way flow between 07:00 and 19:00) between all surveyed locations. As there are no strategic routes to the east, non-compliant vehicles will be required to route via a viable route to the west. Where they route will depend on the level of access to and from Denburn Road (central route) as controlled by the LEZ boundary and permitted by the LEZ option restrictions.

9.5.15 As with Options 2 and 3, Denburn Road can be fully or partial excluded from Option 4 and Option 5, depending on the exact geometry of the option. Option 4 and Option 5 as originally derived, will prevent all non-compliant vehicles from using Denburn Road. As noted, traffic data shows there to be approximately 3000 to 4000 non-compliant vehicles on Denburn Road, between Woolmanhill and Guild Street, at 2019 compliance levels. If Denburn Road is included in the LEZ, these non-compliant vehicles will also be required to choose alternative route.

9.5.16 In Option 4, with the Eastern Route not available, the Western Route and other local western roads, will likely experience a significant increase in vehicles numbers. In Option 5, the Eastern Route and the Western Route, using Holburn Street, will not be viable alternatives for non-compliant vehicles and therefore adjacent local roads further to the west of the city centre are likely to experience a significant increase in vehicles numbers.

9.5.17 Although it is not possible to accurately quantify this increase and identify the exact routes used or forecast the levels of vehicle compliance without detailed traffic and air quality modelling, both LEZ Option 4 and Option 5 are likely to result in relatively high volumes of non-compliant vehicle rerouting. 2019 traffic data suggest up to approximately 12,000 non-compliant vehicles could be rerouted from the identified key routes as a result of Option 4 and up to approximately 18,000 non-compliant vehicles could be rerouted as a result of Option 5, if the options include Denburn Road. Again, it should be noted that the numbers of non-compliant vehicles are based on 2019 data and do not account for fleet renewal or changes to trip choice or mode, a level of analysis to be undertaken through detailed modelling as required.

Key Point: The anticipated significant rerouting and localised increase in traffic volumes associated with Option 4 and Option 5 (assumptions based on existing 2019 non-compliant vehicles) is likely to increase congestion and pollution levels and may lead to additional locations of air quality exceedance to the west of Aberdeen city centre. In Option 5, all key routes are included and therefore there may be a wider strategic rerouting of non-compliant vehicles (e.g. using North Anderson Drive) that can be quantified through wider traffic modelling as required.

9.5.18 The 2019 traffic survey data also reflects that both King Street and the Eastern Route are key strategic routes for HGVS with between 10% and 15% of all vehicles recorded as HGVs. This compares to average HGV proportions on the Western Route and Denburn Road of approximately 2% and 4% respectively. A key contributor to the HGV levels on the Eastern Route and King Street is Aberdeen Harbour and associated industrial land use, located south and east of Commerce Street, Virginia Street and Market Street. It is assumed that continued access to these locations for HGVs will be required and cognisance of this must be taken when considering the final LEZ option. It is anticipated that the majority of non-compliant HGVs would be replaced by compliant vehicles if the harbour area was included in any LEZ option and it is crucial that engagement with affected operators and business is undertaken to inform the full impacts of any LEZ in Aberdeen.

9.5.19 There are two option variants, similar to the Option 2 and Option 3 variants, that could provide full or partial access on Denburn Road and reduce the impact of rerouting non-compliant vehicles. By allowing access to Denburn Road however, it is likely that this route will see an increase in non-compliant vehicles rerouting from the Eastern Route

9.5.20 Option 4B, in Figure 9.16, and Option 5B, in Figure 9.17, exclude the Guild Street, Bridge Street, Wapping Street gyratory to provide full northbound and southbound movements on Denburn Road, as per the current road network. This would mean that no non-compliant vehicles would be required to reroute from Denburn Road to an alternative route and the corridor would provide alternative routes for non-compliant vehicles no longer able to use the Eastern Route.

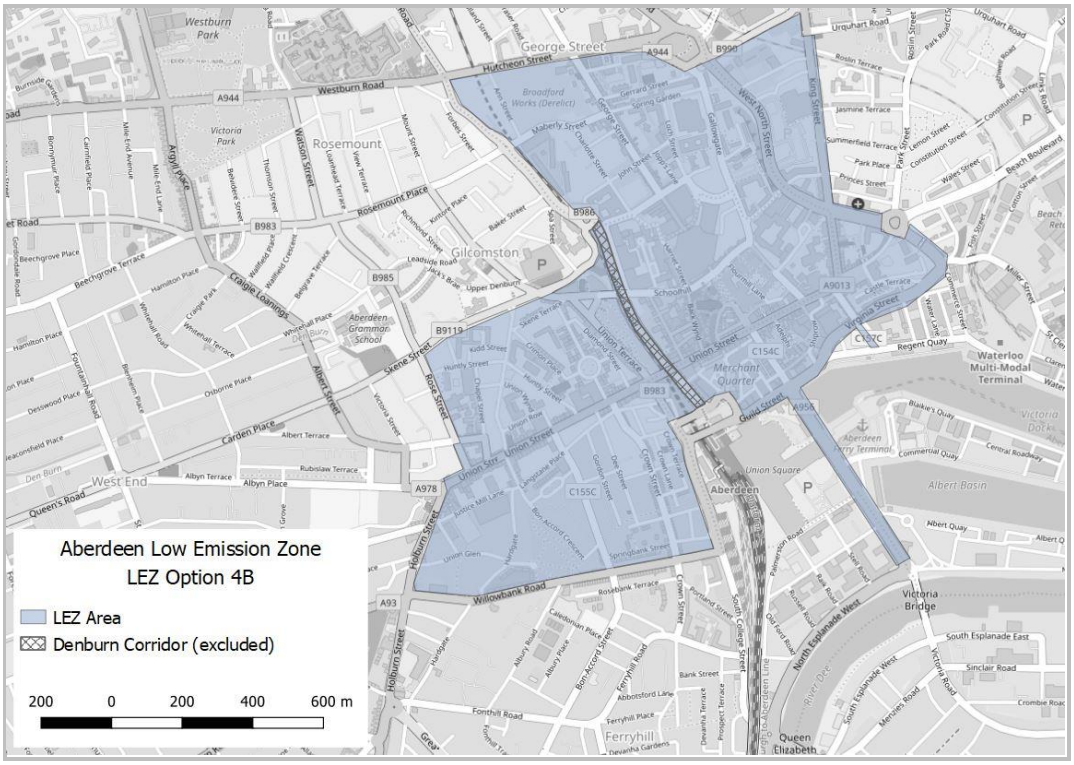

Figure 9.16 : Option 4B – NB & SB Denburn Road access (All Vehicle LEZ)

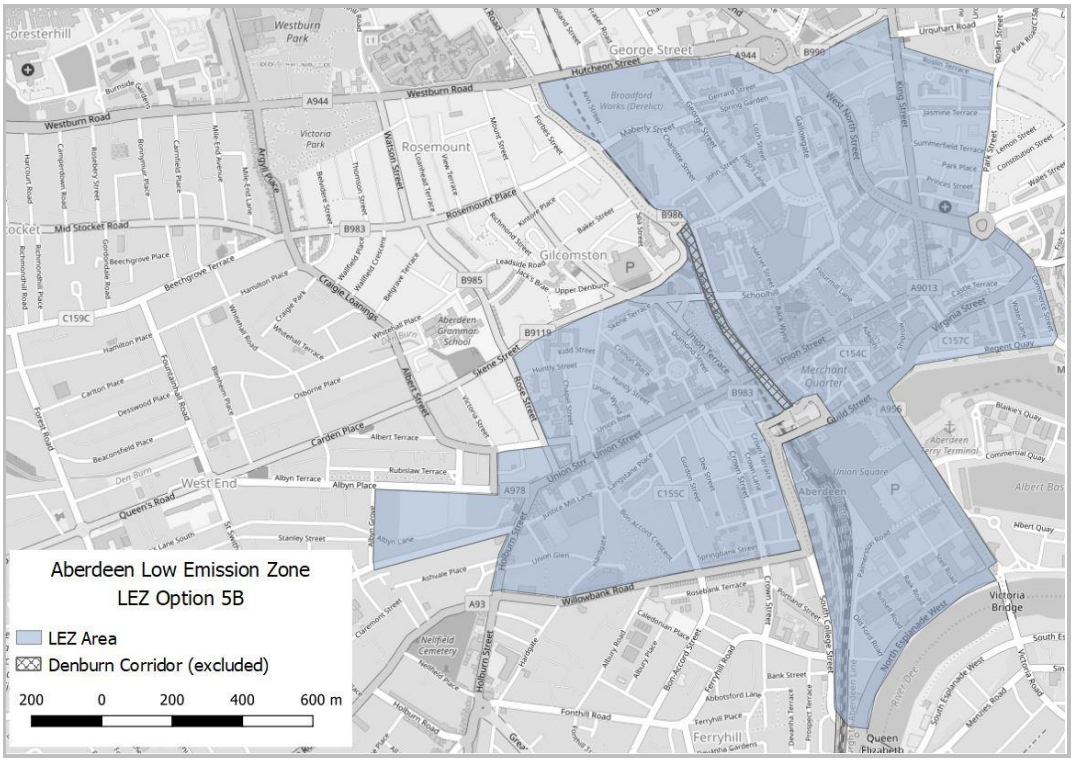

Figure 9.17 : Option 5B – NB & SB Denburn Road access (All Vehicle LEZ)

9.5.21 Option 4C, Figure 9.18, and Option 5C, Figure 9.19, excluded only Bridge Street and Wapping Street between Bridge Street and the Trinity Centre car park and would allow northbound access to Denburn Road from the wider network while providing continued all direction access to the Trinity Centre car park. As noted for Option 2C and 3C, it may be possible to re-design the junction operations at the Bridge Street/Wapping Street and Denburn Road/Wapping Street junctions to allow southbound access from Denburn Road to South Market Street, as tested in 2016 CCMP testing programme (*Aberdeen city Centre Masterplan Testing – Phase 2 & 3, April 2016, SIAS Ref. 77953*).

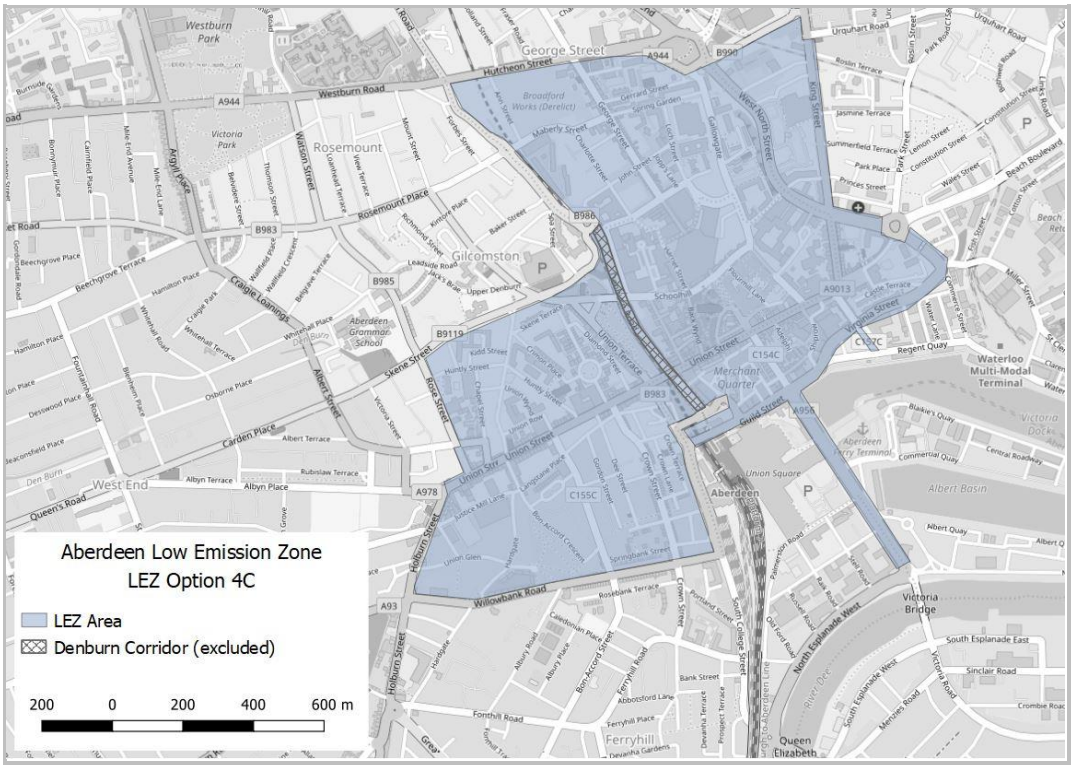

Figure 9.18 : Option 4C – NB & partial SB Denburn Road access (All Vehicle LEZ)

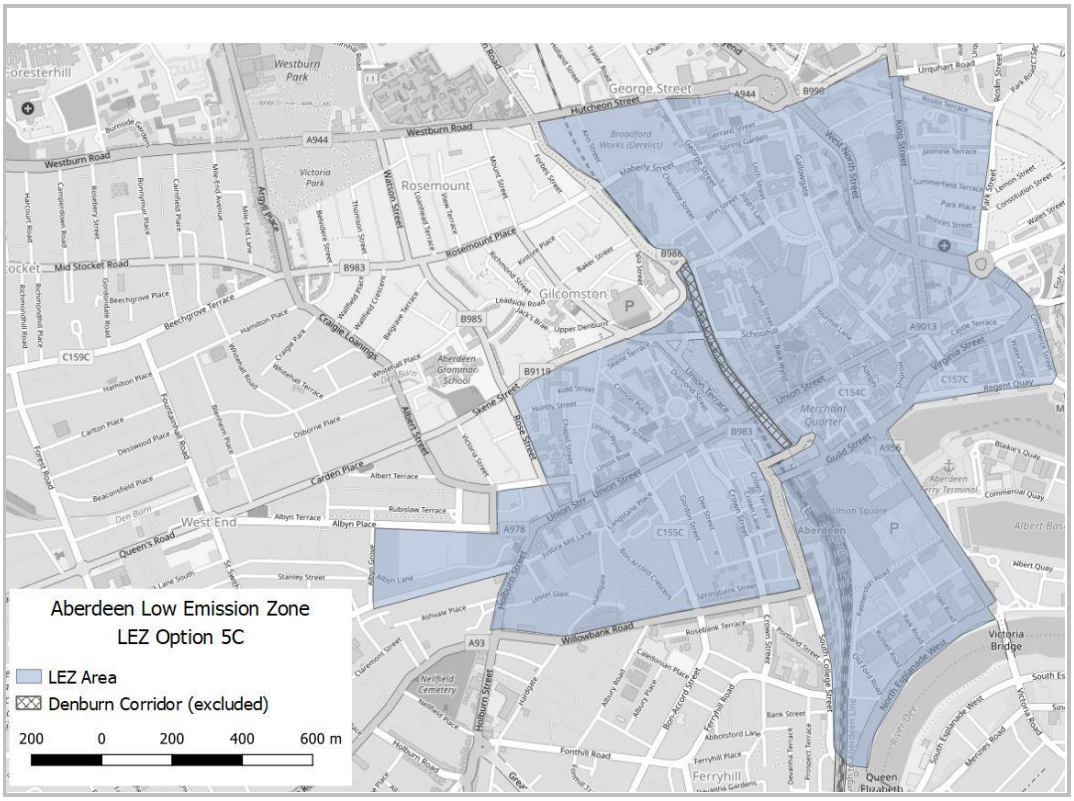

Figure 9.19 : Option 5C – NB & partial SB Denburn Road access (All Vehicle LEZ)

Key Point: In Option 4B/C and Option 5B/5C, the increased volume of non-compliant vehicles likely on Denburn Road and Skene Square (assumptions based on existing 2019 non-compliant vehicles), rerouted from the Eastern Route, may lead to an exceedance of the air quality standards on Skene Square where there are two monitoring locations that currently (2018 data) have annual mean NO_2 levels close to 40 µg/m^3. To fully understand the impacts on air quality, detailed modelling and fleet compliance forecasts are required should these options be recommended for further testing.

9.5.22 The analysis of traffic flows and Denburn Road access has identified a number of all vehicle LEZ option variants, though it should be noted that at this stage of the appraisal process their suitability as final LEZ is options is still to be fully examined. Table 9.6 summaries the identified LEZ option variants.

Table 9.6 : LEZ Options 2- 5: Option Variants

Option	Option Description	Variant	Variant Description
Option 2A	Union Street Area	Includes Denburn Road	No access for non-compliant vehicles
Option 2B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles
Option 2C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access
Option 3A	Union Street & George Street Area	Includes Denburn Road	No access for non-compliant vehicles
Option 3B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles
Option 3C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access
Option 4A	City Centre Air Quality Exceedance Area	Includes Denburn Road	No access for non-compliant vehicles
Option 4B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles
Option 4C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access
Option 5A	City Centre Masterplan Area	Includes Denburn Road	No access for non-compliant vehicles
Option 5B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles
Option 5C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access

9.6 All Vehicle LEZ – Internal Routeing and Access

9.6.1 In addition to the external and through routes identified in the Denburn Road analysis above, there are a number of internal key routes and access points in each LEZ option that will be impacted by the introduction of a LEZ.

9.6.2 As in Table 9.5 above, the analysis undertaken in this section examines the approximate total number of non-compliant vehicles currently on-street based on 2019 traffic survey data. The proportion of non-compliant vehicles city-wide in Aberdeen is calculated using the ANPR analysis as detailed Section 4.6.1 and summarised in Table 9.4. Again, it should be noted that if and when an all vehicle LEZ is enforced in Aberdeen, the total number of non-compliant vehicles is likely to have reduced, primarily due to normal fleet improvements as drivers replace their vehicles but also from potential behaviour changes such as a switch to more sustainable modes of transport and increased working from home practices. At this stage of the interim NLEF appraisal, only the current levels of non-compliant vehicles, using existing data, are assessed, and cognisance of this should be taken when interpreting the data. The LEZ options that progress to detailed testing will be subject to the same analysis but on an agreed predicted future year compliance level, as agreed with ACC and SEPA.

9.6.3 Union Street is entirely internal to all LEZ option areas. It currently operates as a key strategic route in the city and all LEZ options will significantly impact on vehicles on this route. 2019 traffic data (detailed in Table 9.5 above) shows there to be approximately 3000 to 4000 existing non-compliant vehicles on Union Street at assessed locations along its length. Further interrogation of individual junction turn count data suggests that the majority of traffic use the full length of Union Street as a route to other locations in the city, as opposed to using it to access parking or services, although this cannot be confirmed at this stage. It is therefore assumed that non-compliant vehicles currently utilising Union Street will change to alternative routes, such as part of the eastern and western routes or, depending on the exact boundary of the LEZ, Denburn Road if an LEZ is enforced.

9.6.4 In addition to the key routes through and inside the option area, there are a number of key access points where vehicles currently enter the proposed area. At these locations, where traffic surveys information is available, analysis of traffic flows has been undertaken.

9.6.5 Analysis of traffic volumes at key access points for Option 2 (all variants) is detailed in Table 9.7 and Figure 9.8.

Table 9.7 : Option 2 – Traffic Flow Analysis at Key Access Points (12 hour all vehicle flow)

Site Name	Direction	12-Hour Flow				No. of Non-compliant vehicles			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total
Union Street (west)	In	3996	634	263	4893	1210	379	71	1660
	Out	3129	503	245	3877	947	301	66	1314
Marischal Street	In	400	80	17	497	121	48	5	174
	Out	1142	248	51	1441	346	148	14	508
Market Street	In	1278	244	356	1878	387	146	96	629
	Out	1887	343	179	2409	571	205	48	825
Guild Street	In	2674	312	131	3117	810	187	35	1031
	Out	3120	376	523	4019	945	225	141	1311
Bridge Street	In	5851	740	248	6839	1771	442	67	2281
	Out	4097	516	222	4835	1240	309	60	1609
Crown Street	In	1283	157	18	1458	388	94	5	487
	Out	1689	260	25	1974	511	155	7	674
Bon-Accord Street	In	1662	219	29	1910	503	131	8	642
	Out	2025	284	37	2346	613	170	10	793
Union Street (east)	In	5768	772	198	6738	1746	462	53	2261
	Out	4383	607	172	5162	1327	363	46	1736
Rose Street	In	0	0	0	0	0	0	0	0
	Out	2823	342	43	3208	855	204	12	1071
Union Terrace	In	2088	279	47	2414	632	167	13	812
	Out	2763	372	55	3190	836	222	15	1074
Back Wynd	In	717	103	22	842	217	62	6	285
	Out	0	0	0	0	0	0	0	0
Denburn Road	In	4967	600	104	5671	1504	359	28	1891
	Out	5702	735	161	6598	1726	439	43	2209

9.6.6 In total, across all 2019 surveyed locations on the border of the proposed Option 2 LEZ area, there are currently approximately 36,000 vehicles/12,000 non-compliant vehicles that enter the zone and approximately 39,000 vehicles/13,000 non-compliant that exit the zone over a 12 hour period (07:00 – 19:00).

9.6.7 Analysis of traffic volumes at key access points for Option 3 (all variants) is detailed in Table 9.8 and Figure 9.9.

Table 9.8 : Option 3 – Traffic Flow Analysis at Key Access Points (12 hour all vehicle flow)

Site Name	Direction	12-Hour Flow				No. of Non-compliant vehicles			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total
Union Street (west)	In	3996	634	263	4893	1210	379	71	1660
	Out	3129	503	245	3877	947	301	66	1314
Marischal Street	In	400	80	17	497	121	48	5	174
	Out	1142	248	51	1441	346	148	14	508
Market Street	In	1278	244	356	1878	387	146	96	629
	Out	1887	343	179	2409	571	205	48	825
Guild Street	In	2674	312	131	3117	810	187	35	1031
	Out	3120	376	523	4019	945	225	141	1311
Bridge Street	In	5851	740	248	6839	1771	442	67	2281
	Out	4097	516	222	4835	1240	309	60	1609
Crown Street	In	1283	157	18	1458	388	94	5	487
	Out	1689	260	25	1974	511	155	7	674
Bon-Accord Street	In	1662	219	29	1910	503	131	8	642
	Out	2025	284	37	2346	613	170	10	793
Union Street (east)	In	5768	772	198	6738	1746	462	53	2261
	Out	4383	607	172	5162	1327	363	46	1736
Rose Street	In	0	0	0	0	0	0	0	0
	Out	2823	342	43	3208	855	204	12	1071
Rosemount Viaduct	In	3282	301	54	3637	994	180	15	1188
	Out	2682	264	51	2997	812	158	14	984
Denburn Road	In	4967	600	104	5671	1504	359	28	1891
	Out	5702	735	161	6598	1726	439	43	2209
Malberly Street	In	2586	468	65	3119	783	280	18	1080
	Out	743	120	16	879	225	72	4	301
George Street	In	2112	317	40	2469	639	190	11	840
	Out	2281	363	47	2691	691	217	13	920
Gallowgate	In	5280	535	406	6221	1598	320	110	2028
	Out	4712	460	398	5570	1426	275	107	1809

9.6.8 In total, across all 2019 surveyed locations on the border of the proposed Option 3 LEZ area, there are currently approximately 48,000 vehicles/16,000 non-compliant vehicles that both enter the zone and exit the zone over a 12 hour period.

9.6.9 Analysis of traffic volumes at key access points for Option 4 (all variants) is detailed in Table 9.9 and Figure 9.14.

Table 9.9 : Option 4 – Traffic Flow Analysis at Key Access Points (12 hour all vehicle flow)

Site Name	Direction	12-Hour Flow				No. of Non-compliant vehicles			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total
Commerce Street	In	6473	1087	653	8213	1960	650	176	2786
	Out	6083	1009	555	7647	1842	603	150	2595
Marischal Street	In	400	80	17	497	121	48	5	174
	Out	1142	248	51	1441	346	148	14	508
Market Street	In	7827	1546	1327	10700	2370	924	358	3652
	Out	8995	1720	1384	12099	2723	1028	374	4125
South College Street	In	5874	817	247	6938	1778	489	67	2333
	Out	4161	551	231	4943	1260	329	62	1651
Crown Street	In	1283	157	18	1458	388	94	5	487
	Out	1689	260	25	1974	511	155	7	674
Bon-Accord Street	In	1662	219	29	1910	503	131	8	642
	Out	2025	284	37	2346	613	170	10	793
Union Street (West)	In	5768	772	198	6738	1746	462	53	2261
	Out	4383	607	172	5162	1327	363	46	1736
Rose Street	In	0	0	0	0	0	0	0	0
	Out	2823	342	43	3208	855	204	12	1071
Rosemount Viaduct	In	3282	301	54	3637	994	180	15	1188
	Out	2682	264	51	2997	812	158	14	984
Denburn Road	In	4967	600	104	5671	1504	359	28	1891
	Out	5702	735	161	6598	1726	439	43	2209
Maberly Street	In	2586	468	65	3119	783	280	18	1080
	Out	743	120	16	879	225	72	4	301
George Street	In	2112	317	40	2469	639	190	11	840
	Out	2281	363	47	2691	691	217	13	920
Gallowgate	In	5280	535	406	6221	1598	320	110	2028
	Out	4712	460	398	5570	1426	275	107	1809
West North Street	In	5028	710	434	6172	1522	425	117	2064
	Out	6020	869	471	7360	1822	520	127	2469
King Street	In	3004	531	600	4135	909	317	162	1389
	Out	3201	574	578	4353	969	343	156	1468
East North Street	In	2705	508	400	3613	819	304	108	1231
	Out	5817	784	503	7104	1761	469	136	2366

9.6.10 In total, across all 2019 surveyed locations on the border of the proposed Option 4 LEZ area, there are currently approximately 71,000 vehicles/24,000 non-compliant vehicles that enter the zone and approximately 76,000 vehicles/25,600 non-compliant vehicles that exit the zone over a 12 hour period.

9.6.11 Analysis of traffic volumes at key access points for Option 5 (all variants) is detailed in Table 9.10 and Figure 9.15.

Table 9.10 : Option 5 – Traffic Flow Analysis at Key Access Points (12 hour all vehicle flow)

Site Name	Direction	12-Hour Flow				No. of Non-compliant vehicles			
		Car	LGV	HGV	Total	Car	LGV	HGV	Total
Commerce Street	In	6473	1087	653	8213	1960	650	176	2786
	Out	6083	1009	555	7647	1842	603	150	2595
Castle Terrace	In	1678	435	200	2313	508	260	54	822
	Out	3415	739	393	4547	1034	442	106	1582
Market Street	In	7827	1546	1327	10700	2370	924	358	3652
	Out	8995	1720	1384	12099	2723	1028	374	4125
North Esplanade West (E)	In	6625	1189	1006	8820	2006	711	272	2988
	Out	5632	1050	1000	7682	1705	628	270	2603
North Esplanade West (W)	In	7114	1257	1035	9406	2154	752	279	3185
	Out	7210	1266	1041	9517	2183	757	281	3221
South College Street	In	5874	817	247	6938	1778	489	67	2333
	Out	4161	551	231	4943	1260	329	62	1651
Crown Street	In	1283	157	18	1458	388	94	5	487
	Out	1689	260	25	1974	511	155	7	674
Bon-Accord Street	In	1662	219	29	1910	503	131	8	642
	Out	2025	284	37	2346	613	170	10	793
Holburn Street	In	5507	689	215	6411	1667	412	58	2137
	Out	4848	688	175	5711	1468	411	47	1926
Union Grove	In	1221	147	41	1409	370	88	11	469
	Out	1890	209	66	2165	572	125	18	715
Alford Place	In	4561	557	142	5260	1381	333	38	1752
	Out	3670	450	152	4272	1111	269	41	1421
Rose Street	In	0	0	0	0	0	0	0	0
	Out	2823	342	43	3208	855	204	12	1071
Rosemount Viaduct	In	3282	301	54	3637	994	180	15	1188
	Out	2682	264	51	2997	812	158	14	984
Denburn Road	In	4967	600	104	5671	1504	359	28	1891
	Out	5702	735	161	6598	1726	439	43	2209
Maberly Street	In	2586	468	65	3119	783	280	18	1080
	Out	743	120	16	879	225	72	4	301
George Street	In	2112	317	40	2469	639	190	11	840
	Out	2281	363	47	2691	691	217	13	920
Gallowgate	In	5280	535	406	6221	1598	320	110	2028
	Out	4712	460	398	5570	1426	275	107	1809
West North Street	In	5028	710	434	6172	1522	425	117	2064
	Out	6020	869	471	7360	1822	520	127	2469
King Street	In	3004	531	600	4135	909	317	162	1389
	Out	3201	574	578	4353	969	343	156	1468
East North Street	In	2705	508	400	3613	819	304	108	1231
	Out	5817	784	503	7104	1761	469	136	2366

9.6.12 In total, across all 2019 surveyed locations on the border of the proposed Option 5 LEZ area, there are currently approximately 98,000 vehicles/33,000 non-compliant vehicles that enter the zone and approximately 104,000 vehicles/35,600 non-compliant vehicles that exit the zone over a 12 hour period.

9.6.13 In all options, a large proportion of recorded vehicles will enter and exit the zone in one "trip" (i.e. routeing through the entire zone on key routes such as Union Street or Denburn Road if included) and are therefore double-counted. There are also likely to be a number of other possible routes through the zone where double-counting occurs (e.g. Crown Street to Union Terrace). Although not possible to quantify with existing data (see Sections 9.7 and 9.8 below), there will also be a large number of vehicles that enter the proposed zone, park and access services and then exit the zone at a later time.

9.6.14 It is therefore not possible at this stage to accurately quantify the total number of non-compliant vehicle trips that will be required to reroute as a result of each proposed LEZ option and the total number rerouting will vary depending on option boundaries and key included routes. The proportion of non-compliant vehicles in Aberdeen at the time of enforcement of an all vehicle LEZ is also unknown and as noted likely to be smaller than existing 2019 recorded levels. However, using the available data, the following estimations can be made on the total number non-compliant vehicles impacted by each LEZ option based on 2019 traffic survey data:

- Option 2: Greater than 10,000 non-compliant vehicles per day
- Option 3: Greater than 10,000 non-compliant vehicles per day
- Option 4: Greater than 15,000 non-compliant vehicles per day
- Option 5: Greater than 15,000 non-compliant vehicles per day

Key Point: Current observed NO_2 levels on Holburn Street, Trinity Quay, West North Street and Skene Square (currently between 36 µg/m3 and 40 µg/m3) suggest an increase in non-compliant vehicles at these locations, and possible others, will likely lead to additional exceedances of the NO_2 annual mean and therefore any LEZ option that moves significant numbers of non-compliant vehicles to these locations is likely be considered unsuitable in isolation. However if delivered with targeted interventions it may be possible to improve vehicle flow and reduce congestion to mitigate against any increases. As noted it is therefore crucial that detailed traffic modelling, with suitable non-compliant fleet projections is undertaken to provide evidence of the impacts of the LEZ and identify supporting mitigation that will be required.

9.7 Access to City Centre Car Parks

9.7.1 Key to understanding the routeing and volume of trips impacted by the proposed LEZ are the routes and destinations of trips on the road network. Aberdeen city centre is a major trip attractor and generator with multiple land uses and city centre car parks are a key start and end point for vehicle trips to and from the city centre. The primary car park locations and their capacities are shown in Figure 9.20.

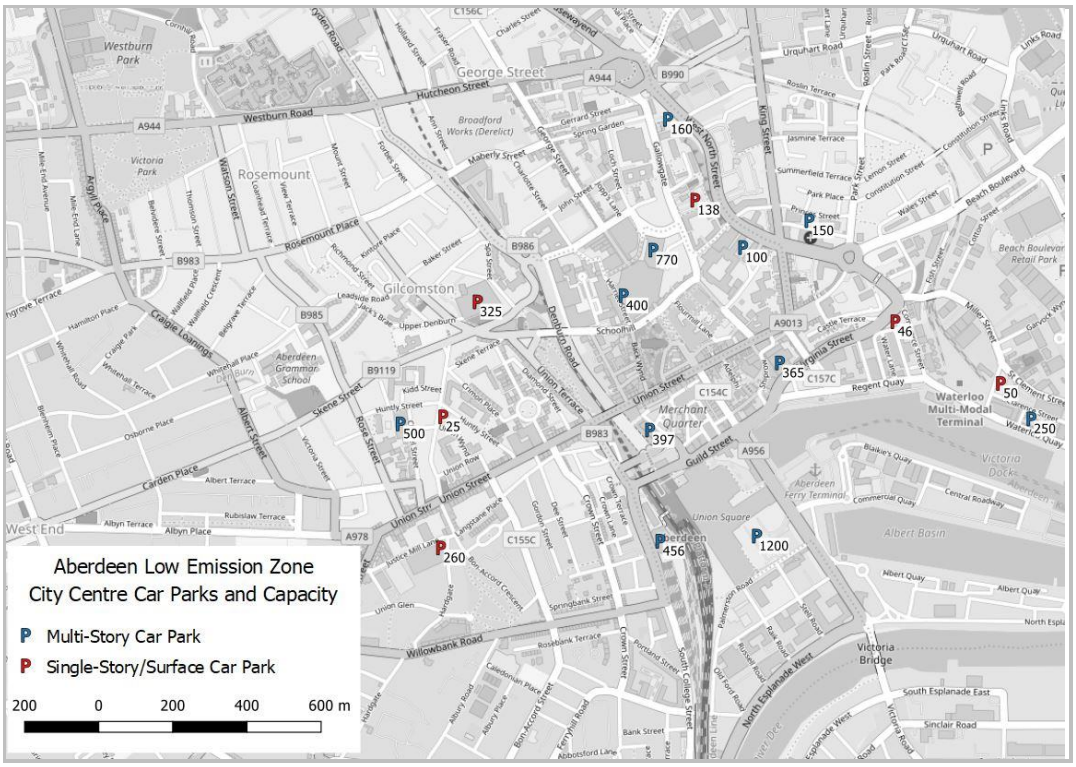

Figure 9.20 : Aberdeen City Centre Car Park Locations and Capacities

9.7.2 The city centre car parks are contained in all four all vehicle LEZ options to varying degrees and therefore there will be impacts on the wider city routeing as non-compliant vehicles adjust their routes to utilise a car park outside any proposed LEZ. Table 9.11 lists the main city centre car parks and their capacity, with an indication whether each car park is contained within all LEZ option variants. Note, Options A include Denburn Road and therefore include the Trinity Centre car park and, in Option 4A and 5A, College Street car park. Options B and C provide access to Denburn Road and in turn access to the Trinity Centre and College Street car parks.

9.7.3 Clearly Option 2, covering the smallest area, contains the fewest car park spaces and has over 70% of listed spaces available for compliant and non-compliant vehicles to utilise. It is expected that Option 2 will result in non-compliant vehicles that currently utilise a car park inside the LEZ area choosing a different car park but it is assumed that there will be sufficient capacity at car parks outside the LEZ area to accommodate these vehicles. As expected, as each option area increases in size, the availability of car park spaces reduces. Option 4A and Option 5A contain over 80% of all listed spaces and there may not be capacity at car parks outside the proposed LEZ areas for non-compliant vehicles.

9.7.4 The final LEZ option will require a supporting car parking strategy to ensure there is sufficient capacity for compliant and non-compliant vehicles. ACC are currently compiling car park capacity data and, if available, will inform the final NLEF appraisal, and in turn be used to inform any parking strategy. This data will allow an assessment of the capacity of car parks outside a proposed LEZ boundary to accommodate non-compliant vehicles that currently park inside a proposed LEZ boundary.

Table 9.11 : City Centre Car Parks and LEZ Area

Car Park	Capacity	Car Park Located Inside LEZ Option Area (Y/N)							
		2A	2B/C	3A	3B/C	4A	4B/C	5A	5B/C
Chapel Street	500	Y	Y	Y	Y	Y	Y	Y	Y
Trinity Centre	397	Y	N	Y	N	Y	N	Y	N
Ship Row	365	Y	Y	Y	Y	Y	Y	Y	Y
IQ Car Park	260	Y	Y	Y	Y	Y	Y	Y	Y
Marishal College	100	Y	Y	Y	Y	Y	Y	Y	Y
Summer Street	25	Y	Y	Y	Y	Y	Y	Y	Y
Union Square	1200	N	N	N	N	Y	Y	Y	Y
Bon Accord (Loch Street)	770	N	N	Y	Y	Y	Y	Y	Y
College Street	456	N	N	N	N	Y	N	Y	N
Bon Accord (Harriet Street)	400	N	N	Y	Y	Y	Y	Y	Y
Denburn Car Park	325	N	N	N	N	N	N	N	N
Lime Street	250	N	N	N	N	N	N	N	N
West North Street	160	N	N	Y	Y	Y	Y	Y	Y
Frederick Street	150	N	N	N	N	N	N	Y	Y
Gallowgate	138	N	N	Y	Y	Y	Y	Y	Y
Crombie Road	60	N	N	N	N	N	N	N	N
Church Street	50	N	N	N	N	N	N	N	N
Virginia Street	46	N	N	N	N	N	N	Y	Y
Fonthill Road	8	N	N	N	N	N	N	N	N
Total Spaces Inside LEZ Area	5660	1647	1250	3115	2718	4771	3918	4967	4114
% Spaces Inside LEZ Area	-	29%	22%	55%	48%	84%	69%	88%	73%

9.7.5 As part of the extensive traffic survey data collection required to inform the development of the Aberdeen Paramics traffic model, Automatic Number Plate Recognition surveys (ANPR) were undertaken at 17 “external” locations on key routes in and out of Aberdeen city centre and at 11 city centre car park locations as shown in Figure 9.21.

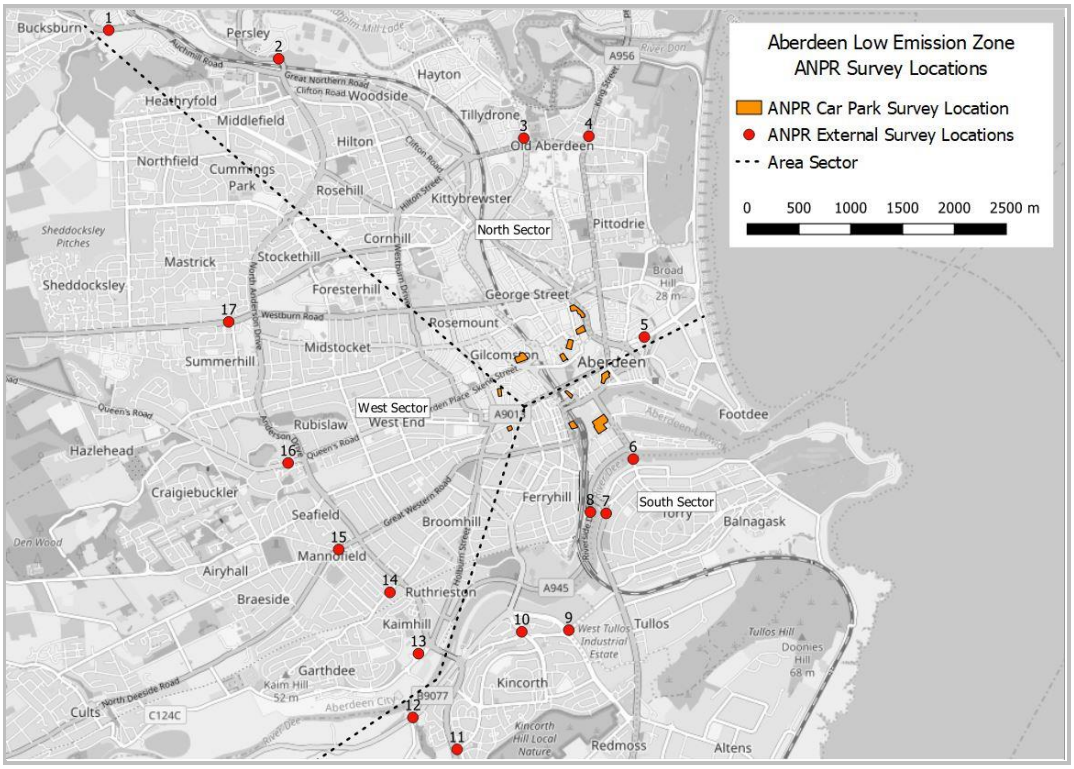

Figure 9.21 : ANPR Survey Locations

9.7.6 Travel patterns to and from city centre car parks can be informed by the ANPR data and used to build up a picture of route choice to these key locations and the potential impact on routeing that the proposed all vehicle LEZ may have. The external ANPR survey locations were split into 3 sectors, North, South and West, as shown in Figure 9.21, and the total proportion of trips from these sectors to each car park was calculated, as detailed in Table 9.12.

Table 9.12 : External ANPR Site to City Centre Car Park Distribution

Car Park	Car Park Sector	Car Park Capacity	Sector where journey originating		
			North	South	West
Bon Accord (Loch Street)	North	770	16%	4%	6%
Bon Accord (Harriet Street)	North	400	3%	2%	6%
Denburn Car Park	North	325	9%	4%	9%
West North Street	North	160	5%	2%	2%
Gallowgate	North	138	11%	3%	8%
Union Square	South	1200	30%	55%	35%
College Street Car Park	South	456	7%	13%	11%
Trinity Centre	South	397	9%	8%	8%
Ship Road	South	365	2%	3%	2%
Chapel Street Car Park	West	500	8%	4%	12%
IQ Car Park	West	260	1%	0%	1%

9.7.7 Table 9.12 highlights a number of travel pattern trends. In particular it is clear that trips entering from one side of the city route across the city to access all car parks. For example, the data shows the Union Square car park is most commonly used car park by vehicles from all three sectors. The Union Square car park is relatively modern, has the largest capacity in the city and is linked to the Union Square shopping centre and train station and it is therefore expected to be a main attractor of trips.

9.7.8 As detailed in Table 9.11, the Union Square car park is located inside all variants of LEZ Options 4 and 5 and therefore will not be accessible to non-compliant vehicles. In all variants of Option 2 and Option 3, Union Square is outside the proposed LEZ area and is

located to the south of Union Street. In Option 2 and Option 3, routes for non-compliant vehicles originating from the south sector of the city will not be impacted by any LEZ. Trips from the west or the north sectors that choose to route to Union Square via Berryden Road and/or Denburn Road would be impacted by all current variants of Option 2 and 3. Non-compliant would be required to find alternative routes such as the A96/West North Street/Commerce Street/Virginia Street.

9.7.9 Union Square shopping centre is also the location of Shop Mobility Aberdeen and cognisance of this should be taken when defining a final LEZ option area. Those who require access to such services should still be able to do so without discrimination, and having a non-compliant vehicle should not be a reason to stop access to a vital service. Regulation 3 of the LEZ Regulations states vehicles for disabled persons, either disabled tax class registered or used with the Blude Badge Scheme, will be exempt from penalty charges and will therefore be able to access this particular services. Consideration of those that do not meet this (or other) exemption criteria will be considered when defining the final preferred LEZ option and through the supporting integrated impact assessment.

9.7.10 Table 9.13 shows the volume of traffic routing inbound to the city centre car parks by sector. The numbers provided are the total vehicles recorded over a 12 hour period (07:00-19:00). The table also shows the resultant volume of car parking traffic which is routing across the city centre to destinate in the car park of choice.

Table 9.13 : Inbound to Car Park Trips (12hr 07:00 – 19:00)

Sector	Car Parks						Total Parking	Cross City	
	North Car Parks		South Car Parks		West Car Parks			(Veh)	%'age
North	506	43%	558	48%	103	9%	1,167	661	57%
South	244	16%	1,192	79%	70	5%	1,506	314	21%
West	282	31%	509	56%	113	13%	904	791	88%
Total	1,032	29%	2,259	63%	286	8%	3,577	1,766	**49%**

9.7.11 Table 9.14 provides a similar set of results but for traffic routing from the city centre car parks.

Table 9.14 : Outbound to Car Park Trips (12hr 07:00 – 19:00)

Car Parks	Sector						Total Parking	Cross City	
	North		South		West			(Veh)	%'age
North Car Parks	605	47%	344	27%	334	26%	1,283	678	53%
South Car Parks	336	22%	902	60%	271	18%	1,509	607	40%
West Car Parks	108	37%	92	31%	94	32%	294	200	68%
Total	1,049	34%	1,338	43%	699	23%	3,086	1,485	**48%**

9.7.12 The analysis shows that approximately half of all the car parking traffic routes across the city centre area to destinate in the car park of choice. The same proportion applies to traffic exiting these car parks.

9.7.13 In real terms, this equates to over 1,700 vehicles inbound and 1,500 vehicles outbound which are routing across the city centre in the weekday 12 hour period. It is highly likely that these figures would be significantly higher at the weekend or through holiday periods. These figures are also based solely upon the data collated, therefore the actual figures are likely to be higher.

9.7.14 The introduction of a LEZ will restrict the number of car park spaces available for non-compliant vehicles and will also result in rerouting of non-compliant vehicles. The above analysis suggests that if car parking traffic can be encouraged to park in the sector of origin, i.e. the nearest car park(s) to their route into the city centre, then this will reduce the volume of traffic routing across the core area of the city centre. This may potentially be of benefit when introducing a LEZ and mitigating its likely routeing changes.

Key Point: The final LEZ option will require a supporting car parking strategy in order to discourage routing across the city centre area. This would need to be supported by an integrated pedestrian signing strategy, together with a longer term placemaking strategies such as the City Centre Masterplan, to encourage greater utilisation of public transport, park and ride, walking and cycling.

9.8 Residential and Business Access to a LEZ

9.8.1 Residential property and business, retail and industrial land use are other main generators of trips in Aberdeen city centre. Aside from analysing city centre car park usage and travel patterns, it is difficult to quantify the total numbers of daily trips made to and from a particular LEZ area by those living, working or providing a service in the proposed LEZ area. Trips that travel to and from these land uses for such purposes are likely to still be required to make the same trip if an LEZ is in place. If they currently use a non-compliant vehicle to make this trip then either their movements, mode or vehicle type compliance is likely to change as a result of the LEZ.

9.8.2 One indicator of trips that currently start or end their trip in the proposed LEZ area is parking permit data. In Aberdeen, a person is entitled to a resident or business parking permit if their property or business is within a controlled parking zone. At the time of writing, historic (2012) is the only dataset available for such analysis. Analysis of historic data is considered relevant as the total number of residents or business spaces in the city centre is unlikely to have changed significantly in the city centre. Table 9.15 details the total number of parking permits (in 2012), both residential and business, that are located in each all vehicle LEZ option, alongside the proportion of all ACC permits inside each option.

Table 9.15 : Parking Permit per LEZ Option (2012 Figures)

Option	All Vehicles		Non-compliant vehicles	
	No. of Permits	% of ACC permits	No. of Permits	% of ACC permits
Option 2	903	8%	273	3%
Option 3	1287	12%	390	4%
Option 4	1407	13%	426	4%
Option 5	1575	15%	477	4%

9.8.3 The non-compliant figure is calculated from observed levels of non-compliant vehicles in Aberdeen in 2019 where 30% of all cars are calculated to be non-compliant (see analysis in Section 4.6.1). For example, LEZ Option 2 covers 6 parking zones (fully and partially) and the total number of resident and business permits issued by ACC in 2012 was 903. Applying the compliance factor, it is estimated that between 250 and 300 vehicles with parking permits would be non-compliant in 2019 and be required to park outside the LEZ area to avoid penalty.

9.8.4 There are also likely to be wider impacts on residents and businesses inside a LEZ area, such as access for both personal and business deliveries or infrequent visitors to a property or business. It is important that engagement with those likely to be impacted by any proposed LEZ is undertaken so any impacts can be understood and be used to inform the final LEZ option. It is also possible that residents and businesses inside any LEZ could be given additional grace periods to comply with LEZ restrictions, a decision that will be informed by the emerging guidelines and regulations as well as the modelling and consultation exercises.

9.8.5 There are key routes for commercial vehicles (e.g. LGVs and HGVS) inside the city centre that are either fully or partially encompassed by the proposed LEZ options areas, such as Union Street (for delivery) and Market Street, Virginia Street, Commerce Street, West and

East North Street (Eastern Route) and King Street. A key contributor to the relatively high proportion of HGV (as noted in Section 9.5 on the Eastern Route and King Street) is Aberdeen Harbour and associated industrial land use, located south and east of Commerce Street, Virginia Street and Market Street. It is assumed that continued access to these locations for HGVs will be required and cognisance of this must be taken when considering the final LEZ option. Option 4 and Option 5 include the full length of this key Eastern Route. The options were devised to capture air quality exceedances along the route, however this means that there is no option that captures the majority of air quality exceedances while providing full access to Aberdeen Harbour (from Market Street) and Union Square, two key land uses in the city centre area. It is anticipated that the majority of non-compliant HGVs would be replaced by compliant vehicles if the harbour area was included in any LEZ option (for harbour businesses to continue to operate) and it is crucial that engagement with affected operators and business is undertaken to inform the full impacts of any LEZ in Aberdeen. In addition to industrial land uses around the harbour area, ferry services to Orkney and Shetland are located here, with access from Market Street. It may be deemed unsuitable to enforce an LEZ that would penalise those using a vital service. Further consideration of Aberdeen Harbour access is made in Section 9.12.

Key Point: The final LEZ option will be required to address the requirements of residents and business impacted by the introduction of a LEZ to the area where they live, work, trade or do business. Actions such as communication strategies and consideration of additional grace periods for residents and businesses of the zone must form part of the final package.

9.9 Existing Aberdeen City Council Strategies

9.9.1 The Aberdeen LEZ and any complimentary traffic management measures should align with the existing transport policy landscape in Aberdeen. As reviewed in Chapter 3, key Aberdeen policies and strategies that may influence or be influence by the final LEZ option(s) are:

- Aberdeen City Centre Masterplan (CCMP)
- Aberdeen City Sustainable Urban Mobility Plan (SUMP)
- North East Scotland Roads Hierarchy Study

9.9.2 Each strategy is crossed checked against the remaining four LEZ options to ensure there is not significant contradictions. Although there will be differences, it is crucial that the introduction of a LEZ does not contradict or interrupt the implementation of these existing key ACC policies.

Aberdeen City Centre Masterplan (CCMP) and Sustainable Urban Mobility Plan (SUMP)

9.9.3 The CCMP was approved by ACC in June 2015 and it outlines a 25-year development strategy for the city centre designed to support economic growth by transforming Aberdeen as a place to live, visit, work and do business. The SUMP was developed by ACC to identify transport interventions that could be delivered to help realise certain city centre elements of the revised hierarchy and complement and expand upon city centre transport interventions identified in the CCMP. Figure 9.22 outlines the CCMP and SUMP boundary.

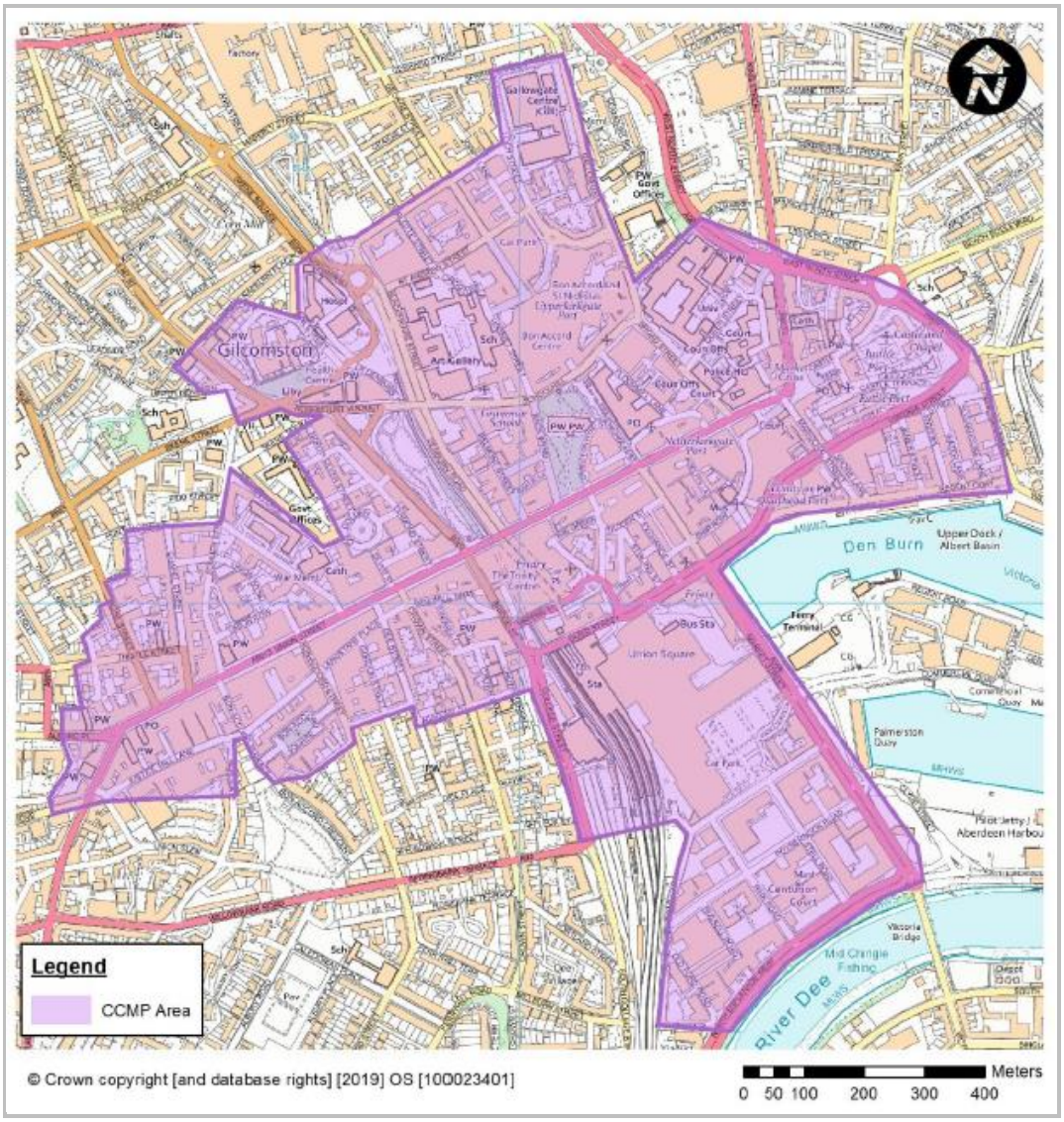

Figure 9.22 : CCMP & SUMP Boundary (Source ACC)

9.9.4 As noted throughout the detailed assessment, a transport assessment and traffic modelling study was undertaken by SYSTRA (then SIAS; *Aberdeen City Masterplan Testing – Phase 2 & 3, SIAS Ref: TPXACCM1/77954, April 2016*) in 2016 to review the CCMP transport interventions with the key tested interventions shown in Figure 9.23. A summary of these interventions and the optimum phased delivery is provided in the policy framework review in Chapter 3.

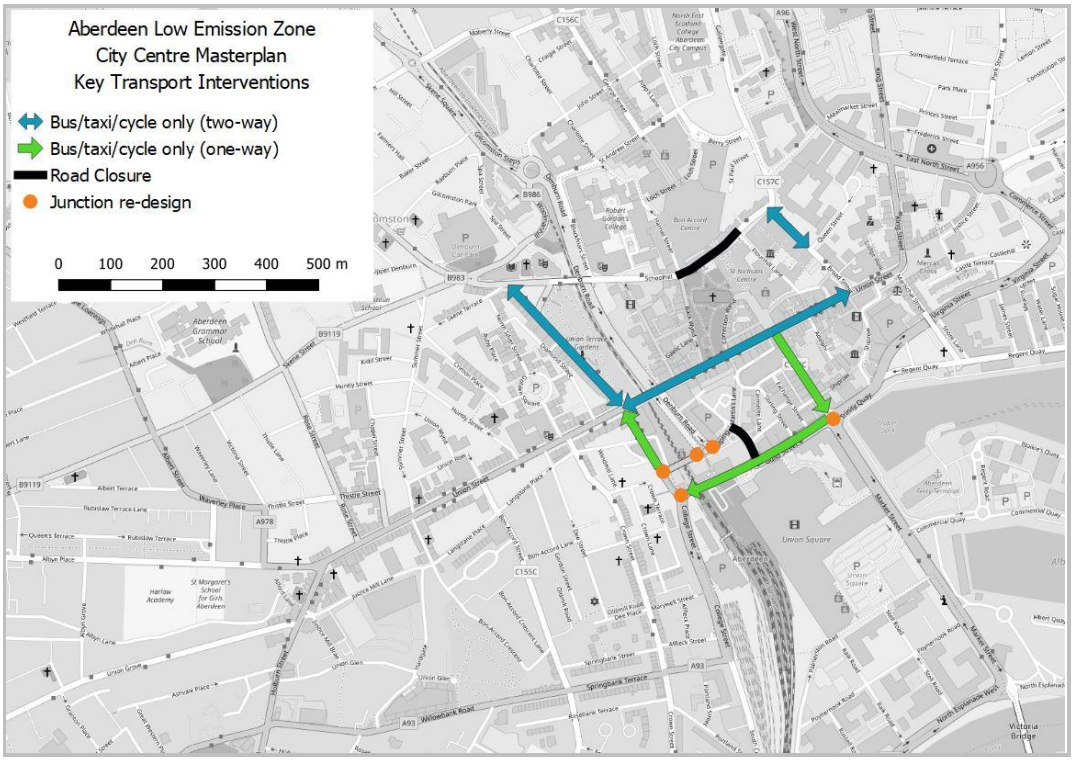

Figure 9.23 : City Centre Masterplan – Key Transport Interventions

9.9.5 The 2016 testing report details significant impacts on vehicle rerouting if all phases of the CCMP are delivered but that these can be accommodated in the current road network with a 20% reduction in city centre traffic volumes together with targeted junction improvements along key strategic corridors.

9.9.6 In the work to develop the 2019 Aberdeen City Centre Paramics Model, comparisons between 2019 traffic levels and 2012 traffic levels (from which original future year forecasts were based) suggests there to be a 5% to 10% reduction in traffic volumes and therefore the future year modelling is very likely to have overestimated the future traffic demand within the city centre. It is clear there is a requirement to re-assess the CCMP measures in the new 2019 Aberdeen City Centre model with updated future year projections.

9.9.7 Analysis of current traffic flows and non-compliant vehicles has identified that the introduction of a LEZ will also result in significant rerouting of non-compliant vehicles and recommends that further detailed Paramics traffic modelling is undertaken to fully understand this.

9.9.8 The NMF air quality analysis suggests it highly likely that the addition of the Phase 2 and/or Phase 3 CCMP measures to any LEZ Option would reduce levels of NO_2 on Union Street and Market Street, north of Guild Street, to levels below the legal limits due to the decreased traffic flow on these routes (as bus, taxi and cycle only corridors). However, as concluded in the 2016 testing report, this would significantly increase traffic volumes on adjacent strategic routes, such as Virginia Street and West and East North Street, thereby potentially increasing NO_2 (and other pollutant) levels.

9.9.9 In addition to the impacts predicted by current and historic modelling (by both air quality and traffic models) are the behavioural impacts of introducing a LEZ such as the encouragement for modal shift or existing trips no-longer being made. It is therefore important that all modelling takes cognisance of the potential reduction in overall private car trip numbers on the road network.

9.9.10 Combining the likely impacts of the LEZ and CCMP interventions, it is clear that many factors must be considered when detailed modelling of the LEZ options is undertaken and

it is crucial that a structured modelling programme is developed and agreed between SYSTRA, ACC and SEPA at the outset of the modelling.

Key Point: Chapter 14 summarises the outcomes from the detailed traffic modelling, including model testing of the CCMP. At this stage however (prior to modelling being undertaken), each remaining LEZ option is assessed against its likely compatibility with the CCMP interventions tested in 2016 and shown in Figure 9.23.

9.9.11 Option 1, a bus only LEZ option, and the key transport interventions in the CCMP are shown together in Figure 9.24 (Option 1A). The majority of the interventions target improvements on key public transport routes such as Union Street and the compatibility of Option 1A and Option 1B (including the bus station) and the CCMP interventions are discussed in Section 9.2 above.

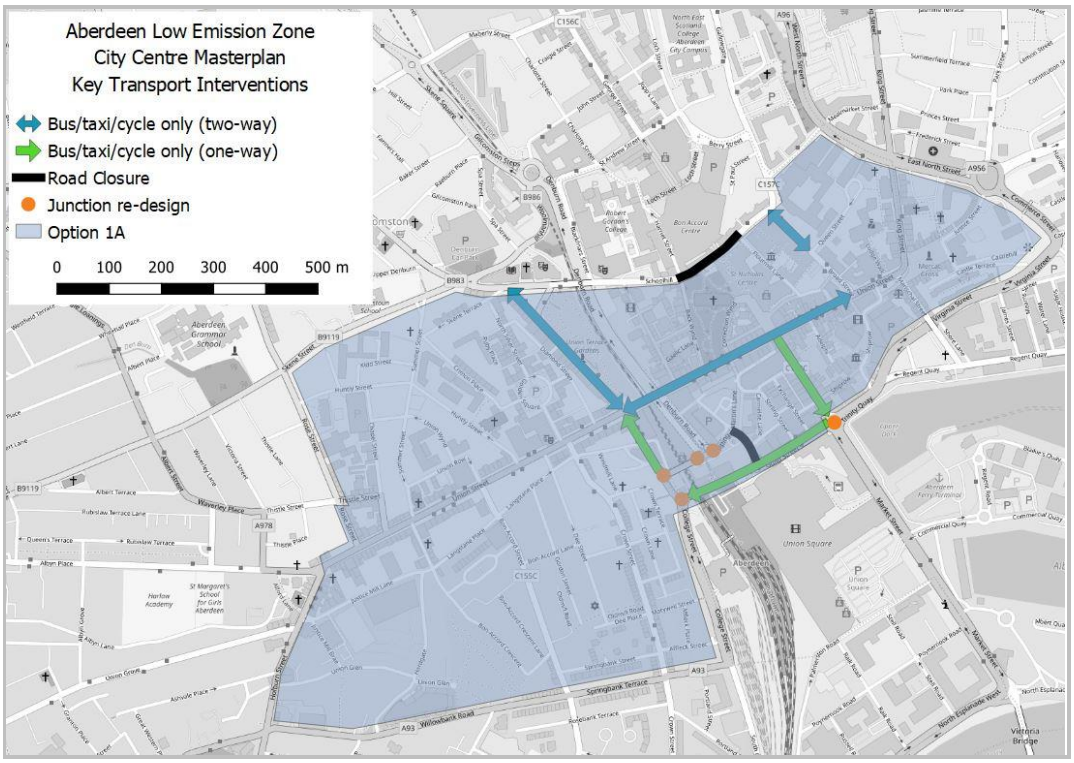

Figure 9.24 : CCMP & LEZ Option 1A

9.9.12 The detailed appraisal of Option 2, Option 3, Option 4 and Option 5 has identified 3 variants with varying access to Denburn Road at the gyratory with Wapping Street, Carmelite Street, Guild Street and Market Street. Consistent across all options, the three Denburn Road variants for Option 2 are shown in Figure 9.25 (Option 2A), Figure 9.26 (Option 2B) and Figure 9.27 (Option 2C).

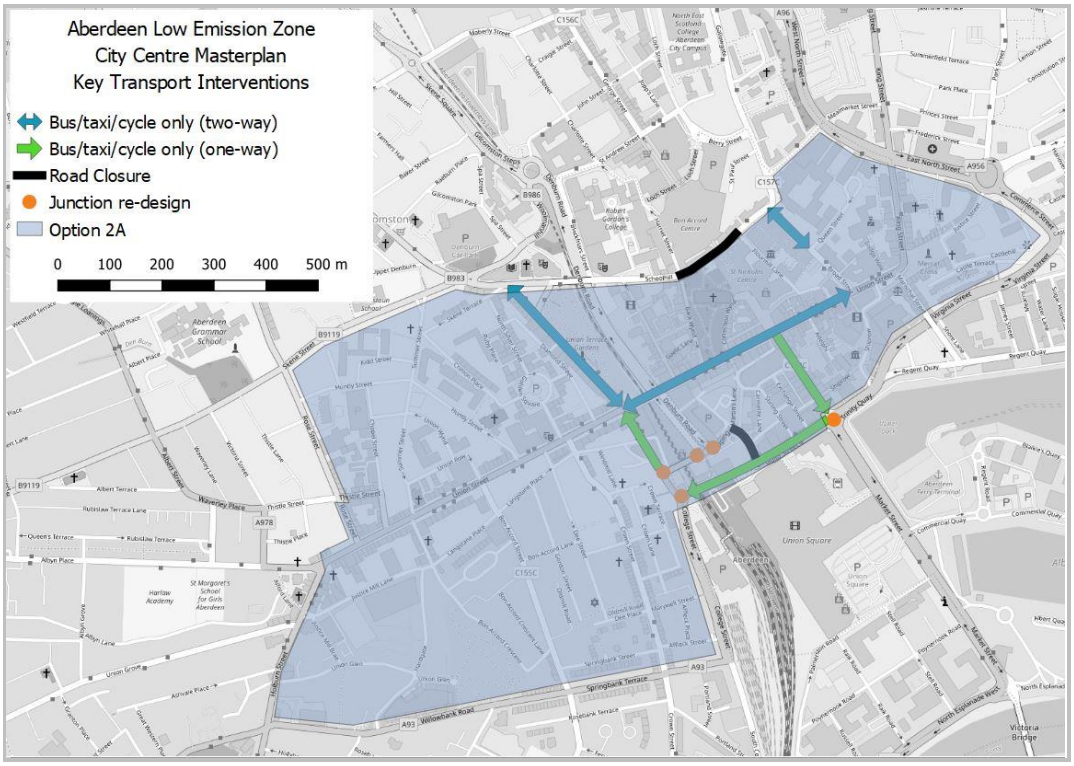

Figure 9.25 : CCMP & LEZ Option 2A (no Denburn Road access)

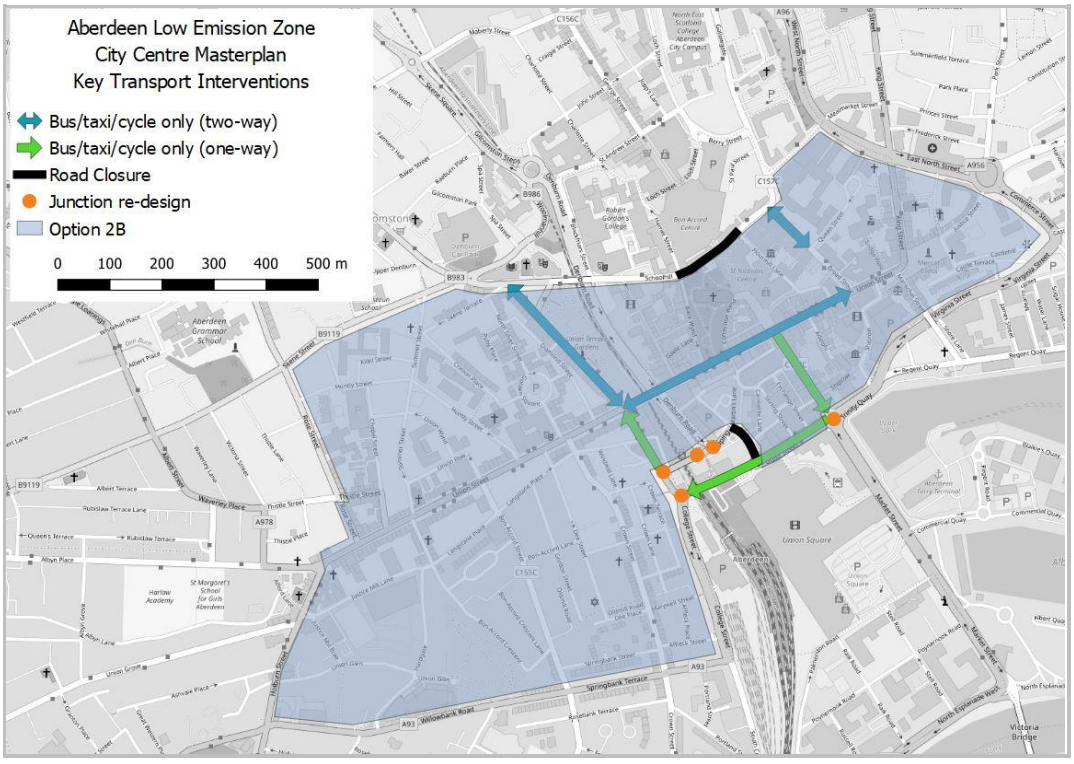

Figure 9.26 : CCMP & LEZ Option 2B (NB & SB Denburn Road access)

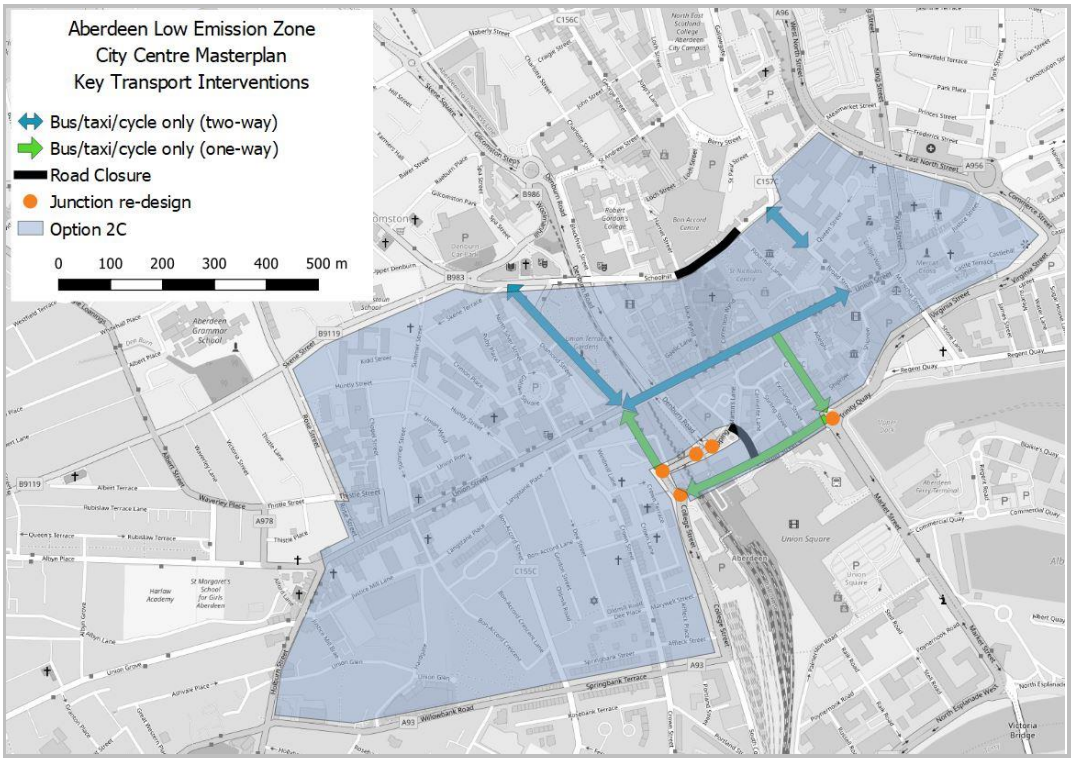

Figure 9.27 : CCMP & LEZ Option 2C (SB Denburn Road access)

9.9.13 Without consideration of the CCMP proposals, all three options are deemed workable as LEZs in isolation. Considered with the CCMP proposals, variant A remains viable and if delivered with junction re-design and the closure of Carmelite Street would allow access for compliant vehicles only to Denburn Road. Variants B and C both in theory deliver the same outcome when considered with the CCMP proposal as, if delivered with junction re-design and the closure of Carmelite Street would provide access for both compliant and non-compliant vehicles to and from Denburn Road via South College Street. The boundaries however do not align with the CCMP proposals and can be logically re-defined as one option variant, named Option 2D and shown in Figure 9.28 below.

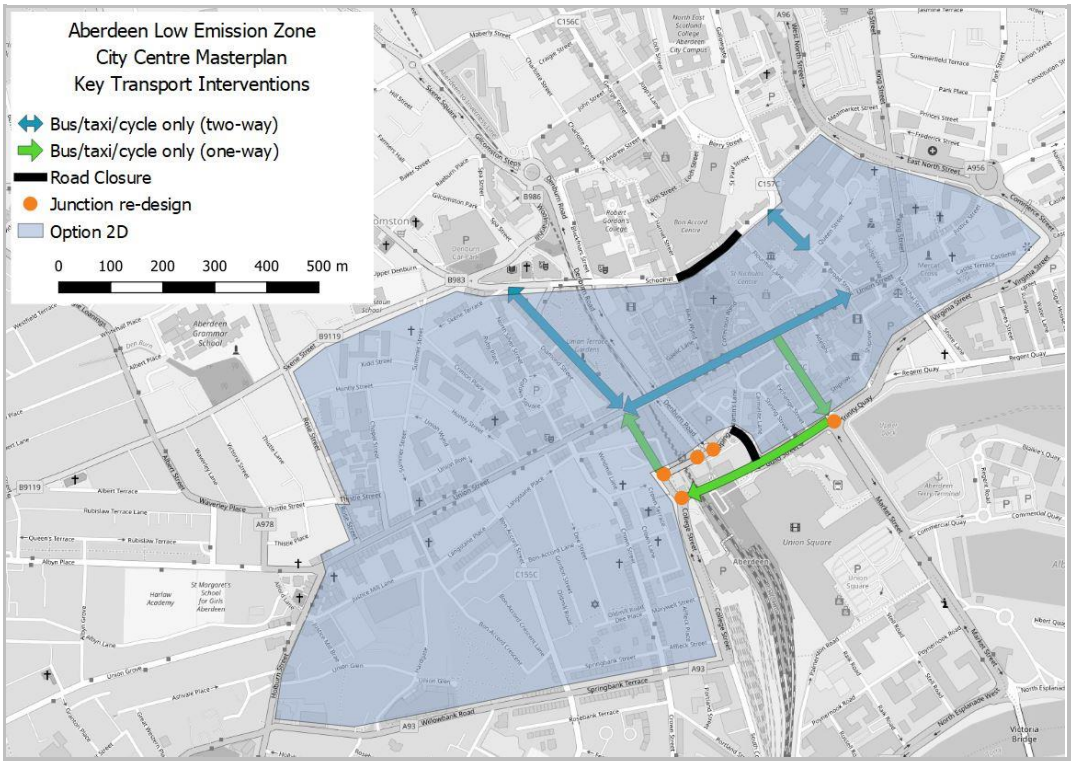

Figure 9.28 : CCMP & LEZ Option 2D (NB & SB Denburn Road access)

9.9.14 Option 2D (and the equivalent Option 3D, Option 4D and Option 5D) could be delivered with the current road network with Carmelite Street open and the gyratory operating as it currently does or it can be delivered with the CCMP proposals including junction re-design to allow full northbound and southbound access via South College Street for all vehicle types.

9.9.15 Upon consideration of the key CCMP transport interventions there are two option variants of Option 2, Option 3, Option 4 and Option 5 that can therefore be progressed in the appraisal process:

- Option variant A – no non-compliant access to Denburn Road (Figure 9.25)
- Option variant D – full access to Denburn Road (Figure 9.28)

North East Scotland Roads Hierarchy Study

9.9.16 ACC and regional partners Nestrans and Aberdeenshire Council commissioned The North East Scotland Roads Hierarchy Study, as detailed in Section 3.3. The City Centre Hierarchy Package recommended changes to the classification of roads in the city with the approved priority, optional priority and secondary routes shown Figure 9.29.

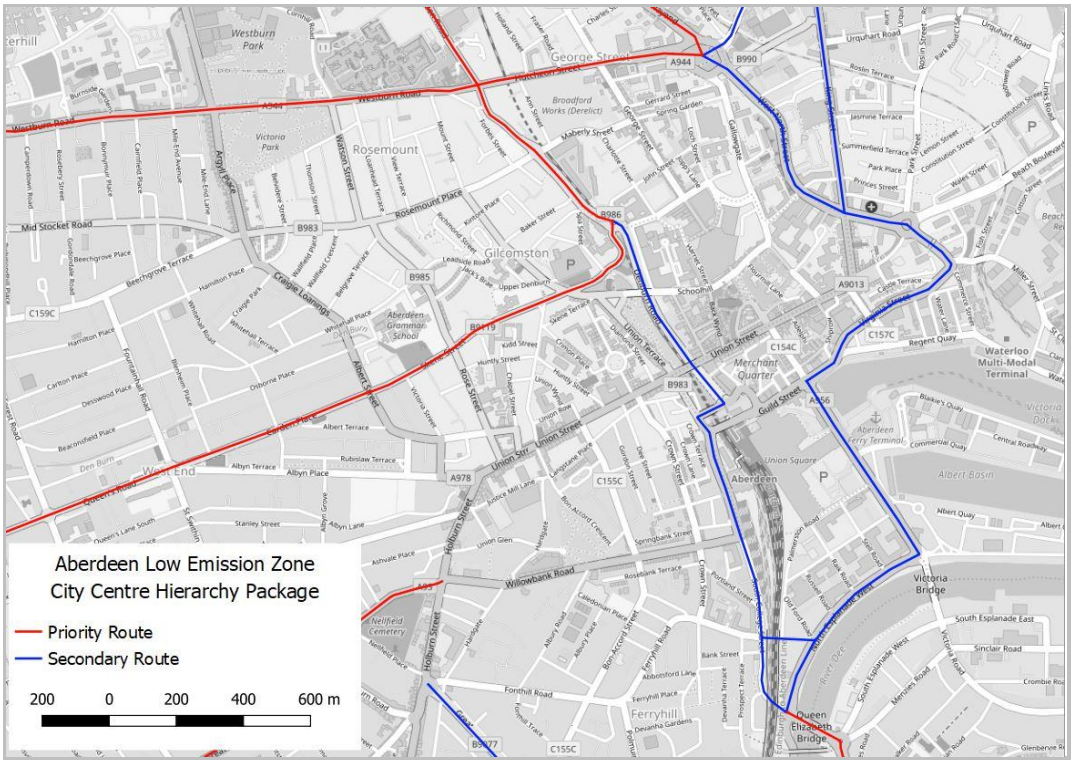

Figure 9.29 : City Centre Hierarchy Package

9.9.17 While there is no requirement for a LEZ option to be bound by particular class or category of road, it is considered important, in the context of Aberdeen's changes to the road hierarchy, that the LEZ area aligns with the new hierarchy. It may be considered a useful method to enhance the message of the changes to the hierarchy, especially if no priority routes are included inside the LEZ area, such that the LEZ (or the city centre) is not an area to be driven through but rather a destination: a key message for Aberdeen.

9.9.18 Comparisons between the CCMP and the LEZ options conclude there to be two option variants for each for each of the all vehicle LEZ: including or excluding Denburn Road. Option 2A, including Denburn Road, and Option 2D excluding Denburn Road, together with the proposed City Centre Hierarchy Package, are shown in Figure 9.30 and Figure 9.31.

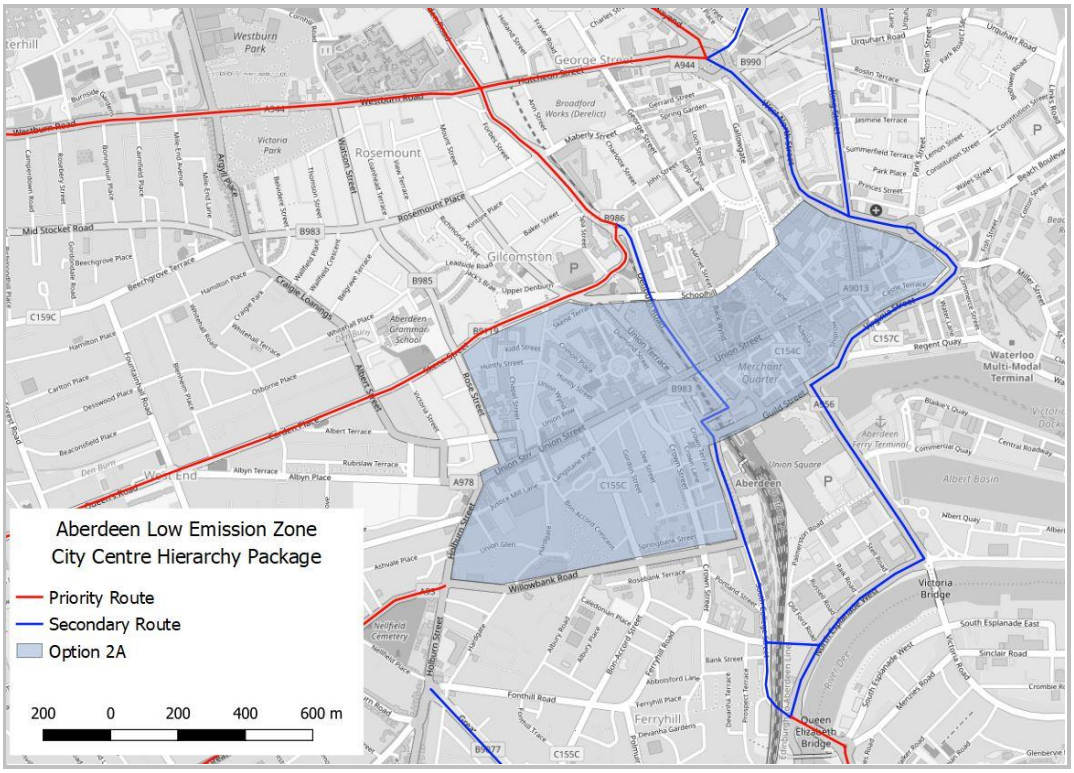

Figure 9.30 :Option 2A (including Denburn Road) and City Centre Hierarchy Package

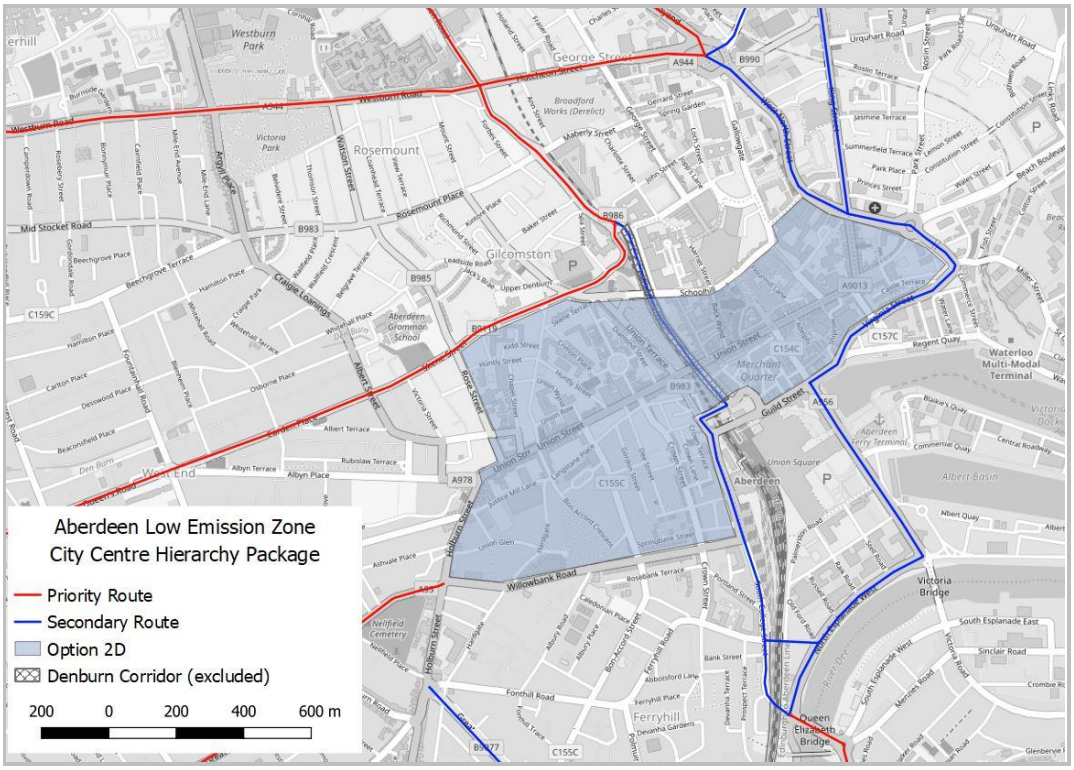

Figure 9.31 : Option 2D (excluding Denburn Road) and City Centre Hierarchy Package

9.9.19 Option 2A and Option 2D do not include any priority routes and are bound on the eastern extent by a key north-south secondary routes. Option 2A includes the key secondary route of Denburn Road and analysis of 2019 traffic flow suggest there are currently up to 4000 non-compliant vehicle per day that could reroute to the eastern secondary route or potentially some re-classified minor routes to the west, such as Holburn Street to Argyll Place (and likely some other adjacent minor routes). As noted traffic and air quality modelling is required to fully quantify the total number of non-compliant vehicles in the LEZ opening year of enforcement and the impacts any shift of non-compliant vehicles has

on congestion and air quality and at this stage of the NLEF appraisal, with the information available, both option variants are considered viable.

9.9.20 Option 3A and Option 3D are bound by similar priority and secondary routes and both are also considered viable options to be taken forward for detailed testing. Option 3D is shown in Figure 9.32.

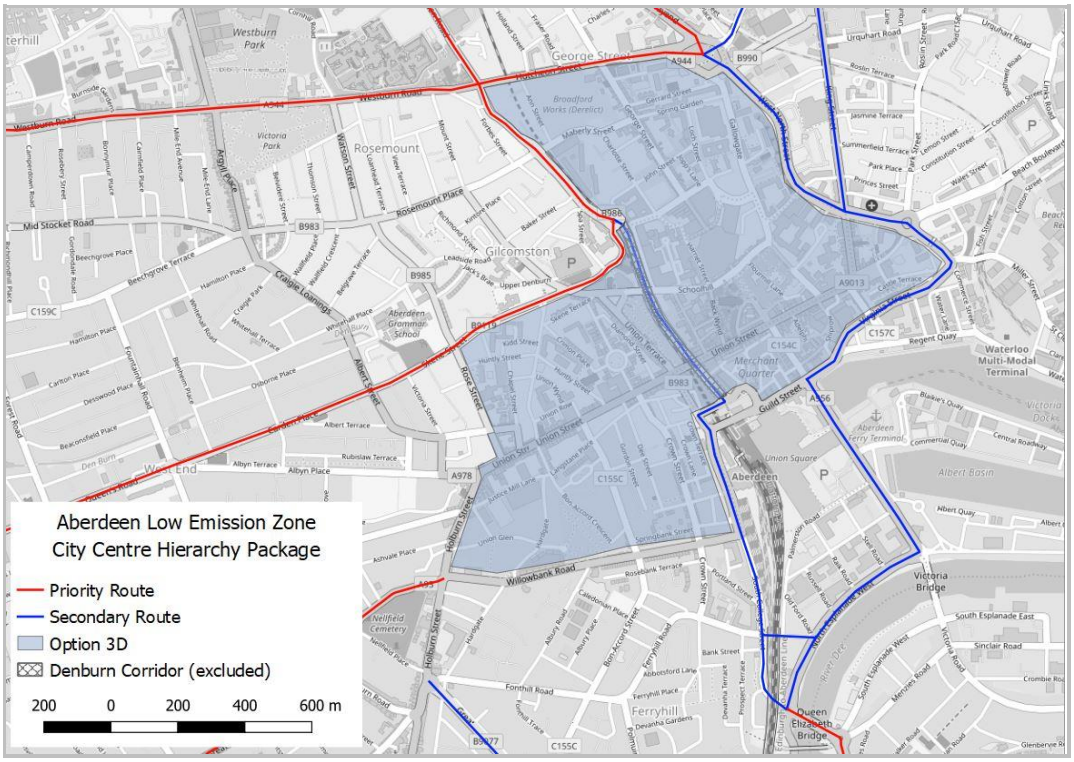

Figure 9.32 : Option 3D (excluding Denburn Road) and City Centre Hierarchy Package

9.9.21 Option 4 (A and D) and Option 5 (A and D) both extend their proposed LEZ boundaries to the east to include the proposed secondary route of Market Street/Virginia Street/Commerce Street/East and West North Street (Eastern Route), as shown in Figure 9.33 (4A), Figure 9.34 (4D), Figure 9.35(5A) and Figure 9.36 (5D).

Key Point: Option 4A and Option 5A include two key secondary routes (Denburn Road & the Eastern Route) and analysis of 2019 traffic data suggest there are currently over 15,000 non-compliant vehicle per day that could reroute to western secondary routes (and likely some adjacent minor routes). Although the total number of non-compliant vehicles is likely to be less than currently observed in the opening year of LEZ enforcement, there is still likely to be a high volume of rerouting non-compliant vehicles and it may therefore be considered unsuitable to progress an LEZ option that moves potentially thousands of non-compliant vehicles on to roads of a lower classification, with less capacity and likely closer proximity to residential properties.

9.9.22 Option 4D and Option 5D allows for non-compliant vehicle access to Denburn Road and as noted in the vehicle routeing analysis, the increased volume of non-compliant vehicles likely on Denburn Road and Skene Square (from the Eastern Route) may lead to an exceedance of the air quality standards on Skene Square where there are two monitoring locations that currently (2018 data) have annual mean NO_2 levels close to 40 µg/m^3. The new Roads Hierarchy proposes Skene Square is classed as a Priority Route following the completion of Berryden Corridor improvements (Section 3.4) and this is likely to impact traffic flow and volumes on Denburn Road and Skene Square and therefore Option 4D and Option 5D (excluding Denburn Road) cannot be excluded at this stage until full modelling of the LEZ options with this, and other road improvements schemes.

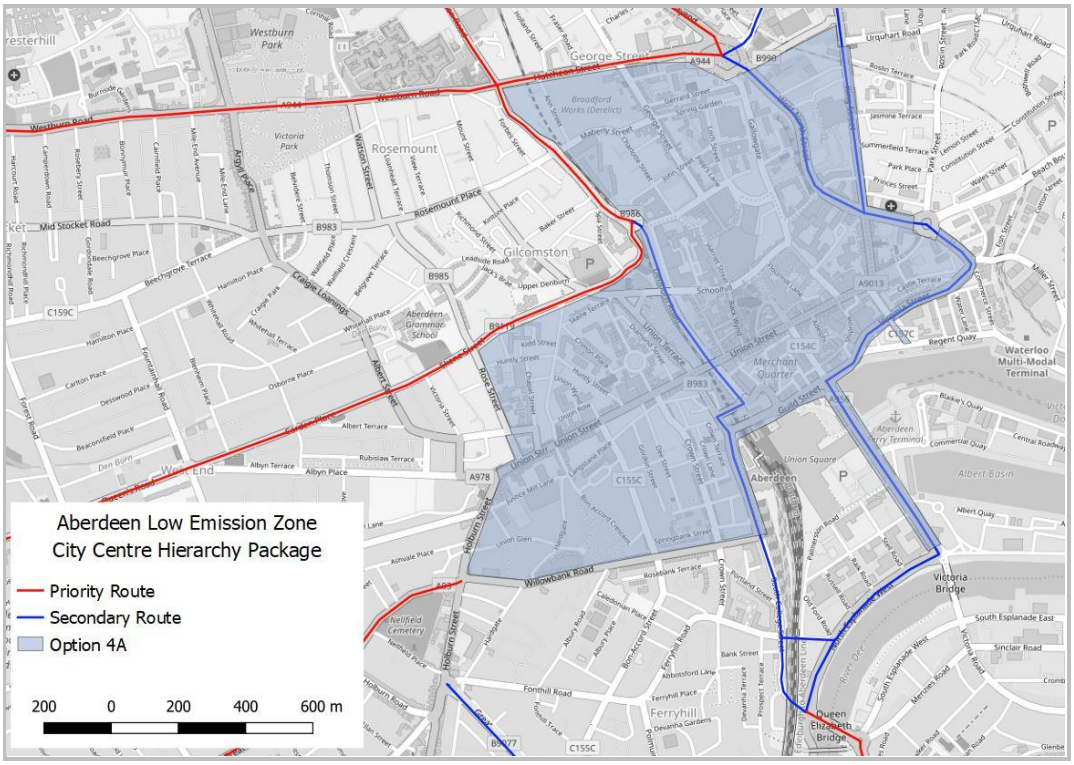

Figure 9.33 : Option 4A (including Denburn Road) and City Centre Hierarchy Package

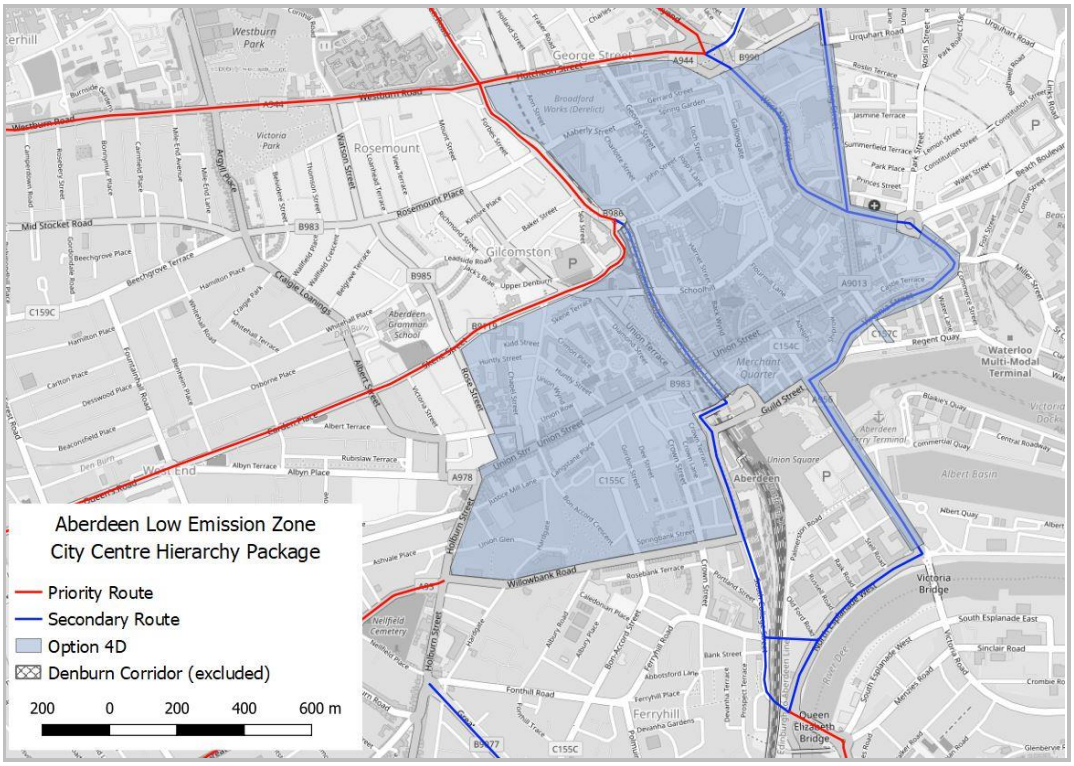

Figure 9.34 : Option 4D (excluding Denburn Road) and City Centre Hierarchy Package

9.9.23 Option 5 variants also extend south to include the forthcoming South College Street improvement scheme, linking South College Street and North Esplanade West. The new Roads Hierarchy proposes the priority route from the south extends to the new junction on North Esplanade West and therefore it is considered appropriate to adjust the area of Option 5 such that it bounds the new link between the two key routes, as reflected in Figure 9.35(5A) and Figure 9.36 (5D) below.

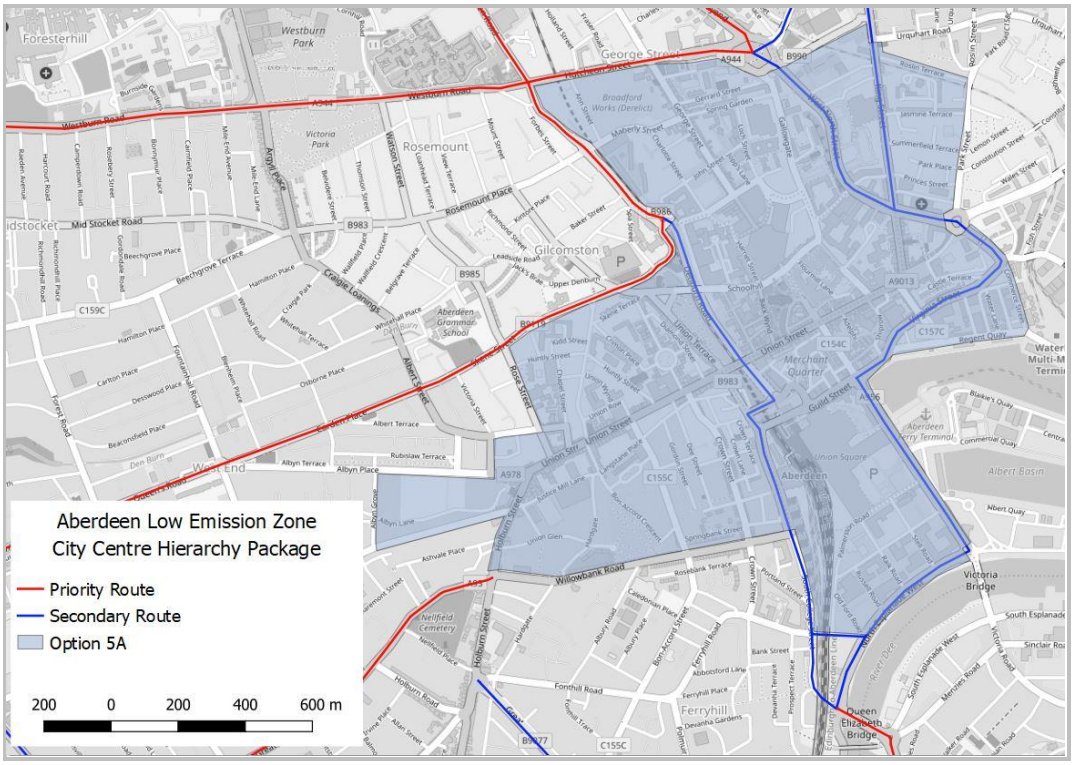

Figure 9.35 : Option 5A (including Denburn Road) and City Centre Hierarchy Package

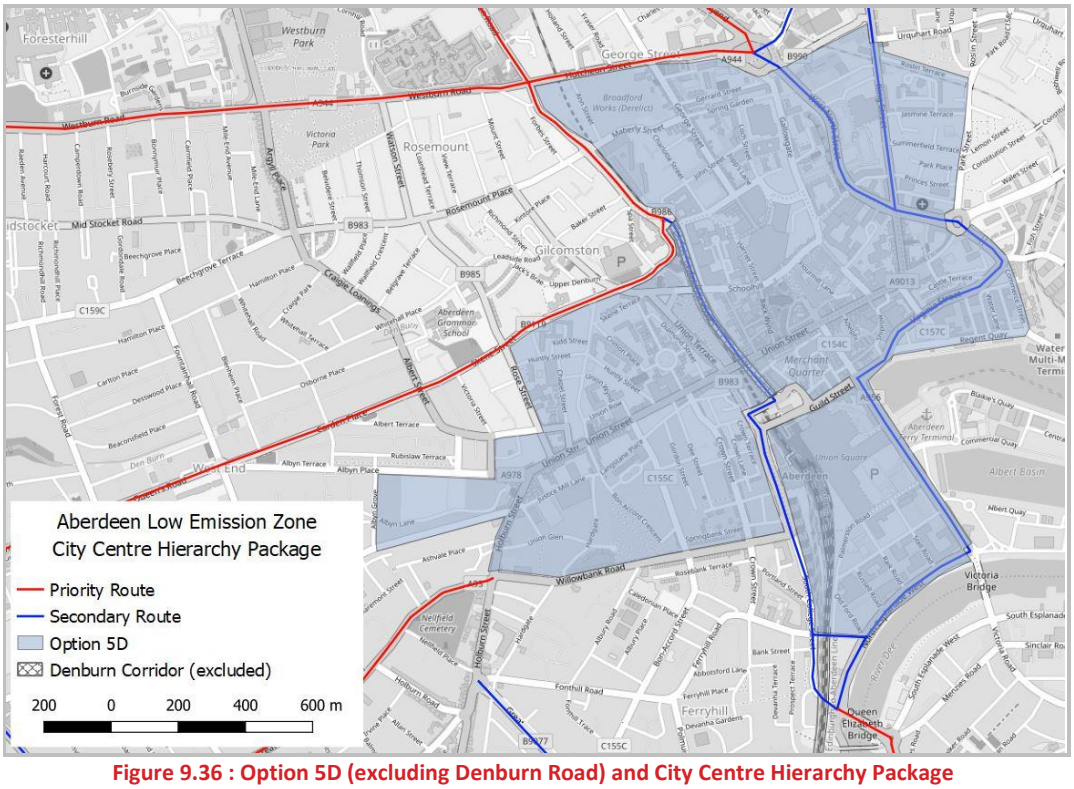

Figure 9.36 : Option 5D (excluding Denburn Road) and City Centre Hierarchy Package

Key Point: All LEZ options are bound by a number of tertiary or unclassified routes such as Willowbank Road and Rose Street. Analysis should be undertaken to quantify the impact of any non-compliant vehicles choosing to route around the LEZ area by utilising these and other tertiary routes. If traffic and air quality modelling shows there to be a high number non-compliant vehicles on these routes, this will likely have to mitigated against using the LEZ signing strategy or possible physical interventions.

9.10 Summary of LEZ Options

9.10.1 The appraisal of the five LEZ options has identified a number of possible variants and as the appraisal has progressed, some of these variants have been shown to be unsuitable while additional variants have been identified. Table 9.6 in Section 9.5 summarised the identified option variants (Option 2A/B/C to Option 5 A/B/C) resulting from the key strategic routeing analysis. Further appraisal of these options against existing ACC strategies has shown some variants do not compliment these strategies and further variants were identified that better align with the CCMP, SUMP and the proposed roads hierarchy changes. All LEZ option variants identified thus far and an indicator of each option to be progressed in the appraisal process is shown in Table 9.16

Table 9.16 : LEZ Option Variants

Option	Option Description	Variant	Variant Description	Option Progressed?
Option 1A	Union Street Area (bus only)	Excludes bus station	Includes Guild Street and bus station exit to Guild Street	Yes
Option 1C		Includes bus station	Includes Guild Street, Market Street and bus station (including both accesses)	Yes
Option 2A	Union Street Area (all vehicle)	Includes Denburn Road	No access for non-compliant vehicles	Yes
Option 2B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	No
Option 2C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access	No
Option 2D		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	Yes
Option 3A	Union Street & George Street Area	Includes Denburn Road	No access for non-compliant vehicles	Yes
Option 3B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	No
Option 3C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access	No
Option 3D		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	Yes
Option 4A	City Centre Air Quality Exceedance Area	Includes Denburn Road	No access for non-compliant vehicles	Yes
Option 4B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	No
Option 4C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access	No
Option 4D		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	Yes
Option 5A	City Centre Masterplan Area	Includes Denburn Road	No access for non-compliant vehicles	Yes
Option 5B		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	No
Option 5C		Partially excludes Denburn Road	Full NB & partial SB access for non-compliant vehicles. Opportunity for junction re-design to allow full SB access	No
Option 5D		Excludes Denburn Road	Full NB & SB access for non-compliant vehicles	Yes

9.10.2 The remaining LEZ options at this stage of the appraisal process can be summarised as follows:

- Option 1 – two variants of the bus only option
  - Variant A excludes the bus station, but includes the exit to Guild Street
  - Variant B includes the entire bus station and both access on Guild Street and Market Street.
- Options 2 – 5 – two variants of the all vehicle options
  - Variant A includes Denburn Road and therefore does not allow access to Denburn Road for non-compliant vehicles
  - Variant B excluded Denburn Road and allows full access to Denburn Road for compliant and non-compliant vehicles

9.11 Appraisal Against Low Emission Zone Objectives

9.11.1 As detailed in Chapter 7, there are two key objectives for Aberdeen's Low Emission Zone as follows:

- Improve air quality in Aberdeen by reducing harmful emissions from transport and delivering on the Scottish Government's statutory air quality objectives.
- Support climate change targets by reducing road transport's contribution to emissions.

9.11.2 In recognition that a LEZ can help realise wider benefits beyond air quality improvement, three supplementary objectives for Aberdeen's Low Emission Zone have been identified:

- Protect public health and wellbeing;
- Support local and regional transport strategies by contributing to the development of a vibrant, accessible, and safe city centre, where the volume of non-essential traffic is minimised and active and sustainable transport movements are prioritised; and
- Contribute to ongoing transformational change in Aberdeen, helping promote the city as a desirable place to live, visit and invest in.

9.11.3 NLEF is objective-led and consistent with the principles of STAG and therefore a qualitative appraisal of the LEZ options against the key LEZ objectives is undertaken using the seven-point assessment scale. If a LEZ option does not satisfy the LEZ objectives for Aberdeen's LEZ they are removed from the appraisal process and not recommended for detailed testing

9.11.4 The results of this assessment are shown in Table 9.17 with the justification described below. Table 9.17 shows all the all vehicle LEZ options (Option 2 to 5) score positively against the LEZ objectives. Option 1, the bus only option scores positively on the two key objectives (1 and 2) and objective 3, to protect public health and wellbeing. It is shown however, to score neither positively or negatively against objectives 4 and 5, as described below.

Table 9.17 : Option appraisal against all LEZ objectives

Option No.	LEZ Area	Aberdeen LEZ Objective				
		1	2	3	4	5
1A/B	Union Street Area (bus only)	++	+	+	0	0
2A/D	Union Street Area (all vehicles)	++	+	+	+	+
3A/D	Union Street & George Street Area	++	+	+	+	+
4A/D	City Centre Air Quality Exceedance Area	++	+	+	+	+
5A/D	City Centre Masterplan Area	++	+	+	+	+

Objective 1: Improve air quality in Aberdeen by reducing harmful emissions from transport and delivering on the Scottish Government's statutory air quality objectives

9.11.5 Section 9.2 (bus only) and Section 9.3 (all vehicle) detail the expected reductions in NO_2 provided by each option, as inferred by the NMF high level scenario results. The NMF results show that the inclusion of buses in a LEZ for Aberdeen would bring the single largest benefit to air quality but there would still be areas of exceedance within the city. In the all vehicle options, the NMF predicts there to be a further reduction in levels of NO_2 but again there will be a number of locations where the annual mean levels of NO_2 will exceed the legal limit of 40 µg/m^3.

9.11.6 As a bus only option, Option 1 was devised to capture all bus services operating in the city and as a service is required to be compliant to enter the LEZ area, the benefit in reduced emissions from each vehicle will be seen across the entire bus network as each bus travels

along its timetabled route. That the option does not encompass all exceedance locations therefore is not the critical factor in defining the bus only option area but rather that the area captures all bus services, which Option 1 is shown to do. For these reasons, Option 1 scores positively against Objective 1.

9.11.7 Option 2 and Option 3 do not encompass all exceedance locations while Option 4 and Option 5 capture all exceedance locations. Although the NMF predicts a greater reduction in NO_2 levels in both Option 4 and Option 5 by approximately 4% the NMF analysis (Chapter 5) concludes that all options will bring similar improvements to NO_2 and is are therefore given a consistent positive score against Objective 1 for Aberdeen's LEZ.

9.11.8 As noted throughout the detailed appraisal, it is recognised that additional traffic management interventions will be required to be delivered with a LEZ in Aberdeen to ensure all of the Scottish Government's statutory air quality objectives are met. Detailed modelling will ensure that these interventions are targeted to address existing air quality exceedance locations and that the introduction of a LEZ, and associated measures, do not adversely create additional areas of exceedance.

Objective 2: Support climate change targets by reducing road transport's contribution to emissions

9.11.9 Transport is the UK's largest emitter of greenhouse gases and the introduction of a LEZ in Aberdeen may contribute towards an increase in the number of low-emission vehicles or encourage additional modal shift towards active travel and public transport in Aberdeen and the wider Aberdeenshire area. This increase in lower emission vehicles is likely to increase as years progress and drivers replace their vehicles. A LEZ will restrict the number of the higher emitting non-compliant vehicles from its boundary and may also influence behavioural changes in the wider driving population. It is considered therefore that all LEZ options will, by their nature, reduce the contribution of road transport to emissions.

9.11.10 While the introduction of a LEZ in Aberdeen will help create a more modern cleaner bus fleet and a more attractive city to walk and cycle in with lower pollution levels, as concluded in the NMF analysis (Chapter 5), the combination of a LEZ with CCMP and SUMP interventions and planned improvements to the bus network infrastructure, including wider studies addressing key city bus and cycle corridors, is likely to help promote greater usage of sustainable modes of transport.

9.11.11 The LEZ is one measure that will contribute to the wider effort of ACC to increase efficiency of the transport system thereby reducing transport's contribution to emissions and is it considered that all LEZ options score positively against Objective 2 of Aberdeen's LEZ.

Complementary Objectives

9.11.12 Each option is shown to reduce emissions in Aberdeen, including those locations where exceedance are likely to remain. A LEZ delivered with additional traffic management measures will likely further reduce the level of emissions in the city.

9.11.13 All LEZ options will proportionately increase the number of lower emitting vehicles in the city centre and contribute to a positive change to Aberdeen's environment. This is particularly true of the city centre where there is high pedestrian activity and where buses may dwell at bus stops for longer or wait at signal controlled junctions with their engines running. These factors may contribute to a city where walking and cycling is considered a more attractive mode of transport and an increase in active travel choices may result from these options. Additionally, a bus fleet that contains more modern vehicles that are likely to be more comfortable to travel on and have better facilities may promote a shift to this more sustainable travel mode, reducing the number of private vehicles on the road

network and contributing to an overall improved environment that may in turn incentivise more active and sustainable travel choices.

9.11.14 It is considered therefore that all LEZ options will contribute positively towards the LEZ satisfying Objective 3, to protect public health and wellbeing.

9.11.15 Each all vehicle LEZ option is shown to be compatible with the key ACC strategies (CCMP, SUMP and Roads Hierarchy) and the additional indirect impacts of each LEZ option show a LEZ will contribute and support the wider transport strategies of ACC, thereby satisfying Objective 4 of Aberdeen's LEZ. A LEZ designed to complement these existing strategies will allow a LEZ to contribute to reducing the volume of non-essential traffic thereby helping Aberdeen become a safe, vibrant and accessible city centre.

9.11.16 As a bus only option, Option 1 was shown to compliment Aberdeen's CCMP where its boundary did not contradict the key public transport proposals in the policy. On its own however, a bus only LEZ is unlikely to contribute, either positively or negatively, to other key policies, such as the proposed changes to the roads hierarchy and reducing strategic trips through the city centre. Option 1 therefore scores neutrally against Objective 4.

9.11.17 Improvements to the wider Aberdeen environment realised from a LEZ alone, and in combination with other complementary measures, will contribute to making Aberdeen a more attractive place to live, study and visit and in the longer term, this may lead to the creation of jobs, services and investment that will drive an improved city economy for all. The improved environment and the "green tourist" may increase visitors to the city and continue its transformational change. In the short term, the all vehicle LEZ options that may change the trip choice of non-compliant private and commercial vehicles to Aberdeen, particularly the city centre, may initially be viewed as detrimental to the city economy and may reduce overall person trips to the city centre. While a reduction in non-compliant vehicles impacts positively on the environment and the attractiveness of the city, there may be a short term negative impact on the city economy and therefore creation of jobs and services. Throughout the lifetime of the LEZ however it is anticipated that each LEZ option will positively impact on the city's health and wellbeing, help develop a vibrant, accessible, and safe city centre and contribute to ongoing transformational change in Aberdeen. It is considered therefore that the all vehicle LEZ options will contribute positively towards the LEZ satisfying Objective 5.

9.11.18 While a bus only LEZ, Option 1, will bring forward an improved bus fleet for the city, it is unlikely to contribute, either positively or negatively, to a wider transformational change in Aberdeen and the option therefore scores neutrally against Objective 5.

9.12 Refinement of LEZ Options

9.12.1 The option appraisal in Sections 9.2 to 9.11 have informed the suitability of each LEZ option that emerged from the high level option generation exercise detailed in Chapter 8. This has led to a number of option variants being considered and a several key observations can be made to refine the proposed option list before presenting the recommended options for consultation and modelling.

9.12.2 Option 1, the bus only LEZ, and Option 2, an all vehicle LEZ, cover approximately the same geographical area with slight distinctions accounting for the identified option variants and after detailed appraisal, both are considered to be workable LEZ options. In the appraisal of these options against the LEZ objectives however, Option 1 is not considered to fully satisfy all objectives. As noted in the appraisal of the LEZ options against the LEZ objectives, any option that fails to fully satisfy all objectives should be removed from further appraisal and detailed testing. Option 1, and its variants, are therefore removed from the appraisal process at this stage.

9.12.3 It is important to note that all remaining all vehicle options could, in theory, operate as a bus only LEZ if required, perhaps as part of a phased introduction of any LEZ. The removal of the single bus only option therefore does not necessarily preclude the possibility of Aberdeen introducing a bus only LEZ if desired. It is also possible that any option could be adjusted further to ensure the bus station is included or excluded from a final LEZ area, with all remaining options either bordering the bus station or encompassing it fully. Consultation with bus operators will be required to provide further information on any desire to include or exclude the bus station from the final LEZ option.

9.12.4 In defining the boundary of the all vehicle LEZ options, it was apparent that each option could include or exclude Denburn Road. Analysis of existing traffic data showed there are currently between 3000 and 4000 non-compliant vehicles on Denburn Road. While the number of non-compliant vehicles on the road network is likely to reduce by the opening year of a LEZ, it is assumed that of the non-compliant vehicles that remain on the road network many would reroute via East & West North Street/Commerce Street/Virginia Street, with some likely to route to the west via Holburn Street, if Denburn Road is included in the LEZ.

9.12.5 In Option 2 and Option 3, the Eastern Route (East & West North Street/Commerce Street/Virginia Street/Market Street) is not included in the option boundary and it remains a feasible alternative route for any non-compliant vehicles and therefore both option variants for Options 2 and 3 are considered viable.

9.12.6 Option 4 and Option 5 encompass the Eastern Route and therefore non-compliant vehicles from Denburn Road would also not be permitted to route via this route. Analysis of 2019 traffic data shows there to be currently between 3,000 and 9,000 non-compliant vehicles on the Eastern Route and any remaining non-compliant vehicles at the time of LEZ enforcement would be required to reroute to an alternative route further west. If access to the Denburn Road corridor is not available for non-compliant vehicles it is possible that the alternative routes to the west would not operate satisfactorily and be liable to increases in congestion and emissions. The Roads Hierarchy package recommended that the western corridors be downgraded in priority and no longer be considered priority or secondary routes. If Option 4A and 5A (including Denburn Road) result in a large number of non-compliant vehicles shifting to these western routes the options may not be considered compatible with this key ACC strategy. Despite this possibility, both Option 4A and Option 5A are recommended to progress to detailed testing to quantify the level of any rerouting of these LEZ options that effectively restrict the north-south movement of non-compliant vehicles across the city.

9.12.7 As noted in the air quality analysis, existing levels of NO_2 on the Denburn Road corridor at Skene Square suggest any large increase in non-compliant vehicles would likely result in new exceedances in NO_2 on the corridor. While excluding Denburn Road from Option 4D and Option 5D and allowing non-compliant vehicles from the Eastern Route to utilise the corridor may result in an increase in vehicle emissions on the corridor, these options cannot be removed at this stage until full modelling is undertaken. The opening of the Berryden Corridor improvements (Section 3.4) is also likely to impact traffic flow and volumes on Denburn Road and Skene Square and therefore to fully quantify any rerouting and understand the impact of such road improvements schemes, detailed traffic and air quality modelling is required. Option 4D and Option 5D therefore remain as options to be progressed for further appraisal and testing.

9.12.8 The option appraisal suggest that Option 4 and Option 5 are likely to have similar impacts on the local road network and air quality. As noted, Option 4 and Option 5 include the key Eastern Route, however this means that there is no option that captures the air quality exceedances on the Eastern Route while providing full access to Aberdeen Harbour (from Market Street) and Union Square, two key land uses in the city centre area. The southern extend of Option 4 is to the junction of Market Street/North Esplanade West/Victoria

Bridge. Here, the junction would require reconfiguration to operate as a viable LEZ as it currently operates as left turn only from North Esplanade West, meaning non-compliant vehicles would be forced into the LEZ without the final opportunity to route away and avoid penalty (a key consideration of any LEZ). While junction reconfiguration is possible, given the similar impacts and coverage of Option 5, it is proposed that the southern boundary of Option 4 is altered such that it extends only to the junction of Market Street/Commercial Quay/Union Square. This would significantly differentiate Option 4 from Option 5 and offer an option that provides access for non-compliant vehicles to Aberdeen Harbour and Union Square.

9.12.9 When assessing the access to Aberdeen Harbour, it was noted that Option 5, by following the CCMP boundary, also does not allow access for non-compliant vehicles to the Aberdeen Harbour area around Regent Quay, south of Virginia Street. Conversely, Option 4 does allow full access to the Regent Quay area but the boundary, following the route of Virginia Street, means that there is a risk non-compliant vehicles could be penalised by entering the LEZ without a viable opportunity to avoid the area. For Option 4, further analysis and consultation would be required to provide access to businesses in the Aberdeen Harbour area but restrict movements of non-compliant vehicles to/from Virginia Street itself to prevent inadvertent penalisation.

9.12.10 With the updated boundaries for Option 4 and Option 5 (both variants) it can be summarised that Option 4 provides access for non-compliant vehicles to Aberdeen Harbour while Option 5 does not. Both options do not impact the accessibility of compliant vehicles to Aberdeen Harbour.

9.12.11 The updated LEZ options after the above refinement considerations are presented in detail in Chapter 10.

10. RECOMMENDED LEZ OPTIONS

10.1 LEZ Options for consultation and detailed model testing

10.1.1 The NLEF Appraisal recommends that four main LEZ options be taken to wider consultation and detailed model testing undertaken using the NMF air quality model and the Paramics microsimulation traffic model.

10.1.2 The analysis demonstrated that from these four options there are two possible variants to each option. To provide a concise and understandable list for detailed testing and subsequent consultation, the LEZ option numbering is reset and are as follows:

- Option 1A – Union Street Area, including Denburn Rd (Figure 10.1)
- Option 1B – Union Street Area, excluding Denburn Rd (Figure 10.2)
- Option 2A – Union Street & George Street Area, including Denburn Rd (Figure 10.3)
- Option 2B – Union Street & George Street Area, excluding Denburn Rd (Figure 10.4)
- Option 3A – CCMP East including Denburn Rd (Figure 10.5)
- Option 3B – CCMP East excluding Denburn Road (Figure 10.6)
- Option 4A – CCMP, including Denburn Rd (Figure 10.7)
- Option 4B – CCMP, excluding Denburn Rd (Figure 10.8)

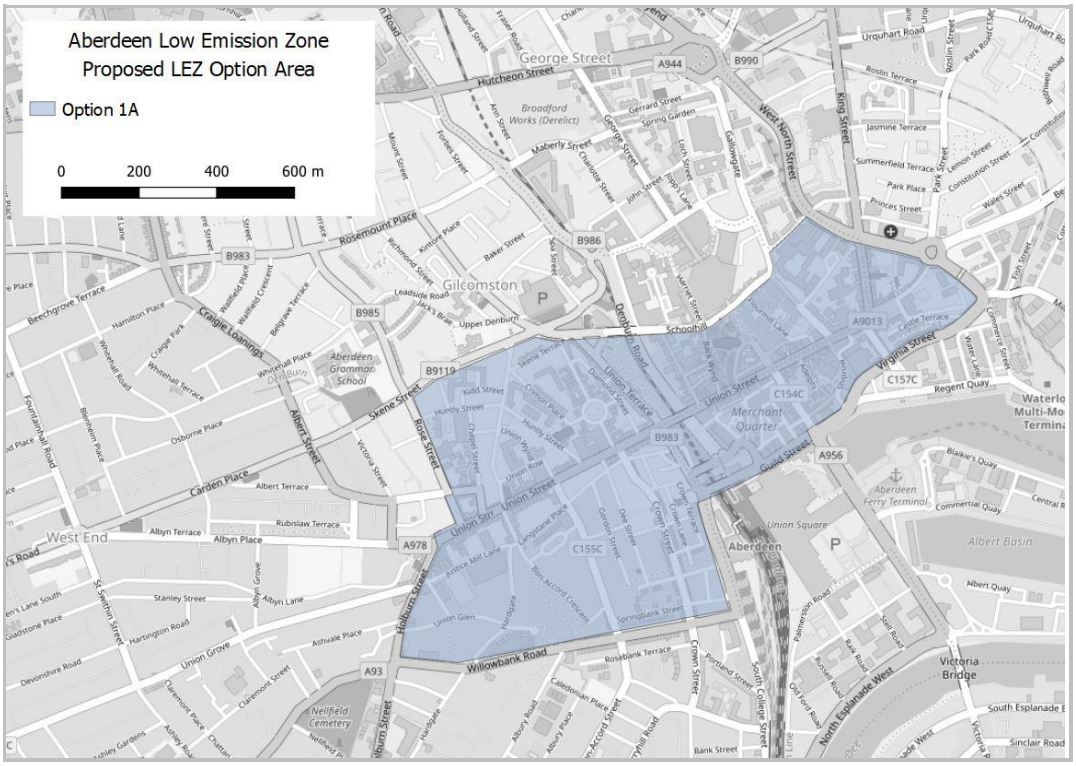

Figure 10.1 : Option 1A – Union Street Area, including Denburn Road

Figure 10.2 : Option 1B – Union Street Area, excluding Denburn Road

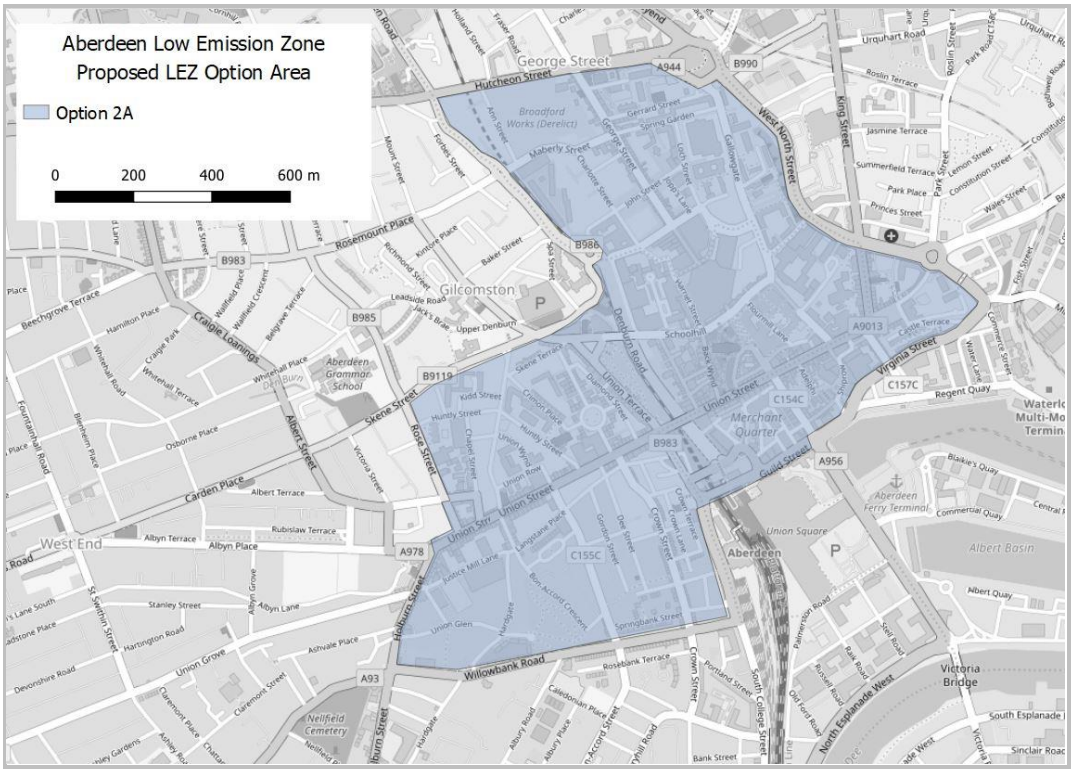

Figure 10.3 : Option 2A – Union Street and George Street Area, including Denburn Road

Figure 10.4 : Option 2B – Union Street and George Street Area, excluding Denburn Road

Figure 10.5 : Option 3A – City Centre Masterplan East, including Denburn Road

Figure 10.6 : Option 3B – City Centre Masterplan East, excluding Denburn Road

Figure 10.7 : Option 4A – City Centre Masterplan, including Denburn Road

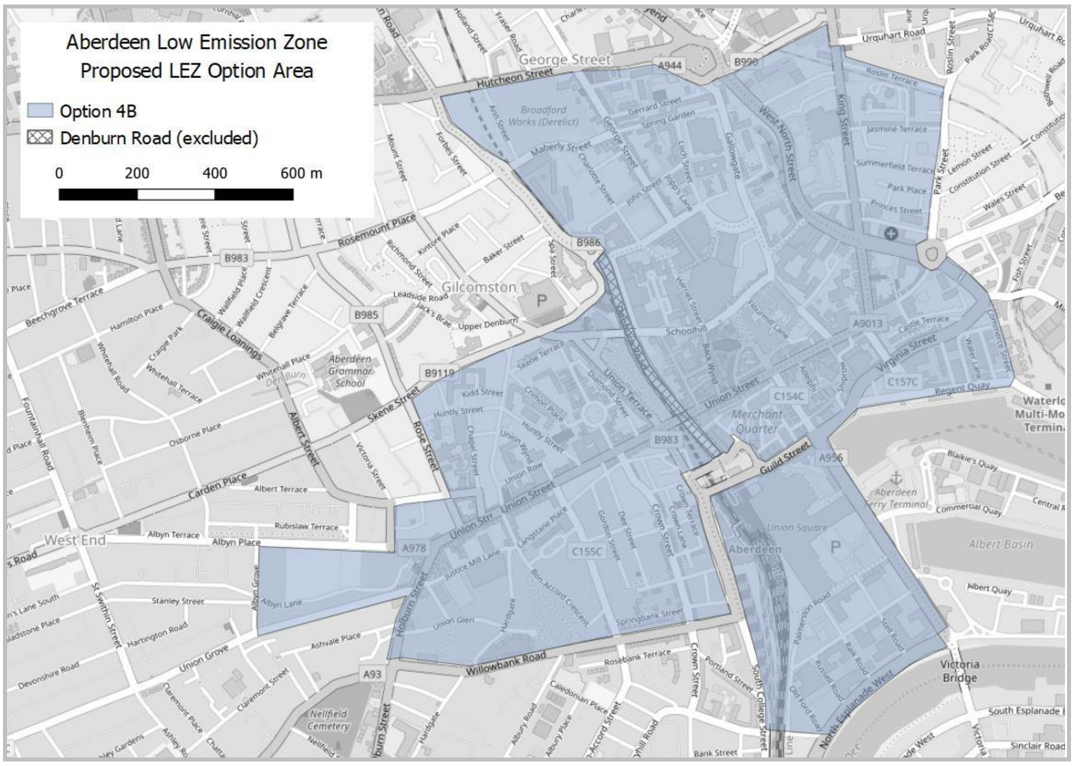

Figure 10.8 : Option 4B – City Centre Masterplan, excluding Denburn Road

11. LEZ PUBLIC AND STAKEHOLDER ENGAGEMENT

11.1 Introduction

11.1.1 Upon completion of the Interim NLEF Stage 2 Assessment Report (*Aberdeen Low Emission Zone, National Low Emission Framework Interim Stage 2 Report, SYSTRA 2020)* ACC undertook a consultation exercise on the eight identified LEZ Options, as detailed in Chapter 10. The consultation took the form of an online public survey and online workshops with key (and statutory) stakeholders. The outcomes from the consultation period are reported in the City Growth and Resources Committee Report, June 2021 and summarised here.

11.1.2 The LEZ Options presented for consultation were:

- Option 1A – Union Street Area, including Denburn Rd (Figure 10.1)
- Option 1B – Union Street Area, excluding Denburn Rd (Figure 10.2)
- Option 2A – Union Street & George Street Area, including Denburn Rd (Figure 10.3)
- Option 2B – Union Street & George Street Area, excluding Denburn Rd (Figure 10.4)
- Option 3A – CCMP East including Denburn Rd (Figure 10.5)
- Option 3B – CCMP East excluding Denburn Road (Figure 10.6)
- Option 4A – CCMP, including Denburn Rd (Figure 10.7)
- Option 4B – CCMP, excluding Denburn Rd (Figure 10.8)

11.2 Public Consultation

11.2.1 An online public survey ran for six weeks from 14 September 2020 to 25 October 2020 and was administered by ACC. Consultation responses were also accepted by email to the Council's Transport Strategy address.

11.2.2 The survey received 506 responses with a further 10 received by email. Of the 506 responses received, 488 (96.5%) were from individuals, 18 (3.6%) were from businesses

11.2.3 Those organisations responding to the online questionnaire were:

- First Aberdeen Limited
- Stagecoach Bluebird
- Blacks of Brechin
- Royal Mail Group
- Road Haulage Association
- The Shore Porters Society
- Leiths (Scotland) Ltd
- Scottish Enterprise
- City Gate Aberdeen Ltd.
- HEAT (no further information provided)
- Friends of the Earth Scotland
- Asthma UK and British Lung Foundation Partnership
- British Heart Foundation Scotland
- Electric Vehicle Association Scotland
- Low Carbon Vehicle Partnership
- Rosemount and Mile End Community Council
- Cults, Bieldside and Milltimber Community Council
- Paths for All

11.2.4 The majority of respondents (77.9%) were regular car drivers in the city centre, with 46.4% walking in the city centre, and 32.8% using the bus to access the city centre. Smaller proportions were noted for cycling (20.8%), the train (12.5%), taxi (9.1%), motorcycle

(5.9%) and van (3.4%). Users of all main modes of transport in the city centre were therefore represented in the survey results.

11.2.5 The survey included questions seeking to discover respondents' views on LEZs in general and:

- 48.4% of respondents supported the general principle of LEZs
- 40.9% were not in favour of LEZs
- 10.3% were unsure

11.2.6 Specifically asked about the introduction of a LEZ in Aberdeen to address air quality problems in the city, 43.9% of respondents were supportive of a LEZ and 42.6% were not supportive of a LEZ in the city.

11.2.7 In terms of those who responded in support of LEZs, main themes were:

- Recognition of the beneficial health impacts
- Recognition of the environmental benefits
- Appreciation that LEZs can contribute to improved quality of places and quality of life
- Appreciation that LEZs can improve the city centre
- Recognition that LEZs can have wider benefits in terms of encouraging more sustainable transport choices
- Evidence from elsewhere testifying to the success of LEZs

11.2.8 In terms of those expressing concern about, or objections to, a LEZ, the main issues raised related to:

- The impacts on individuals, particularly the financial implications, especially given that the impacts of the COVID-19 pandemic may be felt for some time;
- Concerns that the less affluent members of society will be disproportionately impacted
- Concerns about the impacts on the disabled if not granted exemption from the LEZ
- Concerns about the impacts of proposals on the future health and prosperity of the city centre
- Concern that the LEZ could simply move traffic, and resulting congestion and emissions, elsewhere
- Concern about the current scope of the LEZ, whether it was correct to address all vehicle types, whether the emissions standards being proposed are justified and whether the impacts of the harbour should be considered
- A perception that this is simply a revenue-generating scheme
- Scepticism that the problem in Aberdeen is such that these measures are required

11.2.9 Respondents were asked specifically about their views on the eight LEZ options defined in the Interim NLEF Stage 2 Report. Firstly, they were asked to provide their views on the advantages and disadvantages of each option before being asked to rank each option in order of preference.

11.2.10 Considering the options identified by respondents as their preferred option, there was a clear preference for the options at the extreme ends of the scale, with Option 4A (22%) receiving the most preferred option votes overall, followed by Option 1A (19%). Combining all the rankings given in each response, the smallest option, Option 1A emerged as the most popular and Option 4B the least popular.

11.2.11 Respondents were asked what they thought were appropriate grace periods for residents and non-residents. The maximum allowable grace periods were the most popular (45% for residents and 47% for non-residents) although there is significant support for the minimum grace period (19% for residents and 34% for non-residents).

11.2.12 Asked to provide further responses in an open question, a strong theme to emerge in the public consultation was that a LEZ must not be delivered in isolation but must be supported by complementary measures to ensure it achieves its objectives and maximises the benefits. Measures identified include:

- Improving the public transport offering and park and ride opportunities;
- Improving active travel routes;
- Increasing car parking opportunities around the zone;
- Increasing electric vehicle charging opportunities;
- Improving roads around the zone;
- Working with businesses to further improve the city centre; and
- Financial support for vehicle upgrades.

11.2.13 Email responses were received from the following:

- Aberdeen Cycle Forum;
- Aberdeen Friends of the Earth;
- Enterprise Holdings;
- Federation of Small Businesses;
- Hammerson;
- Logistics UK;
- Robert Gordons College;
- UPS;
- A group of MSPs representing the Orkney and Shetland islands;
- One individual.

11.2.14 The main points raised by email respondents match closely those raised within the online survey. These include:

- The need for a LEZ to be integrated with other improvements, such as general traffic reduction measures, an improved sustainable transport offering and Mobility as a Service (MaaS);
- Concerns about the economic implications, particularly for city centre businesses;
- Concerns about the accessibility of key sites for non-compliant vehicles;
- Concerns about the impact on those travelling to Aberdeen from Orkney and Shetland who have no option but to arrive and depart from the ferry terminal;
- Concerns about the displacement of traffic and emissions;
- Concerns that the impacts of AWPR and COVID are not reflected in the modelling undertaken to date;
- Concerns that the impacts of shipping emissions are not being considered;
- A split between those who feel that proposals do not go far enough in scope and ambition, and those who believe the LEZ should be as small as possible;

11.3 Stakeholder Consultation

11.3.1 A range of workshops with key stakeholders were held concurrently with the live public survey dates during September and October 2020. Five workshops were held in total and the format involved a presentation by a member of the Aberdeen LEZ Delivery Group on the Interim NLEF Stage 2 Report findings and the recommended LEZ options, followed by a questions and answer session. The stakeholders represented at the workshops were as follows:

- Bus industry representatives:
  - Stagecoach East Scotland, First Bus, Bains Coaches and the Confederation of Passenger Transport (CPT)
- Local freight industry representatives
- Aberdeen Harbour

- Community Councils:
  - George Street, Rosemount and Mile End, Castlehill and Pittodrie
- Environmental/interest groups
  - Friends of the Earth, Aberdeen Cycle Forum, Asthma UK and British Lung Foundation Partnership, Aberdeen Environment Forum
- Taxi representatives

11.3.2 No business representatives attended the planned business workshops, despite several attempts to contact business groups and their members. This was considered likely a result of the current impact the Covid-19 pandemic is having on businesses. ACC recognise the importance of the business community and a further business workshop was organised for April 2021 (as part of the focussed Covid-19 consultation in Section 11.4 below), where representatives from Union Square shopping centre and Aberdeen & Grampian Chamber of Commerce attended.

11.3.3 The City Growth and Resources Committee Report summarises the outcomes from each individual workshop, with the key themes noted across all workshops as follows:

- No stakeholder expressed views against the LEZ. Some stakeholders made the point of expressing support for a LEZ while others stated they were accepting that a LEZ was to be introduced
- The LEZ should not create problems elsewhere in the city, whether this is new air quality exceedances or increased congestion. If required, the LEZ should be delivered with complementary measures to ensure this does not happen.
- Grace periods, particularly for residents of the LEZ and those on a lower income/income support, should be as long as possible.
- Exemptions are needed for certain vehicles (mobility vehicles, vintage vehicles etc.)
- Bus and coach operators are in a very difficult financial position due to the impact of Covid-19 and will not be able to ensure all vehicles meet LEZ standards if current level of income continues. There is a need for a collective understanding of the difficulties faced by the industry when deciding on the date and impact of the implementation and enforcement of the LEZ.
- The majority of HGVs will be compliant by 2022, 7/8 year cycle on vehicles (i.e. based on 7 years from 2015 (Euro VI introduction)).
- The LEZ should not be implemented in isolation and needs to be part of a wider delivery programme for the city

11.4 Focussed Covid-19 Consultation

11.4.1 In response to the Covid-19 pandemic the national LEZ Leadership Group announced in May 2020 a temporary pause in plans to implement LEZs across Scotland. Plans were formally resumed in August 2020 and a new indicative timescale for the introduction of LEZs was published, that aims to see their introduction between February and May 2022.

11.4.2 It is recognised that the Covid-19 pandemic has had an unprecedented impact on society, including on the wider environment and the economy. Transport Scotland and ACC recognise that the Covid-19 pandemic may significantly influence future travel demand and in turn emissions attributed to road transport. Transport Scotland commissioned a study to consider the uncertainty over what travel will look like after the Covid-19 pandemic has ended, and this is summarised in Chapter 14.

11.4.3 In light of the difficulties faced by many throughout 2020 and 2021, particularly, in the context of a Aberdeen city centre LEZ, city businesses and bus operators, ACC were keen to understand the level of support for the introduction of a LEZ in the city post pandemic and gauge the impact the pandemic may have had on businesses and bus operators in preparing for its introduction.

11.4.4 ACC have consulted with bus operators in the city regularly throughout the LEZ process and have kept them up to date with ongoing proposals for the city's LEZ. Given the importance of bus compliance to the success of any LEZ, the operators (First Bus, Stagecoach and Bains Coaches) were approached in March 2021 and asked to complete a short questionnaire, comprising the following questions:

- What would LEZ enforcement in 2023 mean for your organisation and operations in Aberdeen?
- What will your level of fleet compliance to Euro VI standards be in 2023?
- Will you have to reduce services to meet a 2023 LEZ enforcement date?
- Would applying an additional year grace period before enforcement (to 2024) provide the opportunity for your full Aberdeen fleet to meet the required LEZ standards?
- What are your views on other vehicles being included in the LEZ and if they are included what length should the grace period be?

11.4.5 Key findings from the bus operator questionnaire were:

- The two main operators (First and Stagecoach) confirmed their full bus fleet entering the proposed LEZ area will not be Euro VI compliant by the end of the 2023 minimum grace period under current investment plans
- The impacts from the pandemic on passenger numbers is significantly hampering the ability to invest in new vehicles (and therefore meet compliance levels by 2023)
- The early enforcement of a LEZ may result in a reduction in services or a rerouting of services away from the LEZ area
- Any additional grace period (from the minimum of 2023) would allow time to plan fleet investment to meet LEZ requirements
- Private cars must be included to ensure the bus is not unfairly penalised
- Any grace period should be the same for all vehicles

11.4.6 If bus operators need to reduce or reroute services as a direct result of the LEZ, the city centre may become inaccessible to some city residents that depend on bus services to access the city. For those accessing the city who have a choice between bus or car access, service changes may push more to using private cars.

11.4.7 The business community has been significantly impacted by the Covid-19 pandemic, with many shops and services required to close or provide reduced service due to Government restrictions. As noted above, no business representatives attended the autumn 2020 workshops, and given the importance the business community to the implementation of any LEZ in the city, a further business workshop was organised for April 2021 where representatives from Union Square shopping centre and Aberdeen & Grampian Chamber of Commerce attended, with key themes captured in Section 11.3 above.

11.5 Scotland Wide Consultation

11.5.1 In 2017, Transport Scotland facilitated a public consultation, *Building Scotland's Low Emission Zones*, to inform development of the Transport (Scotland) Act 2019 and the draft National Low Emissions Framework (NLEF). In total, 967 responses were received (Consult.gov.scot) and key findings are published on the Low Emission Zone Scotland website as follows:

- 95.5% supported the principle of low emission zones to help protect public health by improving air quality in Scotland
- 62.3% of respondents agreed with the proposed minimum mandatory Euro class specification for vehicle compliance
- 86.3% of respondents agreed that low emission zone exemptions should be consistent across all Scottish local authorities

11.5.2 Transport Scotland also facilitated the Scotland Low Emission Zone Consultation on Regulations and Guidance 2019-2020. It sought responses about key aspects of LEZ regulations and guidance, particularly emission standards, exemptions and penalty charges.

11.6 Statutory Consultation

11.6.1 As noted above, the statutory consultees include SEPA, NatureScot and Historic Environment Scotland. As part of the overarching NLEF process, a Strategic Environmental Assessment (SEA) is being undertaken in parallel to the NLEF option appraisal process (this Interim NLEF Stage 2 Report). Through the SEA, ACC are required to seek the views from these statutory consultees. Full details of this consultation will be included in the final SEA Environmental Report which will be summarised in the final NLEF Stage 2 Report.

11.7 Key Outcomes from Consultation of LEZ Options

11.7.1 The consultation showed that the introduction of a LEZ in Aberdeen is generally evenly supported and not supported, however the public responses do show an awareness of the potential benefits for the introduction of a LEZ in the city.

11.7.2 A consistent theme across the consultation exercises was the belief that the LEZ should be integrated with other improvements, such as general traffic reduction measures or an improved sustainable transport offering. Similarly there was recognition that the LEZ should not create new congestion or air quality problems in the city. Both these views were taken into consideration in the option development process and the subsequent traffic model analysis.

11.7.3 Bus operators have been significantly impacted by the Covid-19 pandemic and are not likely to be able to suitably invest in their fleets to meet a 2023 enforcement date. A 2024 enforcement date or later would provide more a realistic timeline to meet LEZ compliance. Across the consultation exercises, there was considerable support for the longest possible grace period to be applied although there was also notable support for the shortest grace period to apply.

11.7.4 Although the consultation did not conclude that any of the 8 LEZ options can be ruled out at this stage, support for any options that excluded Denburn Road was low.

12. LEZ TRAFFIC MODELLING AND SIFTING OF OPTIONS

12.1 Introduction

12.1.1 In 2019, Aberdeen City Council commissioned the development of a traffic microsimulation model of Aberdeen City Centre for the purpose of assessing road network options associated with the development of a LEZ in Aberdeen.

12.1.2 The initial Base Model development (ACCPM19) is detailed in the report '*Aberdeen City Centre Paramics Model Upgrade 2019*' (SYSTRA Ref: GB01T19F42/2, October 2020). The ACCPM19 road network description is shown in Figure 12.1.

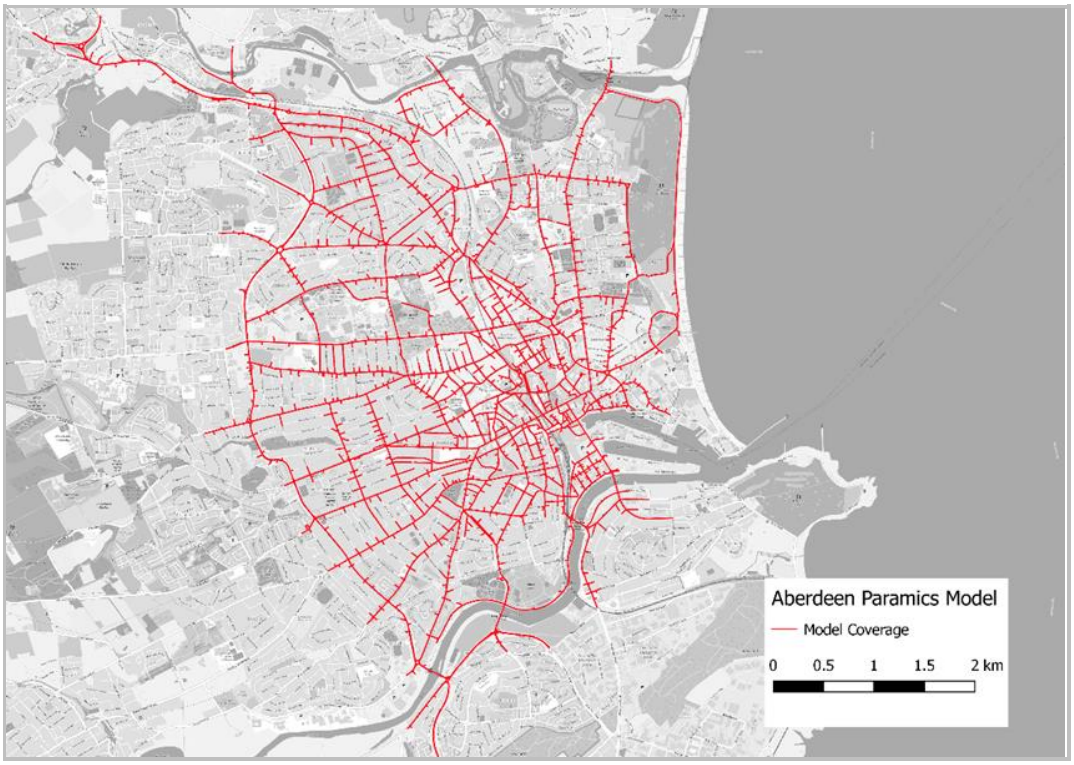

Figure 12.1 : ACCPM19 – Network Coverage

12.1.3 The subsequent development of the 2024 Reference Case Model, from which the LEZ scenarios have been assessed, is detailed in the report '*Aberdeen City Centre: Future Year (2024) Model Development Report* (SYSTRA, Ref: GB01T20D62/1, December 2020).

12.1.4 For the purposes of this report, the Aberdeen City Centre traffic model, against which all testing will be undertaken, will be deemed the *ACCPM24*.

12.1.5 The eight LEZ boundary options detailed in Chapter 10 (LEZ options 1A to 4B) formed the initial model test scenarios.

12.1.6 This chapter first outlines the development of each of the LEZ option models before assessing the impact that each LEZ has on the Aberdeen road network. The assessment allows for the total number of LEZ options to be reduced if they are shown to negatively impact on network traffic conditions or known air quality exceedance locations. The assessment is summarised below with full details provided in the accompanying *LEZ Option Testing Report' (SYSTRA Ref: GB01T20D62/2, May 2021)*. Those options that remain after the initial assessment are progressed to option refinement (Chapter 13) and detailed modelling (Chapter 14).

12.2 Model Development of LEZ scenarios

12.2.1 The higher tier strategic traffic model, ASAM14 (Aberdeen Sub Area Model), was utilised to provide the strategic impact of the future committed developments and infrastructure proposals on the ACCPM24 network. The model includes planning data from the TELMoS14 Land-Use model and both City and Shire Councils (reflecting the 2018 Strategic Development Plan). This resulted in an uplift of **6 to 8%** over the 2019 traffic levels being applied to the ACCPM24. ASAM14 was also utilised to identify the strategic impact of the LEZ scenarios.

12.2.2 In line with the other Scottish LEZ cities, a series of assumptions were required to model the impact of a LEZ on the traffic network. These include:

- 2024 Fleet Composition – Derived by SEPA / ANPR Data (Table 12.1)
- Mode Shift Assumption - No consideration of mode shift from private vehicles to bus, cycle, or taxi as a direct result of the LEZ implementation
- LEZ Adherence Level – 100% of non-compliant vehicles adhere to the LEZ restriction i.e. no non-compliant vehicles can enter the LEZ area
- All buses and taxis are assumed to be compliant
- All cars, LGV's and HGV's that are non-compliant will divert around the LEZ boundary
- All buses, LGVs, HGVs, and Taxis that originate or destinate within the LEZ area are assumed to be compliant
- All cars that originate or destinate within the LEZ are assumed to be compliant, with the exception of off-street car parking, where non-compliant cars were relocated to car parks out-with the LEZ area.

12.2.3 The future forecast of the fleet composition was derived by SEPA using the 'Emission Factor Toolkit, Version 8' (EFT) for national fleet. The change in vehicles compliance predicted from the EFT between 2019 and 2024 was applied to local fleet compliance levels observed in Aberdeen in 2019, as detailed in Table 12.1.

Table 12.1 : Aberdeen Fleet Compliance Prediction to 2024

Source	Emissions	Year	Car (%)	LGV (%)	HGV (%)
EFT National Data	Non Compliant	2019	24.6	43.68	24.6
EFT National Data	Compliant	2019	75.41	56.32	75.4
EFT National Data	Non Compliant	2024	8.14	14.09	4.9
EFT National Data	Compliant	2024	91.86	85.91	95.1
EFT National Data	Non Compliant % Change 2019-2024	-	-16.45	-29.59	-19.70
EFT National Data	Compliant Change % 2019-2024	-	16.45	29.59	19.70
ANPR 2019	Non Compliant	2019	30.3	59.8	27
	Compliant	2019	69.7	40.2	73
Projected 2024	**Non Compliant**	**2024**	**13.85**	**30.21**	**7.30**
	Compliant	**2024**	**86.15**	**69.79**	**92.70**

12.2.4 Vehicle compliance to the LEZ adherence levels have been modelled with a 16% increase in compliant cars, 30% increase in compliant LGV's and 20% increase in compliant HGV's for 2024 compared to the observed fleet proportions in 2019 (as detailed in Section 4.7).

12.2.5 The traffic modelling also considered the impact to car parking for non-compliant vehicles under each LEZ boundary option. Some city centre car parks will be within the proposed LEZ area. This will result in a likely relocation of non-compliant cars to car parks outside the LEZ area. The scale of traffic relocation will be different for each LEZ boundary.

12.2.6 Table 12.2 details the Car Park implications for non-compliant vehicles in each of the eight LEZ scenarios.

Table 12.2 : Car Park Availability for Non-Compliant Cars

Ref.	Name	Capacity	Max % full	1A	1B	2A	2B	3A	3B	4A	4B
1	Chapel Street	500	55%	x	x	x	x	x	x	x	x
2	Denburn	325	53%	✓	✓	✓	✓	✓	✓	✓	✓
3	Bon Accord (Loch St)	990	61%	✓	✓	x	x	x	x	x	x
4	Bon Accord (Harriet St)	400	66%	✓	✓	x	x	x	x	x	x
5	College Street	456	68%	✓	✓	✓	✓	✓	✓	x	x
6	Ship Row	365	30%	x	x	x	x	x	x	x	x
7	Gallowgate	138	88%	✓	✓	x	x	x	x	x	x
8	West North Street	160	69%	✓	✓	✓	✓	x	x	x	x
9	Trinity Centre	397	63%	x	✓	x	✓	x	✓	x	✓
10	Union Square	1200	61%	✓	✓	✓	✓	✓	✓	x	x
11	IQ Car Park	260	64%	x	x	x	x	x	x	x	x
12	Frederick Street	150	55%	✓	✓	✓	✓	✓	✓	x	x
13	Beach Boulevard Retail Park / Esplanade	1900	49%	✓	✓	✓	✓	✓	✓	✓	✓
No. of City Centre Car Parks available for Non Compliant Vehicles (Excl. Beach Boulevard)			12	8	9	5	6	4	5	1	2
Total spaces (Excl. Beach Boulevard)			5341	3819	4216	2291	2688	2131	2528	325	722
% of Total Spaces Available				72%	79%	43%	50%	40%	47%	6%	14%

x	Car Park Available for Compliant Vehicles Only
✓	Car Park Available for all Traffic

12.2.7 As the number of car parks available to non-compliant vehicles decreases, then the volume of traffic re-allocated to car parks on the outskirts of the city centre increases.

12.2.8 For Option 4A and 4B, the volume of traffic that would need to reallocate from the city centre area to the limited remaining available off-street car parks was deemed unreasonable and unworkable (by ACC). In this case, a proportion of the non-compliant car parking vehicles were re-assigned as compliant vehicles.

12.2.9 In Option 4A and 4B therefore, the percentage of non-compliant car park vehicles was re-adjusted until the total number of re-distributed non-compliant vehicles was similar to the other scenarios. Instead of an 86% car compliance level, this was increased to a 95% car compliance level for car parking traffic.

12.3 Development of additional LEZ Boundary - Option 5

12.3.1 From the initial option model assessment process, there was clear evidence that further consideration of potential boundary options could be undertaken which would combine the benefits of both the smaller scale LEZ options (i.e. Option 1A) and the large scale LEZ options (i.e. Option 4A) and also reduce their disbenefits.

12.3.2 The process of developing a further boundary scenario, included the following considerations:

- Ability for the transport network to cater for traffic displacement
- Requirement to displace non-compliant traffic away from the city centre area and onto pertinent routes of a suitable standard and with no existing air quality issues
- Maximise the influence on non-compliant vehicles within the city centre to improve air quality
- Retain a reasonable degree of accessibility for all vehicle fleet (both compliant and non-compliant)
- Limit the number of residential properties within the LEZ area

12.3.3 The proposed additional LEZ Option 5, was based on a hybrid of Option 1A and 4A, and includes the following variations to Option 1A shown in Table 12.3.

Table 12.3 : LEZ Option 5 Boundary Detail

Detail	Rationale
LEZ covers Union Street Area, including Denburn Road	Area derived from NLEF Process
LEZ covers Union Street Area, excluding Denburn Road	Area derived from NLEF Process
Extension of 1A to Holburn St	All LEZ scenarios show traffic increase through the west end of Union Street and particularly the north-south route of Holburn St up through Albert St and Argyle Place. Extending the LEZ through the west end of Union Street will cut this cross city routing option for non-compliant traffic. Note: May need to consider subsequent impact through St. Swithen St / Fountainhill Rd corridor
Extension of 1A to A93 Willowbank Road	Traffic flow increases through this route in all LEZ options as a result of diversion of non-compliant traffic. Corridor has been de-classified as part of Network Hierarchy review so not appropriate route for this traffic. Will need to consider the impact through Ferryhill Rd area, but may need weighed up benefits of a LEZ extension or other TM measures through this corridor.
Extension of 1A to Littlejohn St	Where Littlejohn St is on the periphery of the LEZ, some traffic congestion occurs through the junction onto West North Street
Extension of 1A to Upperkirkgate	In Options 1A/1B, Schoolhill is on the periphery of the LEZ, resulting in slight increases in traffic flow through this corridor. This is not an appropriate route to carry additional traffic (and higher emission traffic).
Extension of 1A to Harbour Corridor (East North St/Commerce St/ Virginia St/ Trinity Quay/Market St	Congestion issues occur through this corridor when it is open to all traffic. The CCCMP measures may be able to partially or fully address this issue. However, it would be prudent, in the first instance, to assess the impact of restricting access through this corridor for non-compliant vehicles with a small scale LEZ boundary.
Combination of 1A - 1G	Full restriction of city centre through traffic to non-compliant vehicles

12.3.4 When the above boundary variations to Option 1A are considered together (see Figure 12.2 below), this LEZ area has the effect of restricting all non-compliant vehicles from routing through the city centre area (as in Option 4A), but critically, it does not restrict access to the city centre (car park options still available, as in Option 1A). This is consistent with other policies and aspirations for Aberdeen City Centre.

12.3.5 The proposed boundary for Option 5 also intersects all key approach routes into the city centre thereby having an impact on the volume of non-compliant traffic in the city centre on a much wider scale than the boundary itself.

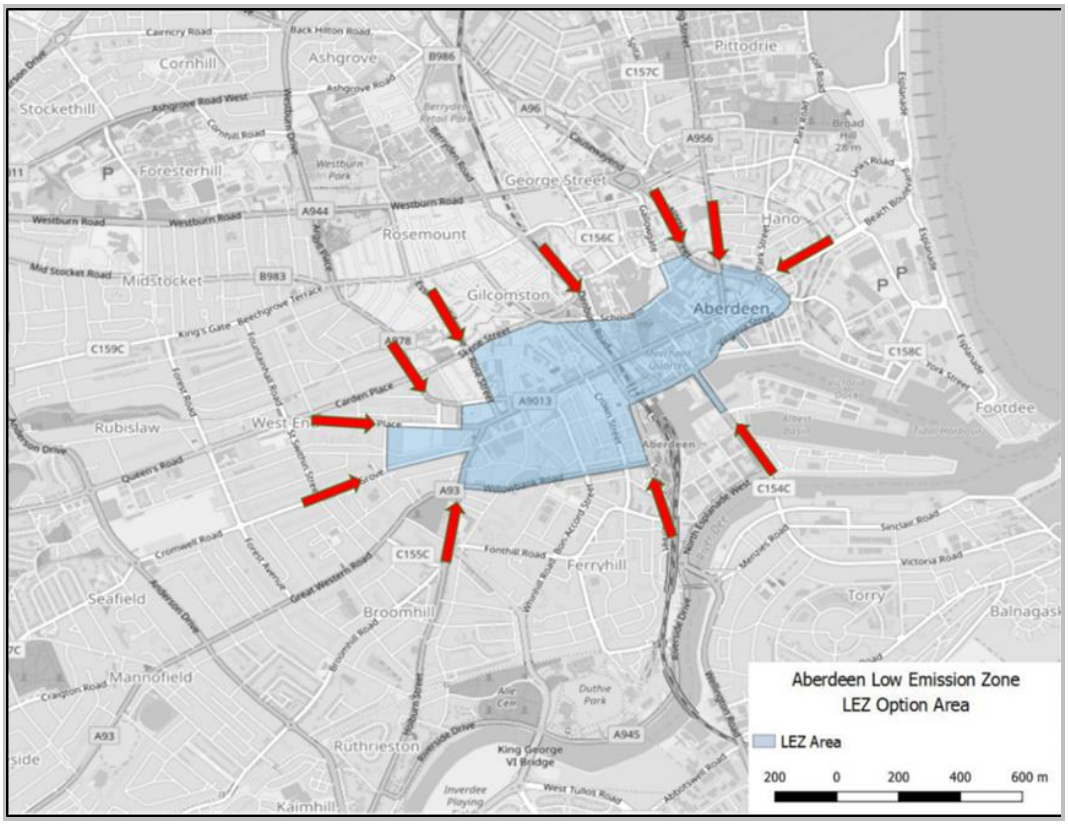

Figure 12.2 : LEZ Option 5

12.3.6 The rationale for the proposed LEZ Option 5 was presented to the ACC LEZ Delivery Group on in February 2021. ACC subsequently agreed to consider this option for further assessment alongside the other eight LEZ scenarios.

12.4 LEZ Boundary Option Sifting

12.4.1 The model appraisal of each of the LEZ scenarios included consideration of:

- Traffic Demand Level that the model was able to run at
- Traffic flow changes at the 2019 NO_2 exceedance locations
- Alignment to proposed future Network Hierarchy
- Car Park Accessibility
- Residential Impact of LEZ boundary

12.4.2 The outcomes from the sifting of the LEZ options is provided here with full details found in the *LEZ Option Testing Report (SYSTRA Ref: GB01T20D62/2, May 2021)*.

Model Network Demand Level

12.4.3 One of the primary criteria for the assessment of each LEZ test scenario was to identify the level of traffic demand that the model could run in each peak period. For example, if a model ran at 80% demand, then this suggests that there would need to be a 20% reduction in the 2024 traffic levels (or 13% reduction on 2019 levels) within the city centre to enable the network to operate without significant congestion and network instability.

12.4.4 The 2024 future year traffic models include approximately 7% predicted growth over the 2019 Baseline traffic levels in the PM Peak. It could therefore be considered that models running at 95% demand is equivalent to a small level of traffic growth on the 2019 baseline traffic demand (i.e. 2% traffic growth from 2019). In addition, due to the potential impact of the COVID-19 pandemic, a zero growth future is also a plausible future.

12.4.5 In the LEZ option testing, there are two network scenarios that do not meet either the 95% or 100% demand levels, namely LEZ boundary Option 2B and 3A, which were shown to run at 80% and 90% demand respectively in the PM period, representing a reduction in traffic demand from the 2019 baseline. Table 12.4 shows the demand level that each LEZ test scenario was able to run at in each period.

Table 12.4 : Network Demand Level

Peak Period	LEZ Boundary Options								
	1A	1B	2A	2B	3A	3B	4A	4B	5
AM	100%	100%	100%	100%	100%	100%	95%	95%	100%
IP	100%	100%	100%	100%	100%	100%	100%	100%	100%
PM	95%	100%	95%	80%	90%	95%	95%	95%	95%

12.4.6 For this reason (with full details provided in the Model Testing Report), **LEZ Options 2B and 3A** are omitted from further consideration at this stage.

Table 12.5 : LEZ Sifting Outcome (Step 1)

LEZ Boundary Options								
1A	1B	2A	~~2B~~	~~3A~~	3B	4A	4B	5

NO_2 Exceedance Locations

12.4.7 As detailed in Chapter 4, ACC undertook non-automatic (passive diffusion tube) monitoring of NO_2 at 70 sites during 2019 as part of the air quality monitoring Annual Progress Reporting (APR).

12.4.8 In total, there are 8 locations where annual mean concentrations of NO_2 exceed the AQO of 40µg/m^3 and a further 6 sites where the annual mean concentrations of NO_2 exceed 36 µg/m^3. Figure 12.3 shows the locations where annual concentrations of NO_2 were recorded as greater than 36 µg/m^3 in 2019.

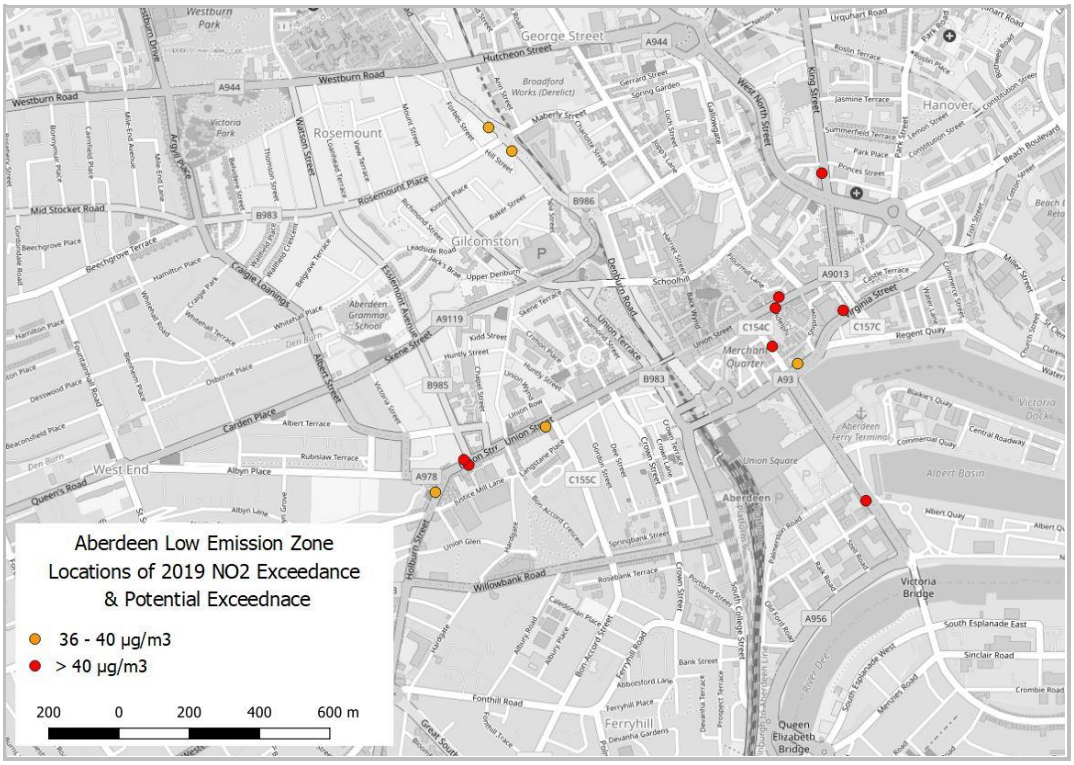

Figure 12.3 : Locations of 2019 Annual Mean Concentration of NO_2 greater than 36 µg/m^3

12.4.9 Each of the LEZ boundary options encompasses the majority of the locations detailed in Figure 12.3. Table 12.6 details the exceedance / potential exceedance locations that are directly inside each of the LEZ boundary options.

Table 12.6 : LEZ coverage of NO_2 air quality exceedance locations

Site	Exceedance Location	Exceedance Location Within LEZ ?						
		1A	1B	2A	3B	4A	4B	5
DT30	335 Union St	✓	✓	✓	✓	✓	✓	✓
DT73	61 Skene Square	×	×	×	×	×	×	×
DT18	14 Holburn St	×	×	×	×	✓	✓	×
CM2	Union Street	✓	✓	✓	✓	✓	✓	✓
DT16	1 Trinity Quay	×	×	×	✓	✓	✓	×
DT77	27 Skene Square	×	×	×	×	×	×	×
DT11	105 King St	×	×	×	×	✓	✓	×
DT10	184/192 Market St	×	×	×	×	✓	✓	×
DT9	39 Market St	✓	✓	✓	✓	✓	✓	✓
DT29	469 Union St	✓	✓	✓	✓	✓	✓	✓
DT12	40 Union St	✓	✓	✓	✓	✓	✓	✓
DT17	43/45 Union St	✓	✓	✓	✓	✓	✓	✓
DT82	7 Virgina Street	×	×	×	✓	✓	✓	×
DT19	468 Union St	✓	✓	✓	✓	✓	✓	✓

12.4.10 The locations detailed above that are outside the LEZ boundary can still be influenced by the impact of the LEZ scheme and the impact of each boundary option on each of the exceedance / potential exceedance locations forms the next stage of the option sifting process.

NO_2 Exceedance Locations – Denburn Road Variation

12.4.11 The LEZ boundary options 1B, 3B and 4B exclude Denburn Road from the LEZ area. The traffic model testing has shown that this has the effect of increasing (non-compliant) traffic through the Denburn corridor and through Skene Square to the Hutcheon Street junction. There are two key issues with this occurrence:

- Skene Square includes two locations where there are potential NO_2 exceedances
- Additional traffic demand through Skene Square adds pressure to a critical pinch point on the network – Berryden Road/Hutcheon Street junction. This junction, even with capacity improvements from the Berryden Corridor Improvement proposals (Section 3.4), shows junction capacity issues through the model testing. It is known from parallel testing that further traffic restrictions within the city centre area (from CCMP) will put further pressure on this junction.

12.4.12 A review of the model traffic flows through Skene Square corridor was undertaken for each of the LEZ boundary options that exclude Denburn Road from the LEZ . Table 12.7 provides a summary of the 12 hour flow comparisons between the LEZ scenario options and the 2019 Base model. Note the 2019 Base model is used for all flow comparisons for consistency with the 2019 observed air quality dataset.

Table 12.7 : Skene Square Flow Change (12-hr Flow)

Site	Exceedance Location	Op 1B		Op 3B		Op 4B	
		Flow Diff	%	Flow Diff	%	Flow Diff	%
DT73	61 Skene Sq.	-375	-2%	1892	12%	1208	8%
DT77	27 Skene Sq.	-371	-2%	1884	12%	1214	8%

12.4.13 Table 12.7 shows that for Option 3B, there is predicted to be an increase in traffic flow in the region of 12% over the 2019 baseline. For Option 4B, this increase is observed to be in the region of 8%. These traffic increases will likely include a more concentrated proportion of non-compliant traffic as they seek an alternative viable route through the city centre with the eastern route of Market Street, Virginia Street, Commerce Street and West North Street restricted for non-compliant vehicles.

12.4.14 As the Berryden Rd/Skene Square/Woolmanhill corridor is a priority route into the city centre, there are no other network proposals, as part of the CCMP or other, that would likely result in a decrease in traffic flow though this corridor of a scale greater than these increases.

12.4.15 The option to allow non-compliant traffic to route through Denburn Road does therefore not comply with other city centre strategies and is highly likely to increase the NO_2 emission levels at Skene Square.

12.4.16 Option 1B does not show the same increases in traffic flows through Skene Square as 3B and 4B, primarily due to the smaller LEZ area impacting fewer vehicles.

12.4.17 Due to the predicted increases in traffic flow (of non-compliant vehicles) and resultant congestion through the Skene Square corridor as well as the potential impact on NO_2 emissions along this corridor, **LEZ Options 3B and 4B** are omitted from consideration at this stage.

Table 12.8 : LEZ Sifting Outcome (Step 2)

LEZ Boundary Options								
1A	1B	2A	~~2B~~	~~3A~~	~~3B~~	4A	~~4B~~	5

NO_2 Exceedance Locations – Detailed Assessment

12.4.18 As detailed in Chapter 5, high level scenario testing using the baseline Aberdeen National Modelling Framework (NMF) Air Quality Model concluded that improving the city bus fleet to LEZ compliant standard (Euro VI) will bring the single biggest reduction in NO_2 levels and that buses therefore must be included in an Aberdeen LEZ. The NMF quantified the impact that an all compliant bus scenario would have on the NO_2 emission levels city wide and at the 2019 exceedance/potential exceedance locations. Table 12.9 shows the predicted NO_2 levels for each location, under the assumption that all buses have been upgraded to a compliant LEZ emission level.

12.4.19 The NMF scenario test results show that if all buses are compliant with LEZ vehicle emission standards, there would still likely be four 2019 exceedance locations where NO_2 levels would be greater than 40µg/m^3 and a further nine locations where the NO_2 is near to this maximum allowable level, as shown in Table 12.9 .

Table 12.9 : Annual Mean Concentrations of NO_2 greater than 36µg/m³

Site	Exceedance Location	Observed 2019 NO2 (µg/m3)	% Reduction in modelled NO2	Bus Compliant Predicted NO2 (µg/m3)
DT30	335 Union St	39.0	-2.4%	38.0
DT73	61 Skene Square	38.0	-4.8%	36.2
DT18	14 Holburn St	39.0	-2.1%	38.2
CM2	Union Street	36.0	-10.5%	32.2
DT16	1 Trinity Quay	39.0	-2.7%	37.9
DT77	27 Skene Square	38.0	-2.2%	37.2
DT11	105 King St	45.0	-2.5%	43.9
DT10	184/192 Market St	47.0	-4.9%	44.7
DT9	39 Market St	44.0	-12.8%	38.4
DT29	469 Union St	42.0	-12.7%	36.7
DT12	40 Union St	43.0	-14.8%	36.6
DT17	43/45 Union St	43.0	-2.5%	41.9
DT82	7 Virgina Street	43.0	-1.6%	42.3
DT19	468 Union St	42.0	-11.0%	37.4

12.4.20 The figures presented in Table 12.9 are critical when considering the traffic model flow changes in the LEZ option test scenarios.

12.4.21 Table 12.10 provides a traffic flow percentage difference comparison between the remaining LEZ scenarios and the 2019 Base Model at each of the exceedance locations in the network. The data is based upon the 12 Hr model flows*.

12.4.22 For absolute clarity, this comparison is between a 2024 future year scenario with a LEZ and a 2019 Base scenario. The traffic flow differences therefore include the influence of background traffic growth as well as the impact of the LEZ.

* Where the model only runs at 95% demand Options 1A, 2A, 4A and 5), the traffic flows have been factored to 100% to enable a like for like comparison with the Base Model

Table 12.10 : Traffic Flow Analysis at Air Quality Exceedance Locations

Site	Exceedance Location	% Flow Change from 2019 Baseline				
		1A	1B	2A	4A	5
DT30	335 Union St	-1%	0%	0%	-2%	5%
DT73	61 Skene Square	-8%	-2%	-8%	-4%	-8%
DT18	14 Holburn St	9%	5%	7%	-6%	1%
CM2	Union Street	1%	0%	1%	-3%	3%
DT16	1 Trinity Quay	11%	10%	16%	-9%	-7%
DT77	27 Skene Square	-8%	-2%	-8%	-4%	-8%
DT11	105 King St	16%	13%	11%	-3%	3%
DT10	184/192 Market St	11%	7%	14%	-8%	-4%
DT9	39 Market St	-4%	-5%	-3%	-3%	1%
DT29	469 Union St	0%	-1%	-1%	-3%	3%
DT12	40 Union St	10%	10%	7%	1%	9%
DT17	43/45 Union St	10%	10%	7%	1%	9%
DT82	7 Virgina Street	13%	10%	16%	-4%	-8%
DT19	468 Union St	0%	-1%	-1%	-3%	3%

12.4.23 Table 12.10 shows that there are traffic flow increases observed at seven of the exceedance locations in Options 1A, 1B and 2A. It is also evident that there isn't a significant difference between each of these three scenarios.

12.4.24 For Option 4A, the LEZ area covers all of the exceedance locations and therefore the traffic flows have reduced as a result of non-compliant vehicles being excluded from these locations. The comparisons show that Option 4A results in traffic flows reducing to a level below the 2019 Baseline at the 2019 exceedance locations.

12.4.25 It can be seen from Table 12.10 that traffic flow changes around the exceedance areas in Option 5 are a closer match to 2019 Baseline than Option 1A,1B and 2A, due to the extension of the LEZ area to include the key radial routes in Option 5. Whilst there is an increase in traffic observed on Union Street (East), this is within the boundary of the LEZ, therefore this traffic increase will be all compliant vehicles.

12.4.26 In lieu of Air Quality modelling available at this point in the assessment, in order to predict the emission level changes for each scenario, a methodology was adopted using the traffic model flow outputs and the NMF predicted NO_2 reductions detailed in Table 12.9.

12.4.27 The methodology applied considered the following information:

- Model Traffic flow changes between 2024+LEZ model and the 2019 Base model
- Impact to NO_2 levels when all buses are compliant
- Consideration whether exceedance locations were inside or outside the LEZ area

12.4.28 Table 12.11 details the predicted impact of the LEZ options on the air quality exceedance locations. These results are presented as coloured banding, representing the predicted impact to the NO_2 levels.

Table 12.11 : Predicted Impact of LEZ on Air Quality Exceedance Locations

Site	Exceedance Location	Predicted Air Quality Impact				
		1A	1B	2A	4A	5
DT30	335 Union St					
DT73	61 Skene Square					
DT18	14 Holburn St					
CM2	Union Street					
DT16	1 Trinity Quay					
DT77	27 Skene Square					
DT11	105 King St					
DT10	184/192 Market St					
DT9	39 Market St					
DT29	469 Union St					
DT12	40 Union St					
DT17	43/45 Union St					
DT82	7 Virgina Street					
DT19	468 Union St					
	NO_2 Levels predicted to be Under Threshhold					
	NO_2 Levels predicted to be Near Threshhold					
	NO_2 Levels predicted to be Over Threshhold					
	NO_2 Levels predicted to be Significantly Over Threshhold					

12.4.29 Table 12.11 shows a very similar pattern to the traffic flow changes detailed in Table 12.10. Where traffic flows are predicted to increase significantly, and particularly at locations outside the LEZ boundary, then there is a high degree of certainty that the NO_2 levels will not improve.

12.4.30 For options 1A,1B, and 2A, due to the scale of the LEZ, many of the exceedance areas are not positively influenced by the LEZ, in terms of traffic flow levels or improvements in the fleet (due to removal of non-compliant vehicles).

12.4.31 Option 4A, where the boundary covers all the exceedance areas, is anticipated to positively impact on the emission level at each of the exceedance locations, though it can be seen from Table 12.11 that at four locations, the exceedance levels are likely to be still near the AQO of 40µg/m^3.

12.4.32 For Option 5, the majority of the exceedance locations are predicted to be under the exceedance threshold. The Union Street (Site DT17) location is anticipated to be close to or slightly above the AQO of 40µg/m^3, even though it is inside the LEZ area. This suggests that further mitigation may be required to reduce traffic levels within the LEZ area, should this option be progressed.

12.4.33 In addition, the NO_2 level on King Street is predicted to be above the threshold in Option 5. This could be an issue as there are no clear measures within the package of mitigation in the CCMP which would obviously impact on traffic flows at this location.

12.4.34 Further analysis of the traffic flows on King Street in Option 5 showed that almost zero percent of traffic on this route southbound was non-compliant, confirming that even though the Option 5 LEZ boundary does not include the King Street exceedance locations, non-compliant traffic and therefore NO_2 levels at this location are influenced by the LEZ.

12.4.35 Also in Option 5, Holburn Street and Virginia Street are predicted to be near the exceedance threshold, however these locations are also within the LEZ boundary and therefore NO_2 levels are not expected to reach the threshold. Market Street (Site DT10 – South end of Market St) is outside the LEZ, but like King Street, is heavily influenced by the LEZ boundary further north on Market Street, where there is no through route for non-compliant vehicles. Only non-compliant vehicles routing to the Harbour area or Union Square would potentially route along this section of Market Street.

12.4.36 A parallel study on the City Centre Masterplan indicates that the proposed traffic interventions within the core area of the city centre will significantly reduce traffic levels through key routes of Union Street and Market Street (among others), but may not provide a significant reduction to traffic demand levels along King Street or the harbour route of Virginia Street and Trinity Quay.

12.4.37 Therefore, without significant additional interventions not historically considered, the LEZ Options 1A, 1B and 2A are not anticipated to meet the objectives of the scheme.

12.4.38 Due to the limited impact of **Option 1A, 1B and 2A** on the observed NO_2 emission locations, these options are no longer considered.

Table 12.12 : LEZ Sifting Outcome (Step 3)

LEZ Boundary Options								
~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	4A	~~4B~~	5

12.5 Outcome From LEZ Sifting Process

12.5.1 From the option sifting process detailed in this chapter, ACC agreed to take LEZ boundary Options 4A and 5 forward for further appraisal of their suitability, as shown in Figure 12.4and Figure 12.5.

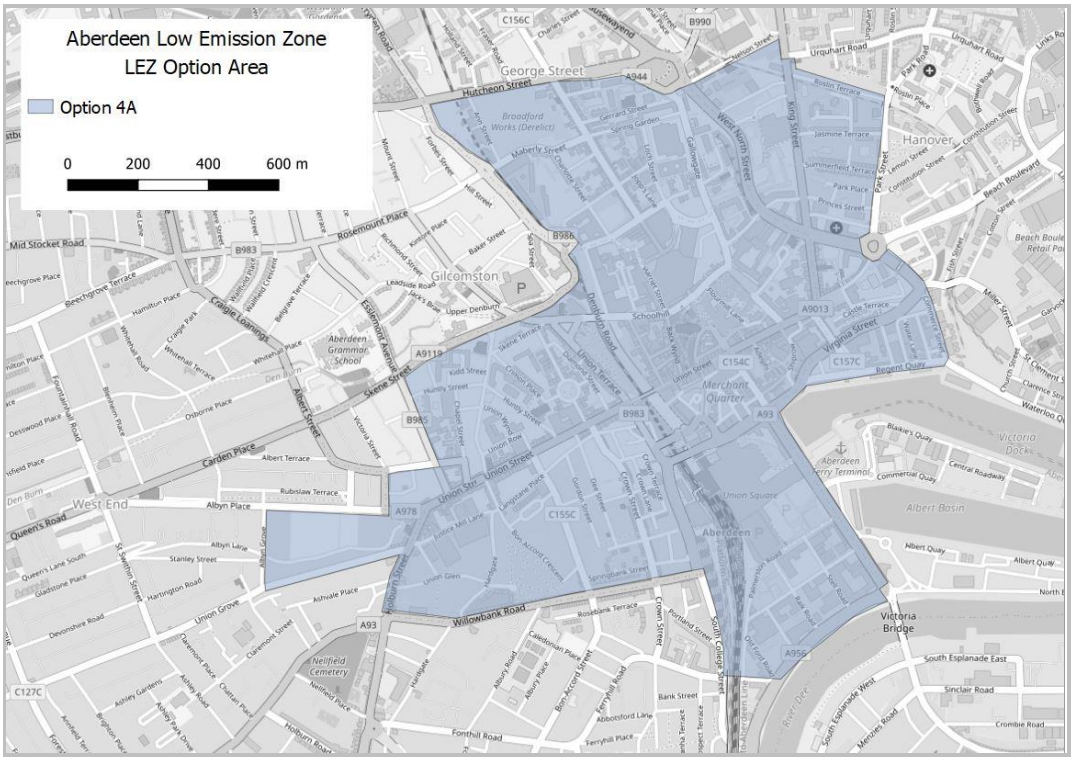

Figure 12.4 : LEZ Option 4A

Figure 12.5 : LEZ Option 5

13. LEZ OPTION APPRAISAL

13.1 Introduction

13.1.1 The NLEF option development process (Chapters 8 to 10) identified eight potential LEZ options for consultation and model testing. Initial testing in the Aberdeen City Centre traffic model (ACCPM24) identified a further option (Option 5) that incorporated elements of existing options (namely Options 1A and 4A). The ACCPM24 was used to assess the impact each of the nine options had on network traffic conditions and on traffic volumes at existing air quality exceedance locations.

13.1.2 As detailed in Chapter 12 above, Option 4A and Option 5 met the sifting criteria and are considered suitable to be progressed in the NLEF LEZ appraisal process. All other options identified up to this stage in the process are removed from consideration.

13.1.3 The NLEF is objective-led and consistent with the principles of Scottish Transport Appraisal Guidance (STAG). The LEZ option generation, sifting and development process and subsequent consultation and reporting undertaken through the NLEF closely mirrors that of the STAG Pre-Appraisal Stage. Following NLEF due process and initial traffic model analysis, two LEZ options remain. To ensure their continued suitability as LEZ options a further appraisal exercise, aligned with the principles of STAG Part 1 Appraisal, is now undertaken. It is important to note that NLEF does not require a full STAG Appraisal to be undertaken. In this chapter, the STAG principals are simply utilised to provide structure to appraise the suitability of the two remaining options.

13.1.4 The LEZ option appraisal (and STAG Part 1 Appraisal) concentrates on the following areas:

- An appraisal of the likely impact of options against LEZ Objectives
- An appraisal of the likely impact of options against the STAG Criteria;
- An appraisal of the fit of options with established policy directives; and
- An appraisal of the feasibility, affordability and likely public acceptability of options.

13.2 Appraisal against LEZ Objectives

13.2.1 In line with STAG a qualitative appraisal of the LEZ options against the LEZ objectives (defined in Chapter 7) is undertaken using the seven-point assessment scale.

13.2.2 Option 4A, one of the original eight options, was appraised against LEZ objectives in Chapter 9 to ensure its suitability to progress to consultation and testing.

13.2.3 Option 5, devised during the initial traffic model testing had not previously been appraised against the LEZ objectives. The area covered by Option 5 is similar to Option 1A/B (appraised in Chapter 9), however it also crucially restricts city centre through traffic of non-compliant vehicles (as in Option 4A) while providing access to the majority of city centre car parks for non-compliant vehicles (unlike Option 4A).

13.2.4 The results of the seven-point assessment is shown in Table 13.1, with justification described below.

Table 13.1 : Option appraisal against LEZ objectives

LEZ Option	Aberdeen LEZ Objective				
	1	2	3	4	5
4A	++	+	+	+	+
5	++	+	+	++	++

Objective 1: Improve air quality in Aberdeen by reducing harmful emissions from transport and delivering on the Scottish Government's statutory air quality objectives

13.2.5 Section 12.4 shows that Option 4A encompasses all NO_2 exceedance locations in Aberdeen and that as a result of the LEZ restricting non-compliant vehicles from entering the LEZ area, traffic volumes at these locations reduces from 2019 Baseline levels. In the absence of emissions or air quality modelling at this stage, it can be inferred that the removal of the most polluting vehicles from existing exceedance locations will bring improvements to NO_2 levels.

13.2.6 Option 5 encompasses the majority but not all NO_2 exceedance locations. Those locations captured by Option 5 are expected to see improved levels of NO_2, as in Option 4A. The analysis in Section 12.4 shows that those locations that remain outside the LEZ are still impacted with flows of non-compliant vehicles generally reducing at these locations as the option targets access to key radial routes through the city. Again, in the absence of emissions or air quality modelling, it can be inferred from the flow comparisons that levels of NO_2 will improve as a result of the introduction of the proposed LEZ option.

13.2.7 In both remaining options, although flow analysis points to improvements in NO_2 levels, the NMF analysis (Chapter 5) concluded that exceedances will remain in the city no matter the size or scope of the LEZ. As noted throughout the detailed appraisal, it is recognised that additional traffic management interventions will be required to be delivered alongside a LEZ in Aberdeen to ensure all of the Scottish Government's statutory air quality objectives are met. Detailed modelling (detailed in the next Chapter) will ensure that these interventions are targeted to address existing air quality exceedance locations and that the introduction of a LEZ, and associated measures, do not adversely create additional areas of exceedance.

13.2.8 Through the analysis and modelling undertaken it can be concluded at this stage that both Option 4A and Option 5 positively satisfy LEZ objective 1.

Objective 2: Support climate change targets by reducing road transport's contribution to emissions

13.2.9 Transport is the UK's largest emitter of greenhouse gases and the introduction of a LEZ in Aberdeen may contribute towards an increase in the number of low-emission vehicles or encourage additional modal shift towards active travel and public transport in Aberdeen and the wider Aberdeenshire area. A LEZ will restrict the number of the higher emitting non-compliant vehicles from its boundary and may also influence behavioural changes in the wider driving population. It is considered therefore that both LEZ options will, by their nature, reduce the contribution of road transport to emissions.

13.2.10 While the introduction of a LEZ itself in Aberdeen will help create a more modern cleaner bus fleet and a more attractive city to walk and cycle in with lower pollution levels, the combination of a LEZ with CCMP and SUMP interventions and planned improvements to the bus network infrastructure, including wider studies addressing key city bus and cycle corridors, is likely to further help promote greater usage of sustainable modes of transport.

13.2.11 The LEZ is one measure that will contribute to the wider effort of ACC to increase efficiency of the transport system thereby reducing transport's contribution to emissions and is it considered that both LEZ options score positively against Objective 2 of Aberdeen's LEZ.

Complementary Objectives

13.2.12 Both remaining LEZ options are shown to reduce emissions in Aberdeen, including those locations where exceedance are likely to remain. A LEZ delivered with additional traffic management measures will likely further reduce the level of emissions in the city.

13.2.13 Both LEZ options will proportionately increase the number of lower emitting vehicles in the city centre and contribute to a positive change to Aberdeen's environment. This is particularly true of the city centre where there is high pedestrian activity and where buses may dwell at bus stops for longer or wait at signal controlled junctions with their engines running. These factors may contribute to a city where walking and cycling is considered a more attractive mode of transport and an increase in active travel choices may result from these options. Additionally, a bus fleet that contains more modern vehicles that are likely to be more comfortable to travel on and have better facilities may promote a shift to this more sustainable travel mode, reducing the number of private vehicles on the road network and contributing to an overall improved environment that may in turn incentivise more active and sustainable travel choices.

Option 5 does not encompass as large an area as Option 4A and excludes a large number of residential properties, particularly around the George Street area. A direct result of this will be to reduce the potential financial impact of complying with LEZ restrictions that the introduction of a LEZ could have on those living inside area (compared to Option 4A). Reducing the financial impact of a LEZ will generally support the wellbeing of residents, particularly those from low income households, as its introduction will not place undue pressure on residents to upgrade their non-compliant vehicles.

13.2.14 It is considered that both LEZ options will contribute positively towards the LEZ satisfying Objective 3.

13.2.15 Both LEZ options have been shown to complement existing local and regional strategies and the impact of each LEZ option will contribute to and support the wider transport strategies of ACC, thereby satisfying Objective 4 of Aberdeen's LEZ. Each option restricts access to key strategic routes for non-compliant vehicles and will contribute to a key ACC objective of reducing the volume of non-essential traffic and helping Aberdeen become a safe, vibrant and accessible city centre. As noted above, the area covered by Option 5 restricts city centre through traffic of non-compliant vehicles (as in Option 4A) while providing access to the majority of city centre car parks for non-compliant vehicles (unlike Option 4A). Option 5 delivers a greater level of access to the city, providing a city open for all whilst restricting the most polluting vehicles from traveling through it and therefore scores higher than Option 4A. Option 4A, whilst positively satisfying the objective will not allow a similar level of access for those in society who rely on an older vehicle to access city centre amenities or services.

13.2.16 Improvements to the wider Aberdeen environment realised from a LEZ alone, or in combination with other complementary measures, will contribute to making Aberdeen a more attractive place to live, study and visit and in the longer term, this may lead to the creation of jobs, services and investment that will drive an improved city economy for all. In the short term, Option 4A may change the trip choice of non-compliant private and commercial vehicles to Aberdeen, particularly to the city centre. This may initially be detrimental to the city economy and may reduce overall person trips to the city centre. While a reduction in non-compliant vehicles impacts positively on the environment and the attractiveness of the city, there may be a short term negative impact on the city economy and therefore creation of jobs and services. As noted, Option 5 provides greater access to the city centre for all vehicles and is less likely to see a significant drop in vehicles accessing the city centre amenities and services, providing less initial economic impact on the city. Throughout the lifetime of the LEZ however it is anticipated that both LEZ options will positively impact on the city's health and wellbeing, help develop a vibrant, accessible,

and safe city centre and contribute to ongoing transformational change in Aberdeen and therefore both LEZ options will contribute positively towards the LEZ satisfying Objective 5, with Option 5 scoring higher against the objective.

13.3 Appraisal against STAG Criteria

13.3.1 While there is no requirement in the NLEF to appraise LEZ options against the established STAG criteria, it is considered a valuable exercise for the introduction of a LEZ in Aberdeen to ensure the proposed options are robust and contribute to the wider aims of the city. At STAG Part 1 Appraisal, a qualitative assessment should be completed for each option against the STAG Criteria, using a seven point assessment scale, that considers the relative size and scale of impacts. A Part 1 Appraisal should capture the likely impacts of options but detailed appraisal should not be undertaken. The results of the seven-point assessment is shown in Table 13.2, with justification described below.

Table 13.2 : Option appraisal against STAG Criteria

LEZ Option	STAG Criteria				
	Environment	Safety	Economy	Integration	Accessibility & Social Inclusion
4A	++	0	-	+	-
5	++	0	+	+	0

Environment

13.3.2 The environment criteria has been examined through the NMF (Chapter 5) and traffic model analysis (Chapter 12) as well as LEZ Objective 1 above and both remaining options will positively impact on the environment criteria. In addition to the qualitative and quantitative appraisal through this report, the final proposed LEZ for Aberdeen will be subject to a Strategic Environmental Assessment and therefore be fully assessed against environmental baseline data.

13.3.3 The high level NMF analysis concluded that a LEZ delivered on its own (and of any size and vehicle type restrictions) was not enough, in itself, to tackle all locations of air quality exceedance. To achieve compliance with air quality standards in Aberdeen, complimentary traffic management measures are required (as detailed in Chapter 14) and for this reason the LEZ options do not achieve the highest score on the seven-point scale.

Safety

13.3.4 It is considered unlikely that the introduction of either remaining LEZ will result in an increase in accidents. The final LEZ will be carefully designed to ensure suitable alternative routes and final-choice junctions for non-compliant vehicles to avoid entering the LEZ in a safe manner. Both LEZ options are shown to reduce traffic volumes in the LEZ area as non-compliant vehicles are removed, creating a safer environment in the city centre. The modelling has not yet fully quantified the locations, if any, where traffic flow significantly increases outside the boundary of the LEZ area and in turn increase the likelihood of accidents and this element will be under consideration in the final LEZ option design. On the seven-point scale, both remaining LEZ options therefore score neutrally against the safety criteria.

Economy

13.3.5 The LEZ in Aberdeen will be enforced through a network of ANPR cameras, in line with the Transport (Scotland) Act 2019. Option 5, which covers a smaller geographical area with a lower number of cameras required, will represent a lower cost option than Option 4A. This is true for both the capital cost per camera and installation and the ongoing maintenance costs to run the enforcement system.

13.3.6 Option 4A includes a larger number of residential properties than Option 5. For residents within the LEZ boundaries, there would be a requirement for their vehicles to be fully compliant with the vehicle emission criteria after the defined grace period for enforcement. It is recognised that the larger the LEZ area, the greater or wider impact there will likely be for air quality improvements. However, where a LEZ covers a larger (and more residential) area, the cost of compliance with the LEZ increases. Cost of compliance is a key indicator of the impact of a LEZ and is considered in more detail in the supporting Integrated Impact Assessment (Chapter 16).

13.3.7 As detailed in Section 9.7, the inclusion of city centre car parks differs between options. The inclusion of any car park in a LEZ area will result in a likely relocation of non-compliant cars to car parks outside the LEZ area. The scale of traffic relocation is different for each LEZ boundary. Option 5 was designed to allow substantial availability of car parks while restricting through trips of non-compliant vehicles. Option 4 was initially designed to encompass all NO_2 exceedance locations and match the CCMP boundary proposals and in doing so, contains the majority of city centre car parks.

13.3.8 For the two remaining LEZ options, the proportion of city centre off-street car parks accessible for non-compliant vehicles is:

- Option 4A – 1 of 12 Car Parks available (6% of total spaces)
- Option 5 – 8 of 12 Car Parks available (72% of total spaces)

13.3.9 Clearly Option 5 retains the most accessibility to the city centre for non-compliant traffic, whilst Option 4 would effectively force non-compliant vehicle drivers to either upgrade their vehicle, travel into the city centre by a different mode or not travel to the city at all. These differences between the LEZ boundary options raise several key implications to consider, including equal opportunity implications (see accessibility and social inclusion) and city economy and resilience implications. The Aberdeen economy, like all urban economies in the UK, has been significantly impacted by the Covid-19 pandemic with significant economic losses incurred by the majority of sectors. Option 5 could be considered compatible with the economic recovery desired for the city, such as maintained access for all modes and an improved environment, and scores positively against the Economy criteria.

13.3.10 With its restricted access to car parks, its large cost to residents and business for compliance, and larger (comparative to Option 5) enforcement and running costs, Option 4A does not provide the same opportunities for economic recovery of the city centre and is unlikely to bring economic benefit in the short term. It therefore scores negatively against the Economy criteria.

Integration

13.3.11 As defined in STAG, there are three sub-criteria when considering the Integration criteria. Firstly Transport Integration, where both remaining options will enforce changes in the wider transport network through required compliance with LEZ emission standards. This will especially impact the bus services in the city, where there are current low levels of compliance amongst operators. Consultation with operators suggest that some services may be altered or reduced as a result of the introduction of a LEZ although this can be mitigated against through suitable grace periods and support funding through the Bus Emission Abatement Retrofit Fund (BEAR). As noted above, access to the parking infrastructure of the city differs between options.

13.3.12 The introduction of a LEZ in the city is a direct response to the Scottish Government's Programme for Government, is legislated in the Transport (Scotland) Act 2019 and the LEZ option development and appraisal process has followed the NLEF, specifically published to guide local authorities implementing LEZs. Clearly, there is a close correlation between the LEZ and transport and land-use planning guidance, the second sub-criteria of the STAG

Integration criteria. At the inception of the LEZ proposals there were a number of existing key ACC transport and land-use plans that it was critical the LEZ took account of, in particular the North East Scotland Roads Hierarchy Study, the CCMP and the SUMP. These, and other local, regional and national land-use and transport plans are detailed in Chapter 3 and show how a LEZ in Aberdeen relates to wider policies, as per the third sub-criteria of the Integration criteria. The direct compatibility of Option 4 with the key ACC plans and strategies is detailed in Chapter 9.

13.3.13 As detailed in Section 9.9, ACC and regional partners Nestrans and Aberdeenshire Council commissioned the North East Scotland Roads Hierarchy Study, which aims to update the cities roads hierarchy to provide a system that reflects the new role of the city centre (as a destination). It is considered important, in the context of Aberdeen's changes to the roads hierarchy, that the LEZ area aligns with the new hierarchy and this is assessed here, informed by the traffic modelling summarised in Chapter 12 above.

13.3.14 The modelling highlighted the potential issues of including two new proposed secondary routes within the LEZ area (Denburn Road and Harbour Route). It was noted that non-compliant vehicles re-routing away from these corridors would likely shift to western secondary and minor routes. In LEZ Options 4A and 5, where the explicit west end of Union Street and Alford Place / Holburn Street are included within the LEZ, the initial traffic modelling has shown this has the effect of displacing traffic further out to the Ashley Road and Forrest Avenue corridors.

13.3.15 In Option 4A, traffic flow increases were also observed along the southern boundary of the A93 Willowbank Road corridor and/or the parallel east-west corridor of Ferryhill Road. Neither of these routes are likely to be deemed acceptable to carry additional non-compliant vehicles under the revised network hierarchy (A93 Willowbank Road to be downgraded to a tertiary route).

13.3.16 The boundary of LEZ Option 5 includes the A93 Willowbank Road corridor. This inclusion has the effect of reducing the total volume of traffic using this route. However, in Option 5, non-compliant traffic migrates to the alternative east-west route of Fonthill Road / Ferryhill Road. Traffic increases were also noted around the west end of Union Street through routes including Ashley Road and Albyn Grove to by-pass the city centre.

13.3.17 The traffic model outputs therefore suggest that neither of the remaining LEZ options directly align with the proposed network hierarchy. The conflicts could be mitigated by either traffic management measures or revisions to the LEZ boundary. This is considered further in Chapter 14.

13.3.18 Analysis of the performance of the remaining options against air quality exceedances has shown that in order to meet the AQO in the city, the LEZ should be delivered with additional complimentary traffic management interventions such as junction re-design, bus priority measures or road closures. As identified, it is crucial that any interventions align closely with those explicitly defined in the CCMP/SUMP and this is examined in the next chapter.

13.3.19 Upon consideration of the above, both remaining options are considered to fit with existing local, regional and national plans, polices and strategies, and therefore score positively against this STAG criteria, but that further work is required to fully satisfy this criteria.

Accessibility and Social Inclusion

13.3.20 As noted in the Integration criteria, it is anticipated that access to bus services will remain the same upon the introduction of either LEZ option but that this is likely to be dependent on continued funding assistance for operators to achieve fleet compliance. If full fleet compliance is not achieved, there is a risk that access to the bus network is reduced as a result of the LEZ introduction.

13.3.21 As it has been noted, Option 4A encompasses the majority of city centre car parks and this reduces the opportunities for those who rely on existing older non-compliant vehicles to access services and amenities in the city centre, likely to be those from lower income households. Option 4A also encompasses larger areas of residential properties which raises implications of fairness and equality where residents are forced to comply with the LEZ measures. It should be noted that the Scottish Government, through its 2018 Programme for Government, is committed to help those who will have most difficulty preparing for the introduction of LEZs through various support funds and the Transport (Scotland) Act 2019 allows for additional 2-year grace period to be applied for residents of a LEZ.

13.3.22 Option 5 has been shown to impact all NO_2 exceedance locations while providing continued access for non-compliant vehicles to the majority of city centre car parks and does not include significant numbers of residential properties.

13.3.23 The final preferred LEZ will be subject to an Integrated Impact Assessment (Chapter 16) where the likely impacts of its introduction on groups such as those with protected characteristics (e.g. age, gender, disability, ethnicity, religion), those vulnerable to falling into poverty (e.g. unemployed, single parents, homeless people, carers and vulnerable families) and geographical communities (e.g. urban, rural, and business communities).

13.3.24 At this stage in the appraisal process, Option 4A is considered to score negatively against the Accessibility and Social Inclusion criteria with its potential to restrict access to services and amenities in the city centre and provide no alternative for those who at the moment rely on non-compliant vehicles for their needs. Option 5, as with any LEZ, will impact in some way but through detailed design and suitable mitigation (such as hardship funds), it is anticipated that such impacts can be lessened and for this reason, the option scores neutrally against the criteria.

13.4 Appraisal against established Policy Directives

13.4.1 As noted above, the introduction of a LEZ in the city is a direct response to the Scottish Government's Programme for Government, is legislated in the Transport (Scotland) Act 2019 and the LEZ option development and appraisal process has followed the NLEF, specifically published to guide local authorities implementing LEZs. Key local, regional and plans, policies and strategies are detailed in Chapter 3 and show how a LEZ in Aberdeen relates to these established policy directives.

13.5 Appraisal of the feasibility, affordability and likely public acceptability of LEZ options

13.5.1 Both remaining LEZ options are considered feasible to be implemented and enforced through a network of ANPR cameras. Although Option 4A covers a larger geographical area, this is not considered a barrier to its feasibility.

13.5.2 Option 4A, as noted, will have a higher cost to introduce and enforce and is likely to have a higher cost of compliance for residents and business given its larger area and the land-uses it covers. On the understanding however that any final proposed LEZ option submitted to Scottish Ministers is fully appraised and the appropriate assessments are

undertaken in line with the NLEF, it is anticipated that its introduction will be accepted and fully funded by the Scottish Government. While the ongoing funding responsibility is unclear at this stage, both remaining options are therefore considered affordable in their introduction.

13.5.3 Chapter 11 summarised the findings from the public consultation exercise and showed there to be broad support for the introduction of LEZs. Of the LEZ options consulted on, Option 4A was the clear preferred option, with 22% of respondents favouring the option. Option 5 was not consulted on but was devised through combining elements of Option 4A and Option 1A. Option 1A was the second preferred option during the public consultation, receiving 19% of all preference votes. It is therefore considered likely that Option 5 will be favourably received and it follows that both remaining options are considered publicly acceptable.

13.6 Outcomes from LEZ Option Appraisal

13.6.1 The NLEF is objective-led and consistent with the principles of Scottish Transport Appraisal Guidance (STAG). The two remaining LEZ options have been appraisal in line with the principles of STAG Part 1 Appraisal, with the results summarised in Table 13.3.

Table 13.3 : Summary of LEZ Option Appraisal

Appraisal Criteria		4A	5
LEZ Objective	1	++	++
	2	+	+
	3	+	++
	4	+	++
	5	+	++
STAG Criteria	Environment	++	++
	Safety	0	0
	Economy	-	+
	Integration	+	+
	Accessibility & Social Inclusion	-	0
Other criteria	Feasibility	Yes	Yes
	Affordability	Yes	Yes
	Public Acceptability	Yes	Yes

13.6.2 The appraisal of the two remaining LEZ options has shown that Option 4A fails to meet the criteria for economy or accessibility and social inclusion. The appraisal identified that there are key issues and implications for Option 4A, namely:

- Alignment with proposed Network Hierarchy
- Access to city centre car parks and implications to city centre economic recovery post Covid-19
- Access to the city centre services and amenities for those who rely on transport made by non-compliant vehicles (particularly impacting vulnerable groups)
- Implications to the large number of residential properties within the LEZ area
- Option 4A will have a higher scheme costs and higher cost of compliance (for residents and businesses)

13.6.3 For these reasons, and in light of the impact of the Covid-19 pandemic to the city, it was agreed with ACC that Option 4A would not be progressed in the NLEF appraisal process. While it is clear that there are also several issues and implications for Option 5, the appraisal concluded that each criteria scores neutral to positive and that further work through detailed modelling (in the next chapter) should be undertaken on Option 5 to identify a final preferred LEZ option for Aberdeen.

14. DETAILED LEZ MODELLING

14.1 Introduction

14.1.1 The traffic model testing (Chapter 12) and option appraisal process (Chapter 13) identified LEZ Option 5 as the preferred LEZ option boundary. Detailed modelling is now undertaken to further develop the option and define the complementary measures required to address the remaining predicted air quality exceedances and network operational issues identified in the initial LEZ model testing.

14.1.2 The following steps were undertaken in the detailed assessment of Option 5 to develop a preferred final LEZ scheme for Aberdeen which best meets the objectives of the study:

- LEZ air quality improvement supporting measures
- Management of non-compliant traffic
- Finalisation of LEZ boundary
- Model statistics of final proposed LEZ
- Alternative Futures Testing

14.1.3 This chapter summarises the outcomes from the detailed modelling, with full details provided in the accompanying *LEZ Option Testing Report' (SYSTRA Ref: GB01T20D62/2, May 2021)*.

14.2 LEZ Supporting Measures – City Centre Masterplan

14.2.1 High level NMF analysis (Chapter 5) concluded that air quality exceedances will remain in the city no matter the size or scope of the LEZ and, as noted throughout the detailed appraisal and initial modelling, it is recognised that additional traffic management interventions are required to be delivered alongside a LEZ in Aberdeen to ensure all of the statutory air quality objectives (AQO) are met. Any supporting interventions for Aberdeen's LEZ are required to complement other committed network proposals for Aberdeen City Centre to provide a package of measures which will meet the objectives of the LEZ and wider Council objectives for Aberdeen City Centre. These committed proposals include the City Centre Masterplan (CCMP).

14.2.2 The traffic model testing and appraisal has identified a preferred boundary option. The traffic modelling aligned with the outcomes of initial high level NMF analysis and suggests that the LEZ alone is not enough to reduce all NO_2 levels below the AQO of 40µg/m^3 across the city centre area. Table 12.11 showed that 9 of the 14 2019 NO_2 exceedance locations were predicted to be below 40µg/m^3. Three of the five remaining locations were predicted to be just under the threshold, and two (Site DT11-King Street and Site DT17-Union Street) were predicted to remain above the threshold.

14.2.3 To enable the development of a package of measures to meet the objectives of the LEZ study and satisfy the AQOs, traffic modelling was utilised to identify if any elements of the CCMP not yet implemented would enhance and support the LEZ in meeting the objectives. A separate modelling exercise was therefore undertaken on various elements and projects within the CCMP. This is detailed in the report *City Centre Masterplan Model Testing Report* (Ref: GB01T20D62/3, March 2021). The CCMP model test programme considered the impact of each of the key CCMP projects separately, then in combination with each other. In order to identify which CCMP scheme, or combination of schemes, would best address the remaining predicted exceedance locations, traffic flow changes between the 2019 base model and each of the CCMP test scenarios were compared at each of the exceedance locations. Table 14.1 shows a summary of the traffic flow changes at the NO_2 exceedance locations compared to the 2019 base. The figures provided are the 12 hr percentage flow change from the 2019 baseline in two-way traffic flow.

Table 14.1 : CCMP Scenarios – Exceedance Location Traffic Flow Analysis (% Change from 2019 Base)

Site	Exceedance Location	LEZ Option 5 AQ Impact	CCMP 1 Full Scheme	CCMP 2a Guild St Scheme	CCMP 2b Guild St Scheme + Mitigation	CCMP 3a Union St Scheme	CCMP 3b Unioin St Scheme + Mitigation	CCMP 4a Schoolhill Scheme	CCMP 4b Schoolhill Scheme + Mitigation	CCMP 5a Guild St & Union St Scheme	CCMP 5b Guild St & Union St Scheme + Mitigation	CCMP 6a Guild St & Schoolhill Scheme	CCMP 6b Guild St & Schoolhill Scheme + Mitigation	CCMP 7a Union St & Schoolhill Scheme	CCMP 7b Union St & Schoolhill Scheme + Mitigation
DT30	335 Union St		-36%	0%	1%	-36%	-22%	7%	11%	-22%	-28%	1%	6%	-20%	-19%
DT73	61 Skene Square		25%	-3%	-4%	-12%	8%	0%	18%	27%	14%	2%	16%	1%	19%
DT18	14 Holburn St		-14%	13%	14%	-25%	-7%	10%	11%	8%	0%	14%	11%	-5%	-5%
CM2	Union Street		-47%	-7%	-6%	-45%	-35%	9%	9%	-33%	-38%	-5%	1%	-33%	-32%
DT16	1 Trinity Quay		31%	17%	17%	2%	19%	11%	15%	40%	17%	20%	19%	27%	33%
DT77	27 Skene Square		25%	-3%	-4%	-12%	8%	0%	18%	28%	14%	2%	16%	1%	19%
DT11	105 King St		32%	4%	36%	-15%	35%	8%	14%	26%	43%	13%	42%	4%	45%
DT10	184/192 Market St		28%	14%	14%	4%	12%	7%	7%	37%	15%	17%	17%	13%	18%
DT9	39 Market St		-64%	-70%	-70%	-30%	-22%	0%	7%	-63%	-66%	-70%	-70%	-22%	-15%
DT29	469 Union St		-43%	6%	7%	-43%	-29%	9%	9%	-27%	-33%	7%	5%	-29%	-29%
DT12	40 Union St		-85%	-6%	-5%	-57%	-56%	19%	33%	-81%	-83%	-1%	18%	-54%	-51%
DT17	43/45 Union St		-85%	-6%	-5%	-57%	-56%	19%	33%	-81%	-83%	-1%	18%	-54%	-51%
DT82	7 Virgina Street		18%	16%	17%	6%	15%	10%	16%	43%	17%	20%	21%	25%	30%
DT19	468 Union St		-43%	6%	7%	-43%	-29%	9%	9%	-27%	-33%	7%	5%	-29%	-29%

	NO_2 Levels predicted to be Under Threshhold
	NO_2 Levels predicted to be Near Threshhold
	NO_2 Levels predicted to be Over Threshhold
	NO_2 Levels predicted to be Significantly Over Threshhold

14.2.4 The CCMP modelling clearly identified that CCMP test CCMP3a: 'Union Street Scheme' was the scenario most likely to address the remaining exceedances, with a significant reduction in traffic flow at the majority of 2019 NO_2 exceedance locations. Importantly, the modelling of the Union Street Scheme showed a reduction in traffic flows through the NO_2 exceedance locations of King Street and Union Street, identified as locations where the LEZ alone would not allow the AQOs to be met.

14.2.5 As a result of the Union Street Scheme, the traffic flows through the harbour route of Trinity Quay and Virginia Street showed a very marginal increase. However this was significantly lower than many of the alternative CCMP scenarios.

14.2.6 The key elements of the Union Street Scheme are:

- Union Street - Bus and Taxi only between Bridge Street and Market Street
- Union Terrace - Bus and Taxi only (potentially south end only)
- Rose Street - Pedestrianised between Union Street and Thistle Street

14.2.7 Figure 14.1 schematically shows the key elements of Union Street CCMP Scheme.

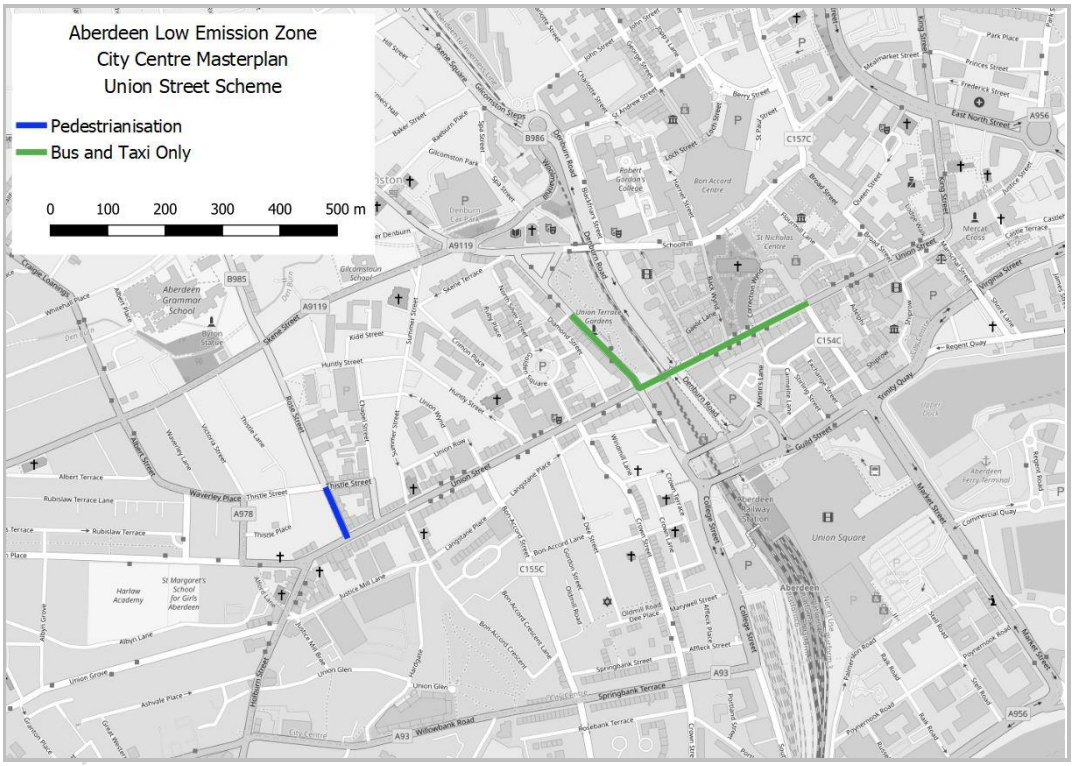

Figure 14.1 : CCMP Union Street Scheme

14.2.8 The rationale for the package of measures associated with the Union Street Scheme are as follows:

- Extensive testing of individual elements of the CCMP in 2016 identified that Union Terrace restrictions were required in combination with the Union Street restrictions to prevent local traffic diversions through Schoolhill / Upperkirkgate.
- With the Union Terrace restriction in place, traffic seeking to route between Union Street and Skene Street utilise Rose Street as a rat run, hence the requirement to restrict this movement to push through routing traffic outside the city centre area
- Rose Street pedestrianisation is identified within the CCMP Master documents. This proposals also has placemaking advantages.

14.2.9 With the CCMP testing identifying the Union Street scheme as the most suitable CCMP element to improve NO_2 exceedance locations, this was modelled in combination with the LEZ Option 5. This combined LEZ & CCMP scenario was named LEZ Option 6.

14.2.10 Table 14.2 provides both the traffic flow difference between Option 5 and Option 6 against the 2019 baseline alongside the resultant predicted air quality impact at the NO_2 exceedance locations. The traffic flow differences are provided as a percentage difference of 12 hour traffic flow compared to the 2019 Base model.

Table 14.2 : LEZ & CCMP Impact at Air Quality Exceedance Locations

Site	Exceedance Location	Flow Difference to Base		Air Quality Impact	
		Option 5	Option 6	Option 5	Option 6
DT30	335 Union St	5%	-25%		
DT73	61 Skene Square	-8%	-10%		
DT18	14 Holburn St	1%	-14%		
CM2	Union Street	3%	-41%		
DT16	1 Trinity Quay	-7%	8%		
DT77	27 Skene Square	-8%	-10%		
DT11	105 King St	3%	-2%		
DT10	184/192 Market St	-4%	-2%		
DT9	39 Market St	1%	-36%		
DT29	469 Union St	3%	-32%		
DT12	40 Union St	9%	-61%		
DT17	43/45 Union St	9%	-61%		
DT82	7 Virgina Street	-8%	5%		
DT19	468 Union St	3%	-32%		
	NO_2 Levels predicted to be Under Threshhold				
	NO_2 Levels predicted to be Near Threshhold				
	NO_2 Levels predicted to be Over Threshhold				
	NO_2 Levels predicted to be Significantly Over Threshhold				

14.2.11 Table 14.2 shows that the Union Street Scheme has a significant impact on the volume of traffic routing through Union Street, with a 60% reduction in traffic at two of the NO_2 exceedance sites. This also has an additional impact to the volume of traffic approaching Union Street from both Holburn Street and King Street. These traffic reductions will therefore have a direct impact on the air quality figures at these locations.

14.2.12 The Union Street restrictions also result in traffic diversions to other local routes. The harbour routes of Trinity Quay and Virginia Street therefore show a slight increase in traffic volumes due to the restrictions on Union Street. It should be noted that these locations are still within the LEZ boundary and therefore any slight increase in traffic flow will be from lower polluting compliant vehicles and is likely therefore to have a lower detrimental impact on the NO_2 levels. Any increase (and decrease) in NO_2 levels will be quantified through SEPA's emissions and air quality modelling.

14.2.13 In summary, the addition of the CCMP Union Street Scheme to the proposed LEZ results in traffic reductions through key areas of the city centre network where the LEZ alone is not anticipated to be enough to reduce all NO_2 levels below the AQO of 40µg/m^3.

The City Centre Masterplan Union Street Scheme has been shown to complement the proposed LEZ and is expected to positively impact on the NO_2 exceedance locations in the city. This combination of the LEZ plus CCMP Union Street Scheme is predicted to significantly reduce the emission levels at all the 2019 observed NO_2 exceedance locations.

SYSTRA therefore recommends that the LEZ and the CCMP Union Street Scheme is viewed as a combined package of measures to meet the objectives of the LEZ.

14.3 Management of Non-Compliant Traffic

14.3.1 The proposed LEZ boundary generally fits well with the future network hierarchy proposals, with the exception of a noticeable increase in traffic through the east-west route of Fonthill Road / Ferryhill Road (as summarised in Chapter 13). Increases in non-compliant traffic were also noted around the west end of Union Street through routes including Ashley Road and Albyn Grove to by-pass the LEZ boundary.

14.3.2 The proposed LEZ boundary has the effect of restricting all non-compliant vehicles from routing through the city centre area, but critically, it does not restrict access to the city centre (car park options still available for all traffic). This is consistent with other policies and aspirations for Aberdeen City Centre. However, the detailed model testing has shown that traffic is finding local routes around the periphery of the LEZ but within the boundary of Anderson Drive (See Figure 14.2).

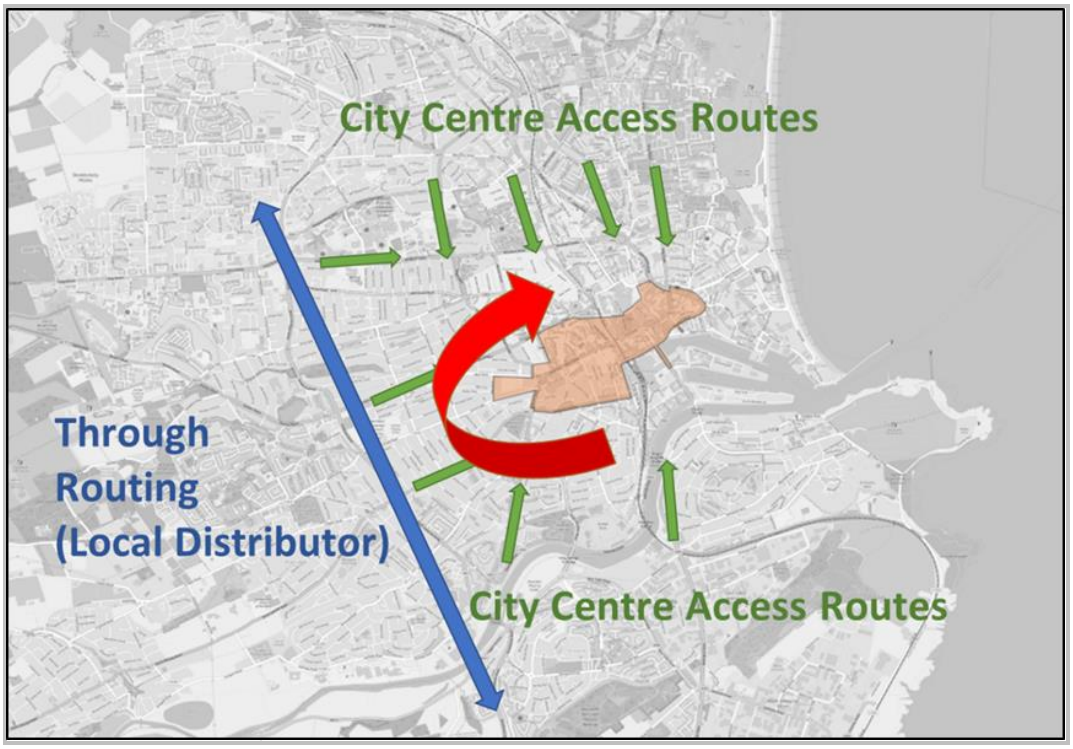

Figure 14.2 : Observed Model Routing of displaced Traffic

14.3.3 Through discussions with ACC, several options were developed to better manage the displacement of traffic around the south and west border of the proposed LEZ. These included:

1. Extension of LEZ boundary to include full South College Street corridor
2. Bus Gate on Ferryhill Road
3. Traffic Management Measures to restrict routing on Ashley Road and Forrest Avenue
4. Revised Milburn Street / South College Street Junction as part of South College Street Improvements – Phase 2

14.3.4 Through model testing of the above options, and in consultation with ACC, the following conclusions were drawn from each option:

1. Extension of LEZ boundary

- ACC raised an issue with extending the LEZ for a traffic management reason and not for an air quality reason
- Model testing showed only a slight improvement to traffic volume through Ferryhill Road corridor. A high proportion of the traffic on this corridor was shown to be compliant vehicles and not influenced directly by any LEZ extension. This suggests

that the Union Street measures were also a key factor in the traffic increases through this corridor

- The LEZ extension option would therefore not fully manage traffic displaced from the city centre area and was excluded from further consideration.

2. Bus gate on Ferryhill Road

- ACC advised that this was an acceptable consideration but not preferable over alternative proposed measures at Milburn Street / South College Street junction as it is more intrusive than other measures, includes maintenance costs and may not be popular with the general public
- Model testing showed a significant reduction in traffic through the Ferryhill corridor by as much as 95%. However a significant proportion of this traffic was observed to divert through Albury Road to Springbank Terrace, thus retaining traffic routes through the area.

3. Traffic management measures through Ashley Road and Forrest Avenue

- Model testing had shown a high volume of traffic routing around the western edge of the LEZ / City Centre area. SYSTRA identified that Ashley Road carried a high proportion of this traffic. Whilst Forrest Avenue was not included within the model, ACC advised that rat-running traffic is also known to use this route in parallel with Ashely Road.
- Model testing showed a significant reduction in traffic on Ashley Road when routing costs were increased (actual traffic management measures not defined at this point).
- Model testing also showed little improvement in traffic routing through the Ferryhill corridor as the restrictions pushed traffic out to Anderson Drive but still left routing between Holburn Street and South College Street through the Ferryhill corridor.

4. Revised Milburn Street / South College Street Junction

- The South College Street Scheme is to be implemented in 2022 and is considered as Phase 1 of a two phase programme of works. The first phase involves the creation of a link road between South College Street and North Esplanade West to alleviate traffic congestion at the QEII Bridge roundabout.
- As advised by ACC, a second phase will consider changes to the junctions at either end of QEII Bridge. As part of Phase 2, ACC are also considering restricting access to Milburn Street from South College Street, pending a review of the operation of the junction (post-implementation of Phase 1).
- Following advisement of the traffic modelling impact of the LEZ, ACC advised SYSTRA to consider restricting access to/from Milburn Street to restrict strategic movement through this corridor.
- Model testing was undertaken on a design option (specific design detail will be developed in due course)
- The traffic modelling showed that there was only a small (approx. 10% on average) increase in the two way traffic flow on the Milburn Street corridor in the LEZ scenario compared to the Reference Case.
- This proposal effectively cuts off the Ferryhill corridor as a rat-run and pushes traffic back out to Anderson Drive. It was found to be, on balance, the best solution of the options considered.

The model testing of various proposals to manage traffic displaced from the city centre has identified that a revision to the operation of the Milburn Street / South College Street junction is best placed to address potential rat runs through the south and west border of the LEZ.

Junction changes are required to restrict or prevent strategic traffic (both compliant and non-compliant) routing through Milburn Street and the Ferryhill corridor. Further assessment of the specifics of these measures will be considered by ACC in due course.

14.4 Comment on Future Year Modelling

14.4.1 The Covid-19 pandemic has had a dramatic impact on travel across all modes and specifically travel in Scotland's city centres. To assist in the development of the LEZs across Scotland, Transport Scotland commissioned a study to apply the principals of modelling in considering the uncertainty over what travel will look like after the pandemic has ended.

14.4.2 The study set out a framework for embracing uncertainty by consulting with stakeholders on 'what will travel look like post Covid-19'. This framework set out the rationale for any additional modelling required to provide evidence to support the introduction of any LEZ. To assist this process, workshops were held with the local authorities, including ACC, to agree the key metrics to measure against the current LEZ objectives and identify the key disruptors which are likely to have the greatest impact on travel activities within each city centre.

14.4.3 A Scenario Planning Process was developed to allow a range of plausible future scenarios to be defined using important and likely disruptors. These scenarios were used as a reference case against which the anticipated LEZ impacts were applied to understand how an LEZ performs in the context of plausible future scenarios.

14.4.4 The outcomes from the study are detailed in the *LEZ Post-Covid Uncertainty Summary Note (SYSTRA Ref. GB01T20E86/11024112/005, January 2021*). The study concluded that the impact of the LEZs will vary between each city depending on their specific traffic levels and fleet composition. Importantly, the LEZ will protect the city centres by preventing non-compliant vehicles from entering them. Whilst the impact of the LEZ may vary across each city in terms of emissions, the outcome is likely to be very similar with the level of emissions limited to a reduced value compared to pre-LEZ levels. The study recommended that sensitivity tests of the final preferred LEZ are undertaken on two further plausible futures, to ensure a robust set of modelling results to inform Aberdeen's LEZ. This analysis is provided in the accompanying *LEZ Option Testing Report' (SYSTRA Ref: GB01T20D62/3, May 2021)*

14.4.5 Given the impact Covid-19 is having on trip making, future travel patterns are still uncertain and it is important to note that minor mitigation measures identified in Section 14.3 to support the wider LEZ scheme may be required in one plausible future scenario but not necessarily the another.

14.4.6 The traffic modelling undertaken to date is based upon a pre-Covid-19 network and the 'spaces for people' measures currently in place include some of the traffic restrictions proposed as part of the permanent LEZ package of measures (e.g. restrictions on Union Street) . If ACC considers that these temporary measures should remain in place until the LEZ is operational, then the city centre travel patterns, post-Covid-19, will build back up around the current restrictions. This is therefore subtly different to how the modelled traffic patterns are currently constructed and adds a degree of uncertainty to the actual future traffic volumes that the scheme can be assessed against.

14.4.7 It is therefore important to utilise the traffic modelling appropriately, and extract the key findings to aid the decision making process, whilst acknowledging that the need for additional mitigation measures can be monitored and reviewed after the wider LEZ scheme is implemented in post-Covid-19 environment.

SYSTRA recognises the current uncertainty in predicting the future city centre travel patterns post-Covid-19. Because of this, SYSTRA recommends that the consideration of additional mitigation measures identified in Section 14.3 as part of the wider LEZ package should be reviewed after the key LEZ elements are implemented to determine if these, or other measures are still required.

14.5 Adjustment of LEZ Boundary

14.5.1 As part of the development of the final package of measures proposed for the final preferred LEZ scheme, the boundary of the LEZ itself was reviewed by both SYSTRA and ACC and some minor amendments considered from the original Option 5 as detailed:

- *Ashvale Place / Holburn Street* - The LEZ boundary on Holburn Street requires to be moved from just north of the junction with Willowbank Road to just north of the junction with Ashvale Place. This is to allow non-compliant traffic an exit on Ashvale Place, as it is a one-way eastbound route onto Holburn Street
- *Regent Quay Area* - ACC identified the need to rationalise the LEZ boundary around the Regent Quay area of the network, noting a requirement to retain access to Virginia Street Car Park on Mearns Street for all vehicles. In addition, Regent Quay requires to be excluded from the LEZ as this road is under the jurisdiction of the Harbour Board and not ACC and therefore cannot be included within the LEZ as defined by the Transport (Scotland) Act 2019.
- *East North Street / King Street* – Model testing of the LEZ boundary around the Harbour route of East North Street, Commerce Street and Virginia Street has shown that the combined inclusion of all of these routes within the LEZ boundary reduces the volume of non-compliant traffic significantly on King St, which currently has air quality NO_2 exceedances. The roundabout of East North Street with Beach Boulevard remains outside the LEZ boundary to allow U-turning for non-compliant vehicles on Beach Boulevard and Park Street.
- *Market Street/Union Square/Bus Station* – Consultation with local business stakeholders in April 2021 (Section 11.4) identified that goods delivery access to Union Square shopping centre is from Market Street at the shared access to Aberdeen Bus Station. The boundary of the LEZ on Market Street is therefore adjusted to now extend just north of this access to allow continued access for goods delivery.

14.5.2 The final proposed LEZ boundary is provided in Chapter 15, Figure 15.1.

14.6 Model Statistics for Final Proposed LEZ Scheme

14.6.1 The detailed model outputs for the final preferred LEZ option and associated package of measures is provided in the accompanying *LEZ Option Testing Report' (SYSTRA Ref: GB01T20D62/3, May 2021)* and summarised here:

Model Demand Level

14.6.2 Through all model testing of the various LEZ options, the maximum percentage demand that the models were able to run at was 95% of the Reference Case Demand.

14.6.3 The 2024 future year traffic models are based upon a high traffic growth scenario and include approximately 7% predicted growth over the 2019 Baseline traffic levels in the PM period. It could therefore be considered that models running at 95% demand is equivalent to a small level of traffic growth on the 2019 baseline traffic demand (i.e. 2% traffic growth from 2019). An alternative way of viewing this is that that the LEZ scheme helps to manage the traffic levels through the city centre so that if high growth occurs in the wider

Aberdeen network, the LEZ helps to restrict this level of growth through the city centre areas.

Predicted Impact of LEZ on Air Quality Exceedance Locations

14.6.4 Table 14.3 provides a traffic flow percentage difference comparison between the final preferred LEZ option and the 2019 Base Model at each of the exceedance locations in the network. The data is based upon the 12 Hr model flows. The resultant predicted impact on the NO_2 exceedance levels is also provided.

Table 14.3 : Predicted Impact of Final LEZ Scheme on Air Quality Exceedance Locations

Site	Exceedance Location	Flow Change from 2019 Baseline Final Option	Predicted Air Quality Impact Final Option
DT30	335 Union St	-24%	
DT73	61 Skene Square	-10%	
DT18	14 Holburn St	-14%	
CM2	Union Street	-40%	
DT16	1 Trinity Quay	6%	
DT77	27 Skene Square	-10%	
DT11	105 King St	2%	
DT10	184/192 Market St	-5%	
DT9	39 Market St	-37%	
DT29	469 Union St	-32%	
DT12	40 Union St	-62%	
DT17	43/45 Union St	-62%	
DT82	7 Virgina Street	5%	
DT19	468 Union St	-32%	
	NO_2 Levels predicted to be Under Threshhold		
	NO_2 Levels predicted to be Near Threshhold		
	NO_2 Levels predicted to be Over Threshhold		
	NO_2 Levels predicted to be Significantly Over Threshhold		

14.6.5 The modelling results shows that the predicted traffic flow changes associated with the final proposed LEZ scheme are expected to reduce emissions through each of the NO_2 exceedance locations to the extent that all current exceedances fall below the legal limit, the principal objective of the LEZ. The predicted reduction in NO_2 will be quantified by SEPA through their emissions and air quality modelling work as available.

Predicted Impact of LEZ Scheme on Network Travel Pattern

14.6.6 Traffic model flow analysis shows a general trend of traffic reduction through the core area of the city centre with displaced traffic pushed out to Anderson Drive. The LEZ boundary restricts non-compliant traffic from routing through the city centre but retains access to the city centre.

14.6.7 The locations where traffic is diverted generally follow the proposed hierarchy routes. The mitigating measures through Milburn Street help to protect the local areas around Ferryhill Road from the impacts of the displaced traffic. Some other local routing increases are observed within the model but it is important to highlight again the current uncertainty in predicting the future city centre travel patterns post-Covid-19. Because of this, SYSTRA recommends that the consideration of additional mitigation measures as part of the wider LEZ package should be reviewed after the key LEZ elements are implemented to determine if these, or other measures are still required.

14.6.8 From the model testing, SYSTRA would highlight the following corridors as locations where traffic monitoring is undertaken as the network traffic recovers and also after the key elements of the LEZ are implemented:

- Springbank Terrace / Willowbank Road
- Huntly Street
- Chapel Street
- Albyn Place
- Ferryhill Road / Fonthill Road
- Albert Street
- Ashley Road
- Seaforth Road

Predicted Impact of LEZ Scheme on Aberdeen's Traffic Network

14.6.9 Model network-wide summary statistics report on the overall network performance of a traffic model. Analysis of the network-wide statistics for the final preferred LEZ option and complementary package of measures suggest:

- The LEZ would result in an increase (<2%) to the average distance travelled for vehicles through the city centre area. The nature of a LEZ together with traffic restrictions through the city centre area will undoubtedly have an impact on the trip distance of some vehicles. This would be a factor when considering Carbon emissions.
- Whilst the modelling suggests that the LEZ scheme would result in an increase (10-15%) on the average time taken for traffic to route through the city centre area, outputs suggest that the volume of traffic queueing would reduce (by approx. 10%) It is assumed that this is due to the removal of traffic from some of the high queue areas within the LEZ area.

14.6.10 Given that the primary objective of a LEZ is to reduce emission levels associated with road traffic by restricting access for certain vehicles to parts of the city, the overall impact to the traffic network is perhaps expected. The model testing has shown however that the proposed measures should significantly improve air quality levels in the city and when delivered together with the proposed CCMP measures, the LEZ also enables ACC to consider improved pedestrian or Public transport measures through the road space created.

15. ABERDEEN LEZ OPTION DETAIL

15.1 Introduction

15.1.1 The analysis undertaken and summarised in Chapters 11 to 14 has identified a final preferred option for Aberdeen's LEZ, including the package of supporting measures to enable the LEZ to meet its objectives. The next stage of the NLEF process is to define the LEZ Option detail in line with the Transport (Scotland) Act 2019.

15.1.2 Section 14 of the Transport (Scotland) Act 2019 states the required content of a LEZ, namely:

- The zone to which it relates, which must be specified by
  - i. reference to an area on a map, and
  - ii. specifying the roads (or parts of a road) which form part of the zone
- the types of vehicles to which it applies
- the date on which the scheme comes into effect
- the grace periods applicable
- the LEZ objectives

15.1.3 This chapter will provide information on the required content of Aberdeen's LEZ.

15.2 Aberdeen LEZ Area

15.2.1 In line with Section 14 of the Transport (Scotland) Act 2019, the final detailed drawing of the Aberdeen LEZ Option is shown in Figure 15.1

15.2.2 The detail presented in Figure 15.1 is considered appropriate for this stage of the Interim Stage 2 Reporting and subsequent submission to Aberdeen City Council Committee and for the consultation period thereafter. However, detailed design work should be undertaken prior to final submission of the Aberdeen LEZ Option to Scottish Ministers that will include aspects such as signage and camera placement and will present a further opportunity to finalise the LEZ boundary. It is anticipated that through the final consultation, locations, accesses or land uses may be identified and require consideration of whether they fall inside or outside the LEZ area.

15.2.3 A list of all roads which form part of the zone, as required by the Transport (Scotland) Act 2019 is included in Appendix C.

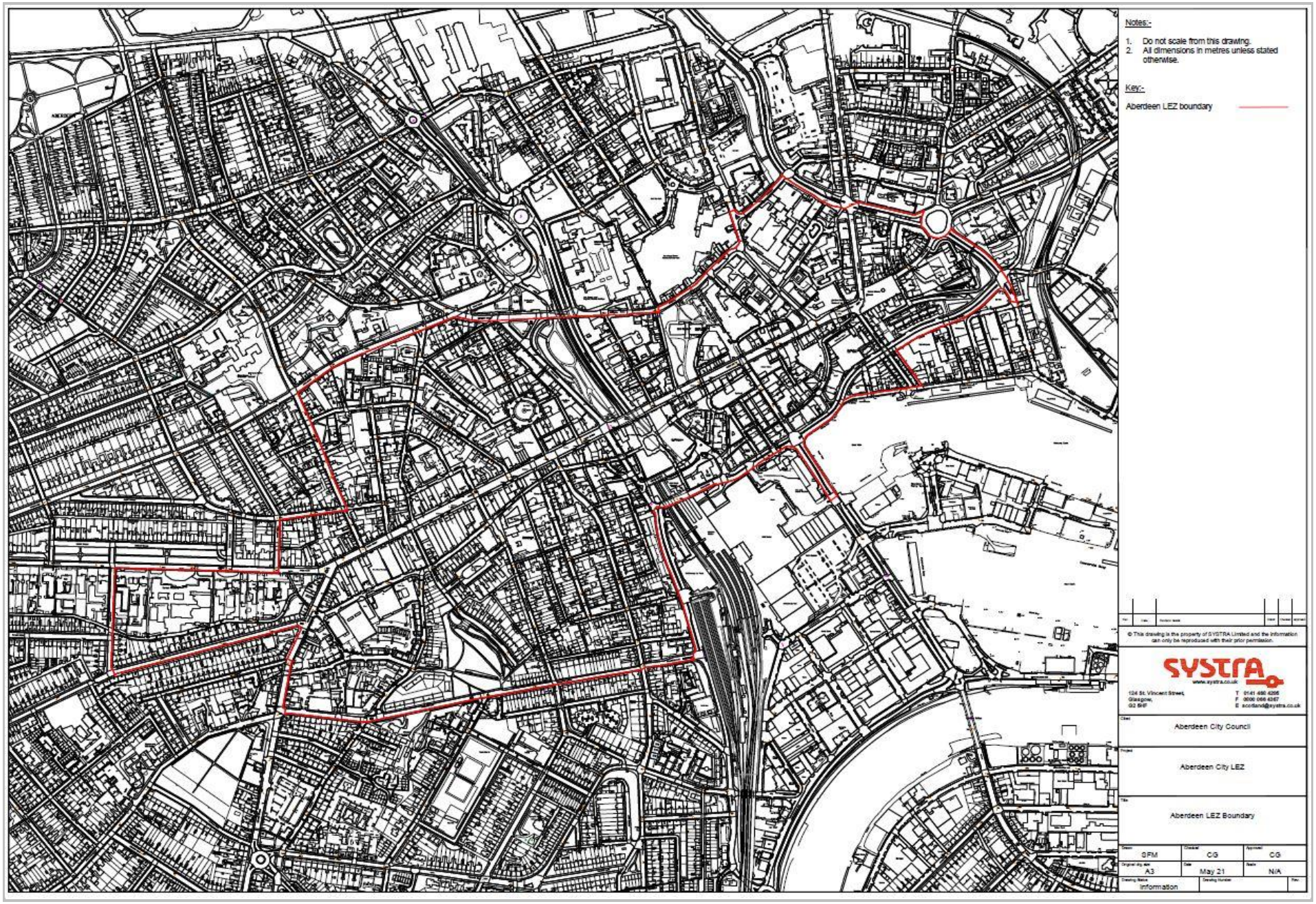

Figure 15.1 : Aberdeen LEZ Option Area

15.3 Vehicles types restricted from entering Aberdeen LEZ

15.3.1 The Low Emission Zones (Emission Standards, Exemptions and Enforcement) (Scotland) Regulations 2021 sets the emission standards for entry to the LEZ without penalty and allows ACC to define which vehicle types are to be restricted from entering the LEZ area.

15.3.2 NLEF Guidance states *"all vehicle types should be considered for inclusion in a LEZ and be assessed as part of the NLEF appraisal process…a single vehicle type or a combination of vehicle types could be subject to the LEZ requirements"* (NLEF, 2019).

15.3.3 The final decision of the vehicles types restricted from entering Aberdeen's LEZ is informed therefore by NMF Aberdeen air quality modelling, traffic modelling and consultation outcomes as well as enforcement considerations.

15.3.4 Analysis of modelled emission by vehicle type in the NMF Aberdeen Air Quality Model (Chapter 5) concluded that a LEZ in Aberdeen will have to include all vehicle types and have to be delivered with traffic management measures if all exceedances of the air quality objectives are to be addressed.

15.3.5 The traffic modelling assessed LEZ options that restricted all vehicles (buses, diesel cars, HGVs, LGVs and petrol cars) from access to the city centre unless they were compliant with LEZ emission standards. All non-compliant buses, LGVs, taxis and HGVs were assumed to become compliant while non-compliant cars were assumed to remain on the road network and access the city centre by utilising car parks outside the LEZ area. The detailed modelling results show the road network operates with small increases to average journey distance travelled and average journey times. This impact is balanced against the significant predicted reductions in NO_2 levels and traffic flows inside the LEZ area as a result of the introduction of an all vehicle LEZ and complementary traffic management measures.

15.3.6 In addition to evidence from modelling, the wider messaging and publicising of the LEZ is simplified if vehicle restrictions apply to all vehicle types that do not meet LEZ emission standards. It is also noted that the three other cities in Scotland (Glasgow, Dundee and Edinburgh) plan to introduce a LEZ for all vehicles and introducing an all vehicle LEZ for Aberdeen would ensure consistency across the country.

It is proposed that the final Aberdeen LEZ Option applies to all vehicles types as specified in Regulation 2 of the Low Emission Zones (Emission Standards, Exemptions and Enforcement) (Scotland) Regulations 2021.

15.3.7 The LEZ emission standards for Aberdeen LEZ are therefore:

- Euro VI emission standards for buses, coaches and heavy good vehicles with diesel engines, with retrofitted vehicles to this standard also being acceptable (Euro VI vehicle registrations from 2013)
- Minibuses, large vans, taxis and cars are set at the Euro 6 for diesel vehicles and Euro 4 for petrol vehicles (Euro 6 diesel vehicle registrations in 2015, Euro 4 petrol vehicles in 2006).
- Euro 3 for motorcycles and mopeds

15.3.8 Although the model analysis did not consider motorcycles or mopeds (as they are not generally represented in the traffic or air quality model) these are listed in Regulation 2 and are therefore considered applicable to the emissions standards for Aberdeen's LEZ.

15.3.9 Section 6(4)(a) of the Transport (Scotland) Act 2019 set enforcement exemptions consistently across Scotland, with the national LEZ exemptions listed in Regulation 3 of

the LEZ Regulations and outlined in Table 15.1. Aberdeen LEZ will operate in accordance with the exemption list.

Table 15.1 : National LEZ Exemptions

Vehicle type of classification	Description
Emergency Vehicles	For or in connection with the exercise of any function of:
	the Scottish Ambulance Service,
	the Scottish Fire and Rescue Service,
	Her Majesty's Coastguard, and
	the National Crime Agency.
Military Vehicles	Vehicles belonging to any of Her Majesty's forces; or used for the purposes of any of those forces
Vehicles of Historic Interest	Vehicles which are 30 years old or older, are no longer in production and historically preserved or maintained
Vehicles for Disabled Persons	Vehicles registered with a 'disabled' or 'disabled passenger vehicles' tax class
	Vehicles being used for the purposes of the 'Blue Badge Scheme'.
Showman Vehicles	Highly specialised vehicles used for the purposes of travelling showmen, where the vehicle is used during the performance, used for the purpose of providing the performance or used for carrying performance equipment.

15.4 Aberdeen LEZ Package of Measures

15.4.1 To enable the development of a package of measures to be delivered as part of the LEZ, traffic modelling was utilised to identify if any elements of the City Centre Masterplan (CCMP) not yet implemented would enhance and support the LEZ in meeting its objectives. The CCMP Union Street Scheme was shown to complement the proposed LEZ and is expected to positively impact on the NO_2 exceedance locations in the city. This combination of the LEZ plus CCMP Union Street Scheme is predicted to significantly reduce the emission levels at all the 2019 observed NO_2 exceedance locations.

15.4.2 The model testing of various proposals to manage traffic displaced from the city centre identified that a revision to the operation of the Milburn Street / South College Street junction is best placed to address potential rat runs through the south and west border of the LEZ. Junction changes are required to restrict or prevent strategic traffic (both compliant and non-compliant) routing through Milburn Street and the Ferryhill corridor. Further assessment of the specifics of these measures will be considered by ACC in due course.

15.4.3 It is therefore recommended that the LEZ, the CCMP Union Street Scheme and the Milburn Street junction revision is viewed as a combined package of measures to meet the objectives of the LEZ, as shown in Figure 15.2.

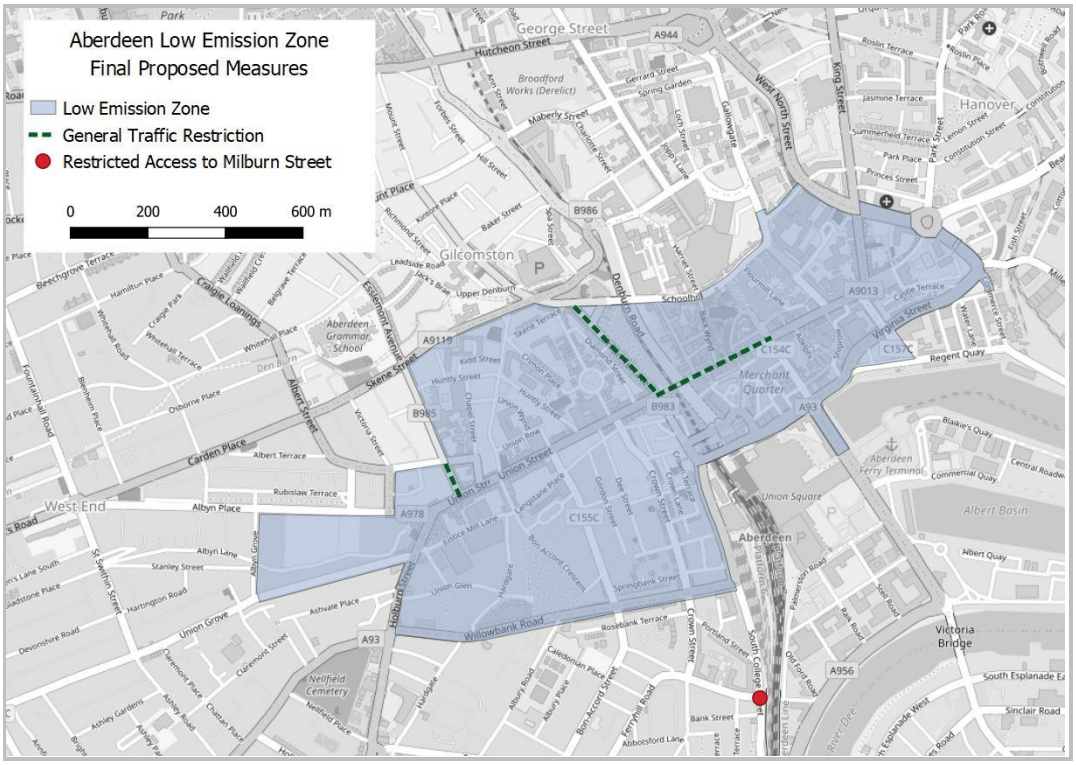

Figure 15.2 : LEZ Supporting Measures

15.5 Enforcement of Aberdeen LEZ

15.5.1 ACC will submit its final proposals for the LEZ to Scottish Ministers in late 2021 and, subject to any objection, is required to declare its LEZ by May 2022. While a decision on the final exact date is made, the working assumption for this Interim Stage 2 Report is that ACC will declare the LEZ in May 2022, and that the LEZ will apply to all vehicle types (not meeting LEZ standards) from this date.

15.5.2 The Transport (Scotland) Act 2019 requires a LEZ to specify a grace period before penalty enforcement of the scheme. Section 15 details the scope and time-limits of the grace period. The grace period applicable to non-residents must expire:

- not less than 1 year after it (LEZ declaration) begins, and
- not more than 4 years after it begins.

15.5.3 The grace period applicable to residents (whose registered address is inside the zone) must expire not more than 2 years after the expiry of the grace period applicable to non-residents.

15.5.4 With declaration of Aberdeen's LEZ in May 2022, the grace period for the LEZ must therefore:

- Not expire before May 2023
- Expire by May 2026 for non-residents
- Expire by May 2028 for residents but can expire from May 2023

15.5.5 To inform the grace period dates, consultation with two key stakeholders, namely bus operators and the business community, was undertaken in March 2021. All bus operators confirmed their full fleet would not be compliant with LEZ emission standards by 2023, the minimum grace period. While a key purpose of any LEZ is to speed up improvements to air quality (through compliance with emission standards) and ACC could enforce the LEZ in 2023, it is considered counter-productive to set a date that bus operators will be unable to meet.

15.5.6 In addition, it is recognised that the Covid-19 pandemic has had an unprecedented impact on society, including on the wider environment and the economy. Cognisance of the difficulties faced by many throughout 2020 and 2021, particularly in the context of a Aberdeen city centre LEZ and its implications for city businesses and bus operators, suggests that a grace period greater than the required minimum is desirable.

15.5.7 A key theme from consultation with key stakeholders was the need for consistency of the grace periods applied to the LEZ enforcement. It is therefore considered important that the grace period should be applicable to all vehicle types from the same date to ensure consistency and ease of enforcement and wider communications. In line with the theme of consistency, it is proposed that residents of the LEZ area are required to comply with the LEZ emission requirements at the same time as non-residents.

With the above considerations in mind, it is proposed that the grace period for Aberdeen's LEZ expires in May 2024 for all vehicle types and for residents and non-residents of the zone.

15.5.8 This represents an additional grace period of two years from the declaration of the LEZ in May 2022.

15.5.9 As context, in May 2024, the approximate age of non-compliant vehicles will be as follows:

- Bus – 11 years or older (including those retrofitted to Euro VI standard)
- HGV – 11 years or older
- Diesel car/van – 9 years or older
- Petrol vehicle – 18 years or older

15.5.10 Section 8 of the Transport (Scotland) Act 2019 enables the enforcement of LEZ schemes. The LEZ will be enforced through Automatic Number Plate Recognition (ANPR) cameras with the LEZ Regulations Schedule 6 detailing the approved devices.

15.5.11 ANPR camera enforcement is currently subject to funding decisions from Transport Scotland and procurement procedures with suppliers. The exact number and location of ANPR cameras is therefore not concluded and will be confirmed in the final NLEF Stage 2 Report and submission to Scottish Ministers.

15.5.12 In line with Section 18 of the Transport (Scotland) Act 2019, it is anticipated that the LEZ will be enforced at all times. Section 17 of the Act does allow for ACC to apply time-limited exemptions to enforcement should it be required, for example for road closures and diversion routes.

15.6 Aberdeen LEZ Objectives

15.6.1 Chapter 7 details the development of the objectives of Aberdeen's LEZ. They are that Aberdeen's Low Emission Zone will:

Improve air quality in Aberdeen by reducing harmful emissions from transport and delivering on the Scottish Government's statutory air quality objectives.

Support climate change targets by reducing road transport's contribution to emissions.

15.6.2 It is recognised that a LEZ can help realise wider benefits beyond air quality improvement, but that these are influenced by many other factors and not solely or directly attributable to a LEZ. Therefore the following supplementary objectives for Aberdeen's Low Emission Zone have been identified:

- Protect public health and wellbeing;
- Support local and regional transport strategies by contributing to the development of a vibrant, accessible, and safe city centre, where the volume of non-essential traffic is minimised and active and sustainable transport movements are prioritised; and
- Contribute to ongoing transformational change in Aberdeen, helping promote the city as a desirable place to live, visit and invest in.

15.6.3 The objectives were shown to align with key ACC plans, polices and strategies. While at this stage it is not possible to fully quantify the effectiveness of the final Aberdeen LEZ in meeting the LEZ objectives, an appraisal of the option against the LEZ objectives (Chapter 13) concluded that the introduction of the LEZ will not contradict the objectives and it is likely to positively meet the objectives in the future.

16. SUMMARY OF NEXT STEPS

16.1 Timetable of Aberdeen LEZ

16.1.1 Table 16.1 below presents the proposed timetable from committee submission of the final Aberdeen LEZ presented in this Interim NLEF Stage 2 Report through to full enforcement of the LEZ after the proposed grace period ends.

Table 16.1 : Timetable towards Aberdeen LEZ enforcement

Activity	Indicative Date
City Growth and Resources Committee Report recommending final Aberdeen LEZ as defined in this report	June 2021
Statutory Consultation	Summer 2021
Completion of additional impact assessments (IIA, BRIA, SEA)	Autumn 2021
Submission of final LEZ scheme to Scottish Ministers	End 2021
Scottish Minister approval and ACC declaration of Aberdeen LEZ	Spring 2022
Enforcement of Aberdeen LEZ	Spring 2024

16.2 Emissions Analysis and the National Modelling Framework

16.2.1 SEPA, who develop and run the National Modelling Framework (NMF) Aberdeen City Air Quality Model, were subject to a cyber-attack in late 2020 resulting in the NMF being temporarily unavailable, with model runs not possible prior to completion of this second Interim NLEF Stage 2 Report. The final Aberdeen LEZ option will however be assessed in the NMF prior to submission to Scottish Minsters (late 2021 as noted above).

16.2.2 As an interim step to inform the likely impact on emissions resulting from the introduction of the LEZ, analysis of emissions based on traffic model outputs using EMIT software is currently being undertaken by SEPA and findings will be incorporated in the NLEF process as available.

16.3 Impact Assessments

16.3.1 NLEF guidance advises that as part of the NLEF Stage 2 Assessment, the final Aberdeen LEZ should be subject to detailed impact, equality and environmental assessments to ensure any impacts, beyond improvements to air quality, are fully considered.

16.3.2 In line with Transport Scotland's approach to the national introduction of LEZs, Aberdeen's LEZ will be subject to the following impact assessments:

- Strategic Environmental Assessment (SEA)
- Integrated Impact Assessment (IIA)
- Business and Regulatory Impact Assessment (BRIA)

16.3.3 These assessments are ongoing and it is anticipated that these tasks will be complete prior to the final submission of the Aberdeen LEZ to Scottish Ministers in Autumn 2021.

16.4 Statutory Consultation

16.4.1 Section 11 of the Transport (Scotland) Act 2019 states that before a local authority submits its final LEZ proposals to Scottish Ministers for approval, it must consult with:

- the Scottish Environment Protection Agency,
- Scottish Natural Heritage (now NatureScot),
- Historic Environment Scotland,
- such persons as the authority considers represent the interests of—
    i. the road haulage industry,
    ii. the bus and coach industry,
    iii. the taxi and private hire car industry,
    iv. local businesses, and
    v. drivers, likely to be affected by the proposal,
- such persons as are specified by the Scottish Ministers in regulations
    i. neighbouring local authorities
    ii. the Regional Transport Partnership (Nestrans)
    iii. the local Health Board
- such other persons as the authority considers appropriate

16.4.2 All statutory consultees have been involved in previous consultation and/or are part of the Aberdeen LEZ Delivery Group. However, in line with The Transport (Scotland) Act 2019, consultation on the final Aberdeen LEZ will take place from June 2021. Thereafter, ACC will publish a Report on the consultation findings and, if required, take account of any representations received in the course of the consultation.

16.4.3 Once the consultation findings have been taken into consideration, ACC will publish the final proposed Aberdeen LEZ scheme and, at this time, objections can be made. When the period in which objections can be made has ceased, ACC will publish a report outlining any objections received and its response.

APPENDIX A – LEZ OPTION AREAS

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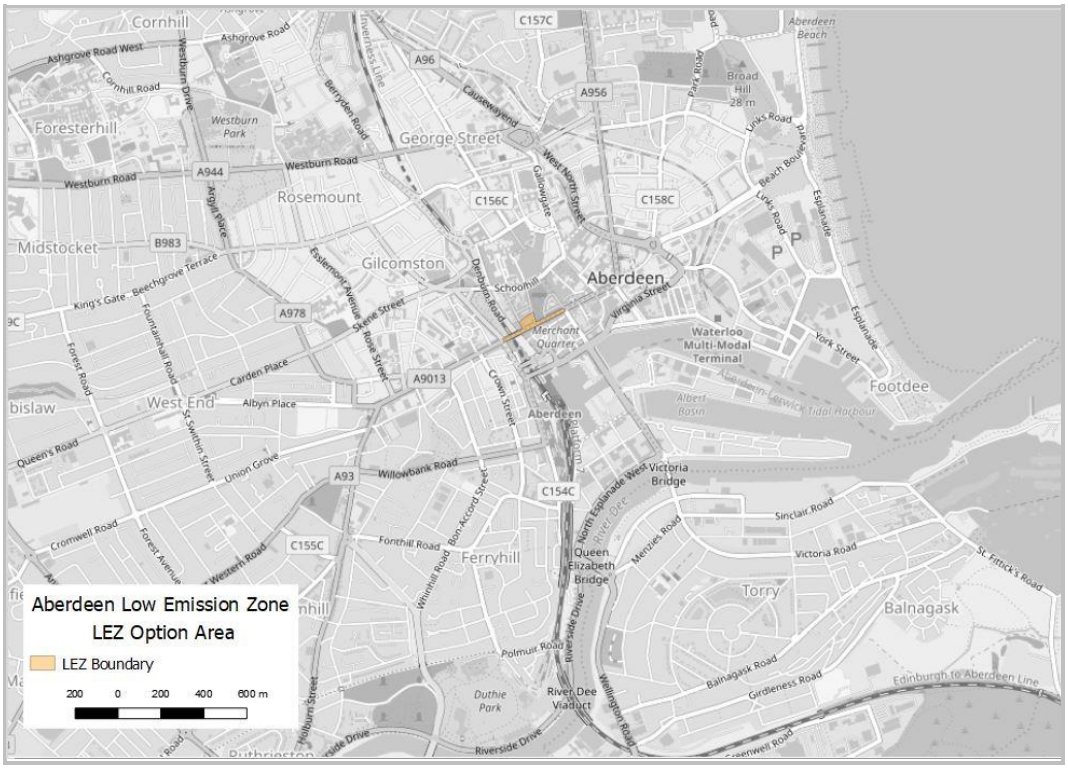

Figure A.1 : Central Union Street

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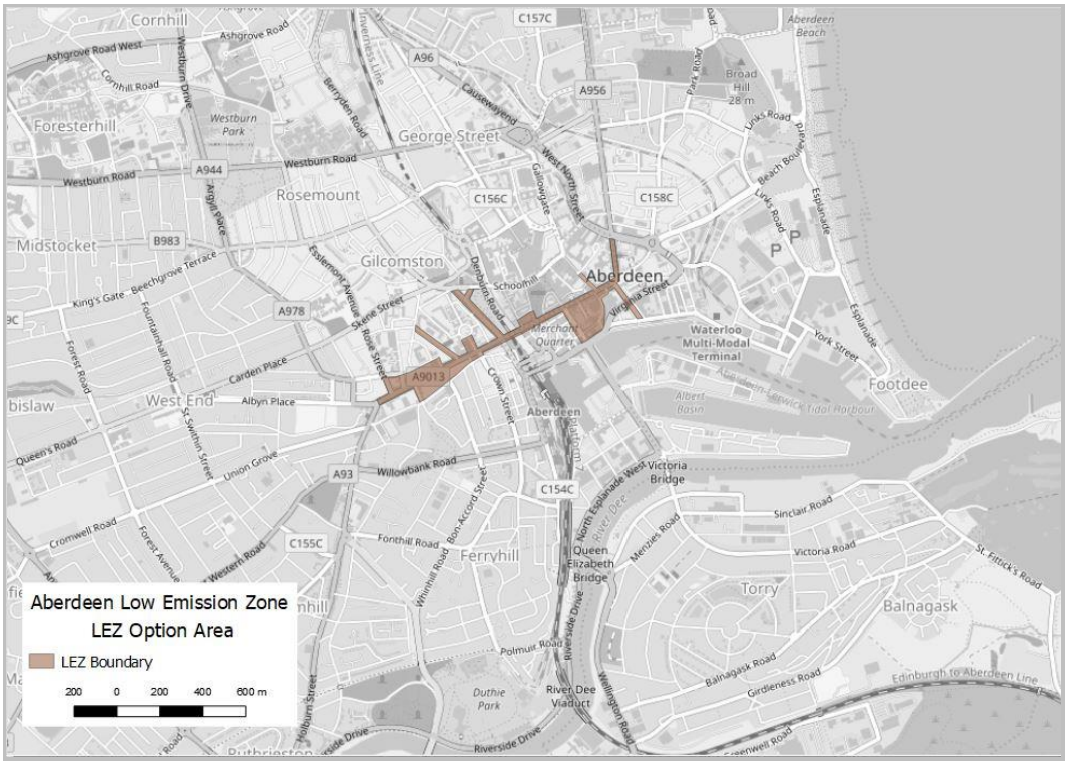

Figure A.2 : Union Street

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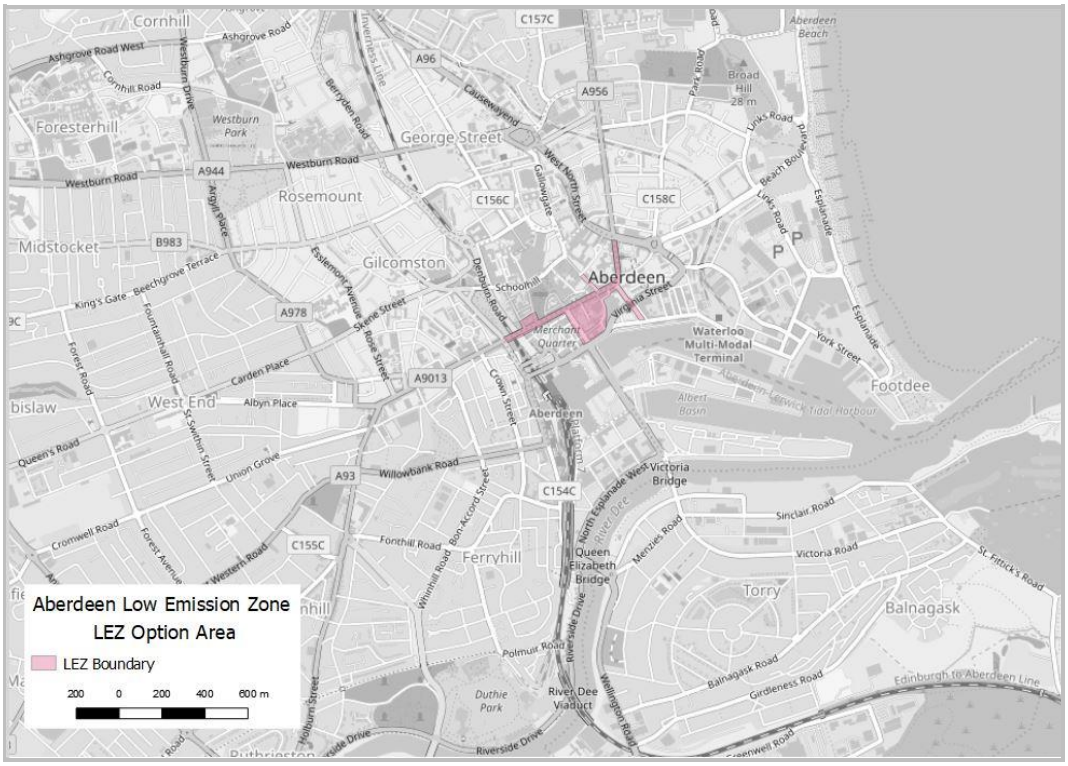

Figure A.3 : Union Street/Market Street/King Street

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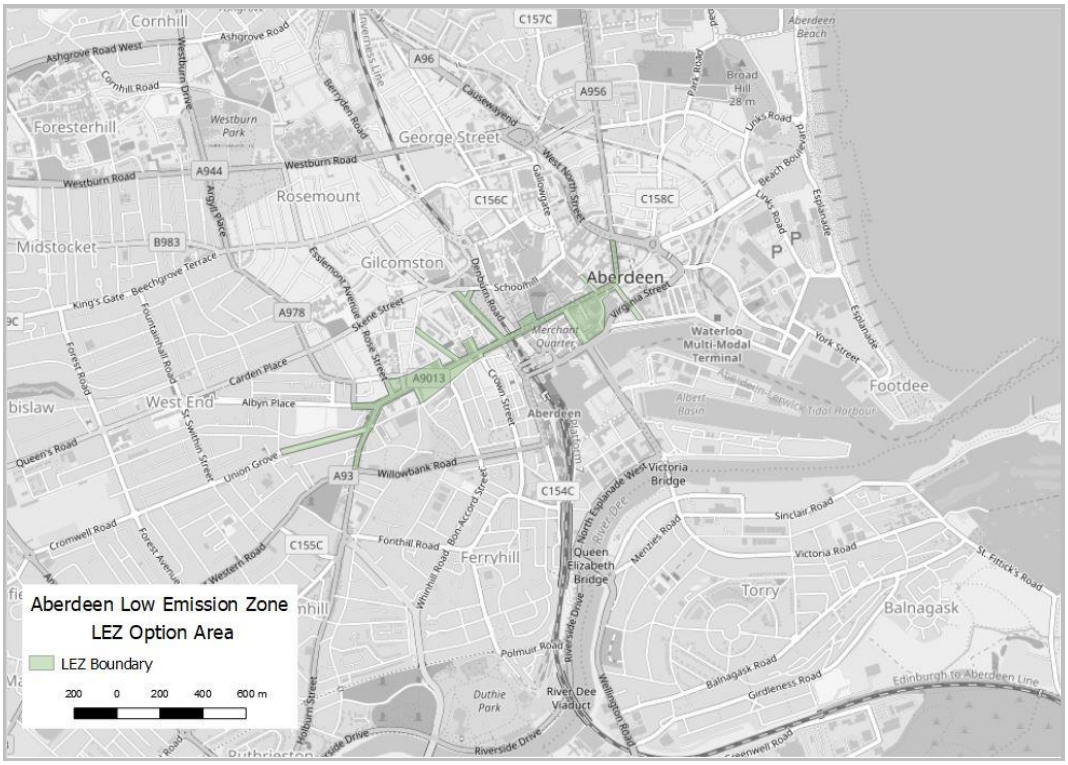

Figure A.4 : Holburn Street/Union Street/King Street

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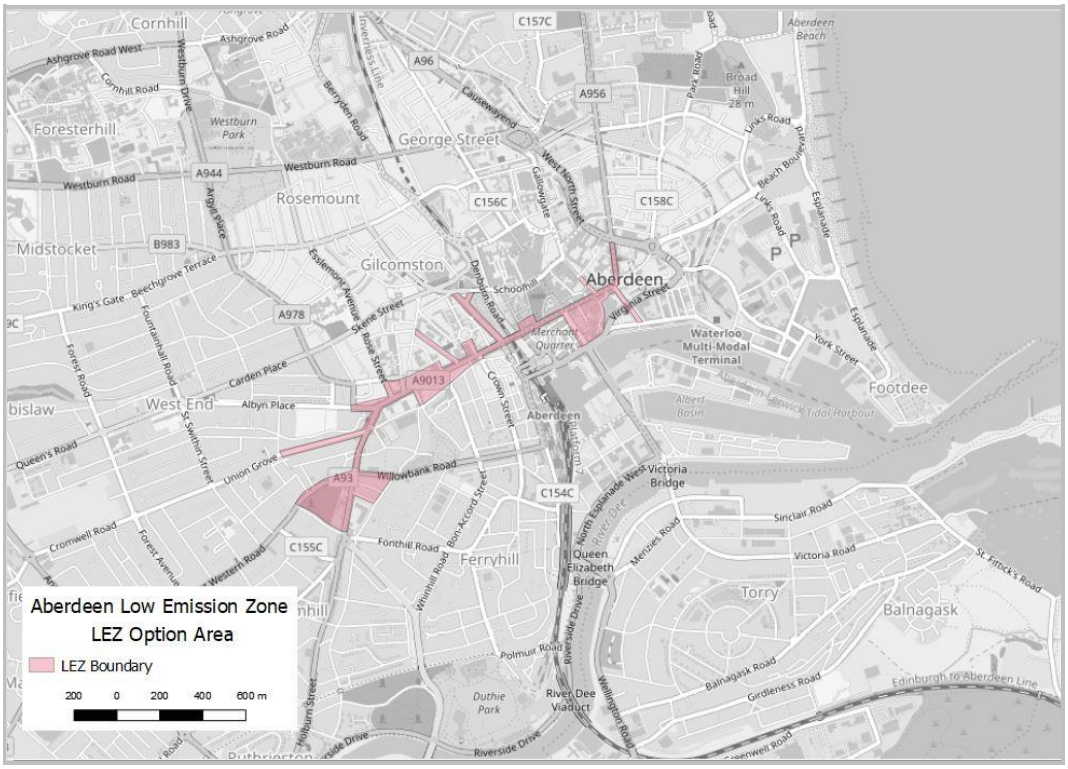

Figure A.5 : City Centre Core

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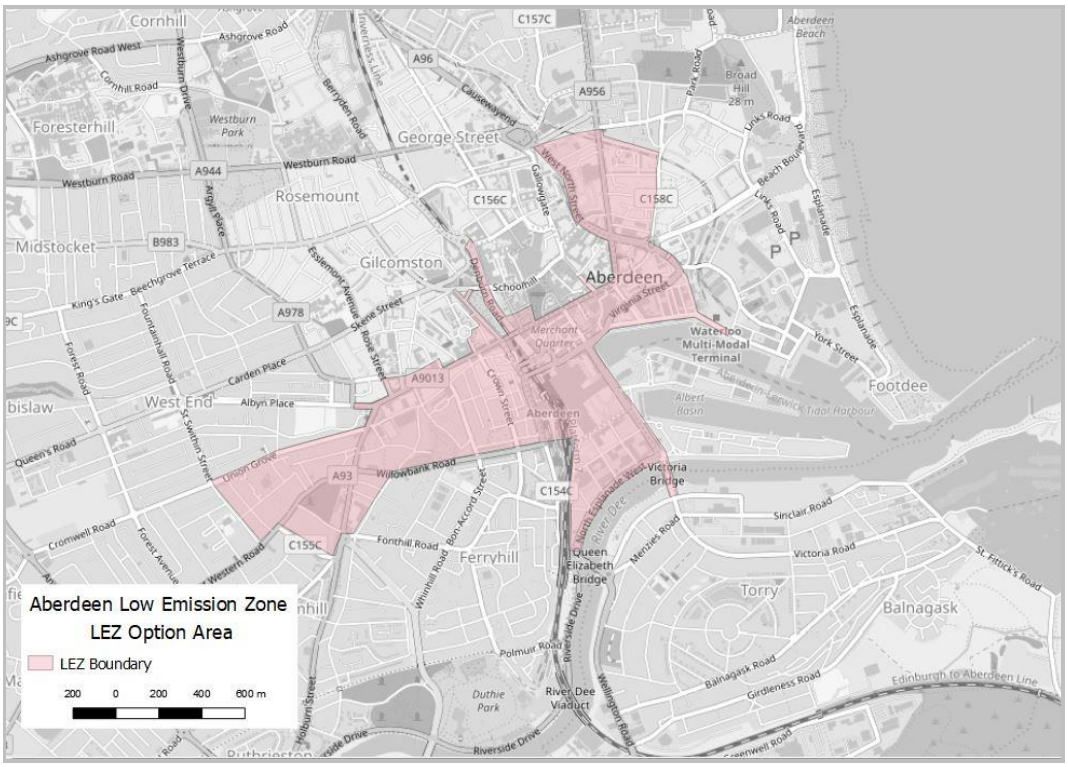

Figure A.6 : City Centre AQMA

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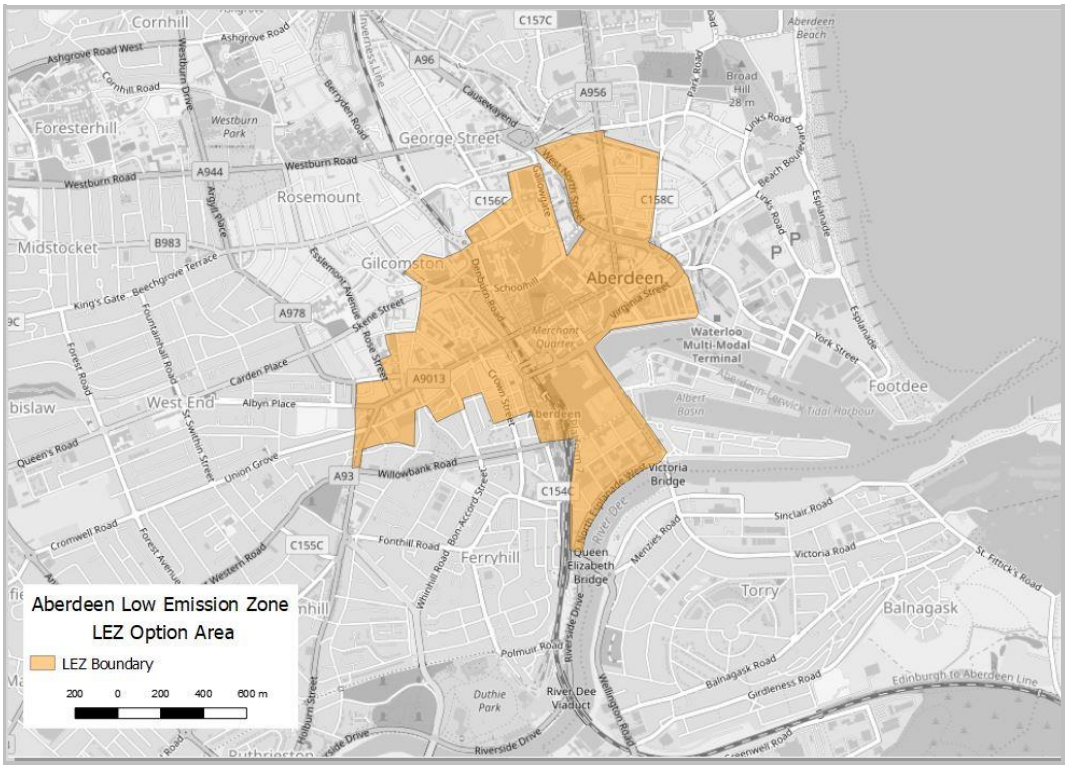

Figure A.7 : City Centre Masterplan

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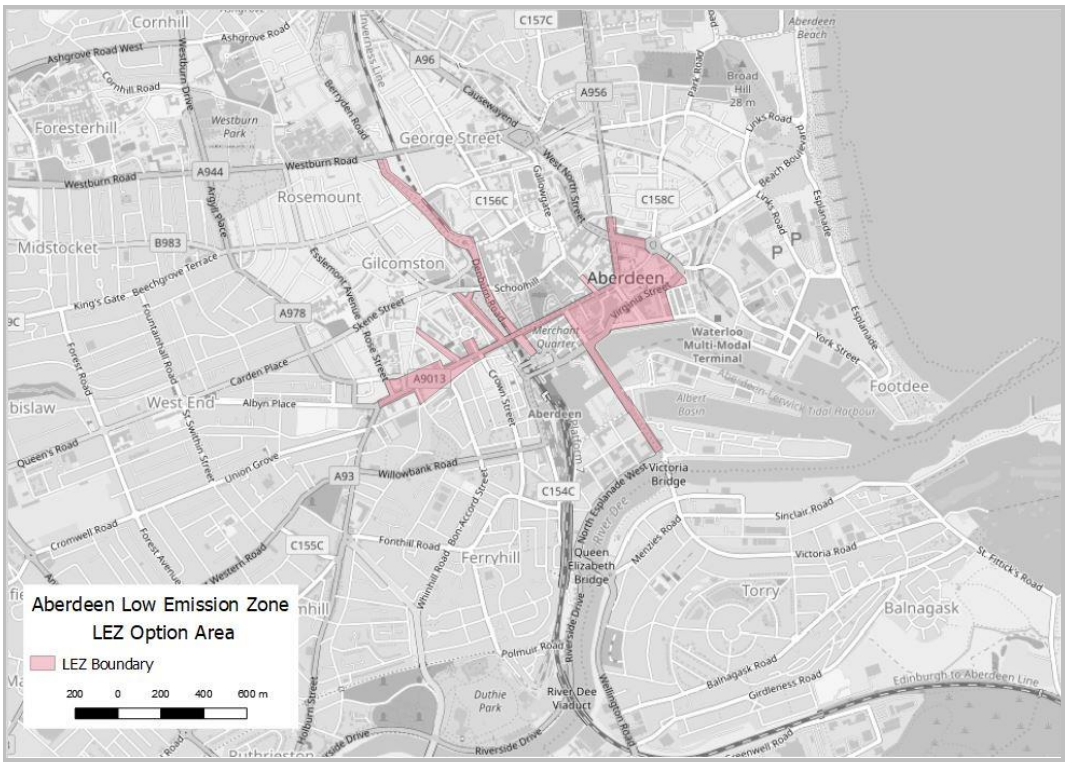

Figure A.8 : City Centre Exceedances

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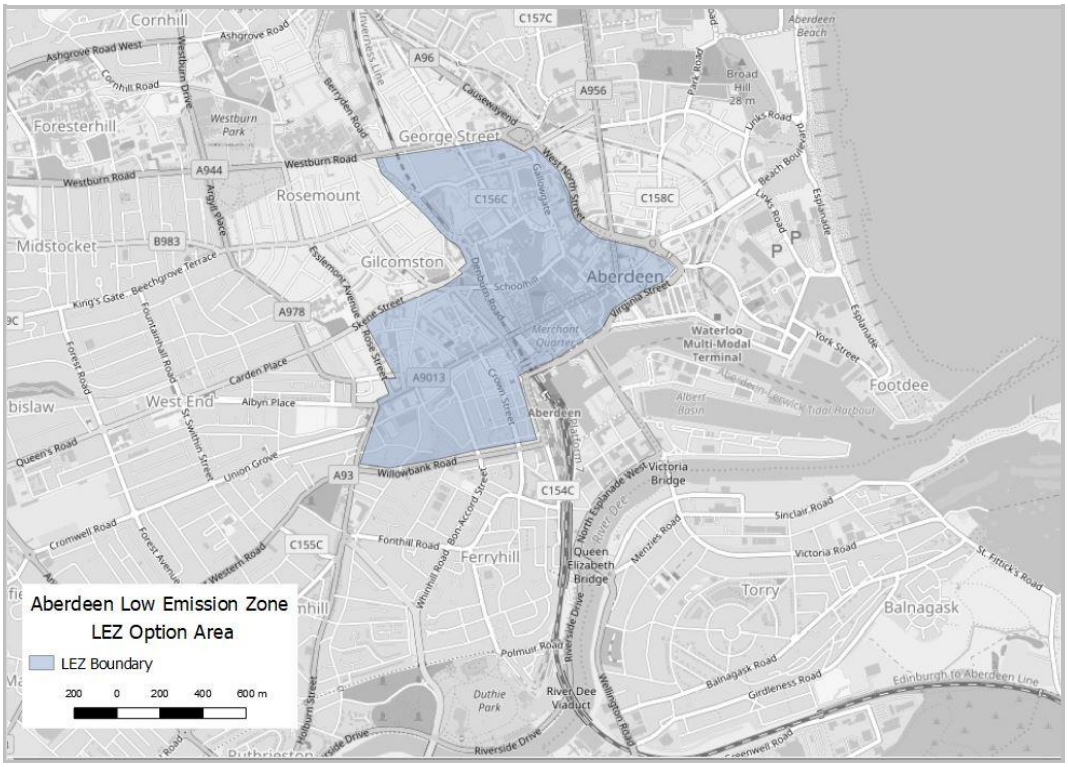

Figure A.9 : Holburn Street to Mounthooly Roundabout

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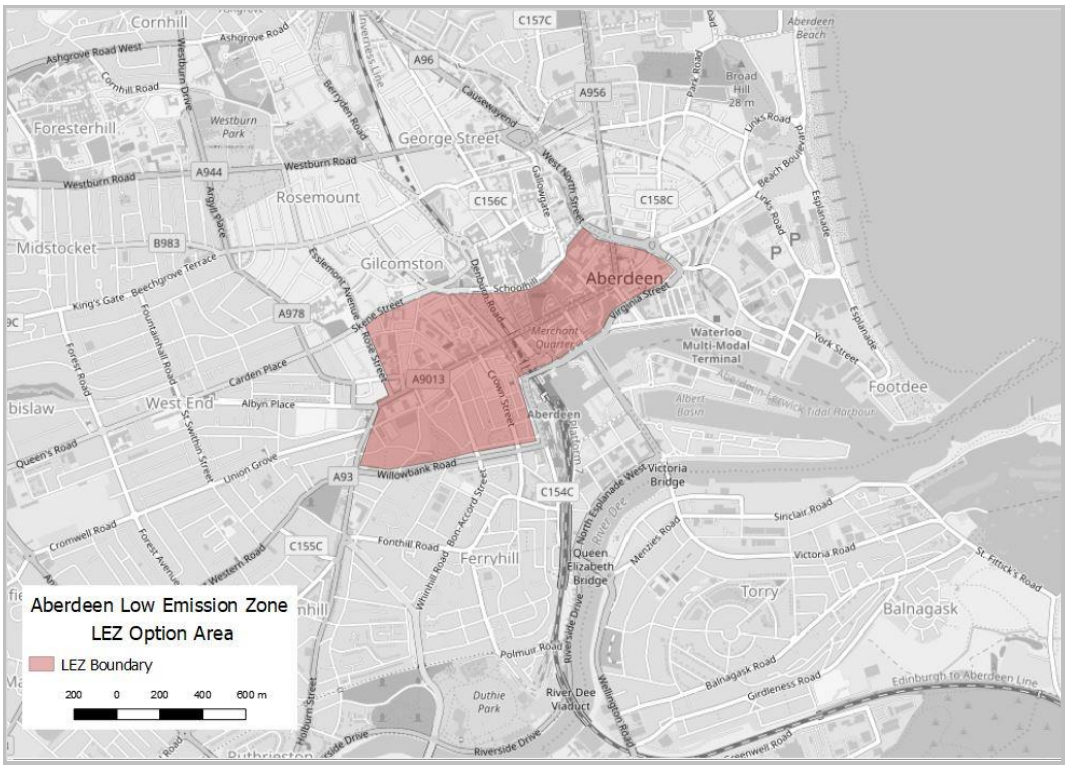

Figure A.10 :Union Street with extended boundary

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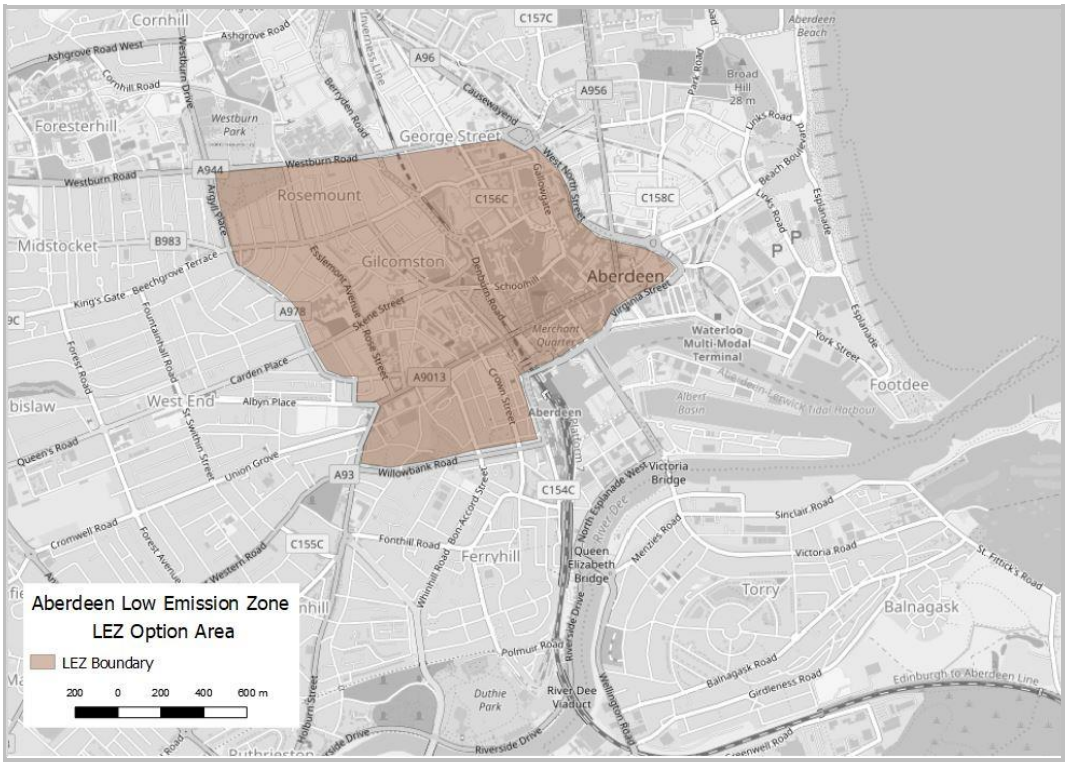

Figure A.11 : Westburn Road/Hutcheon Street to Willowbank Road

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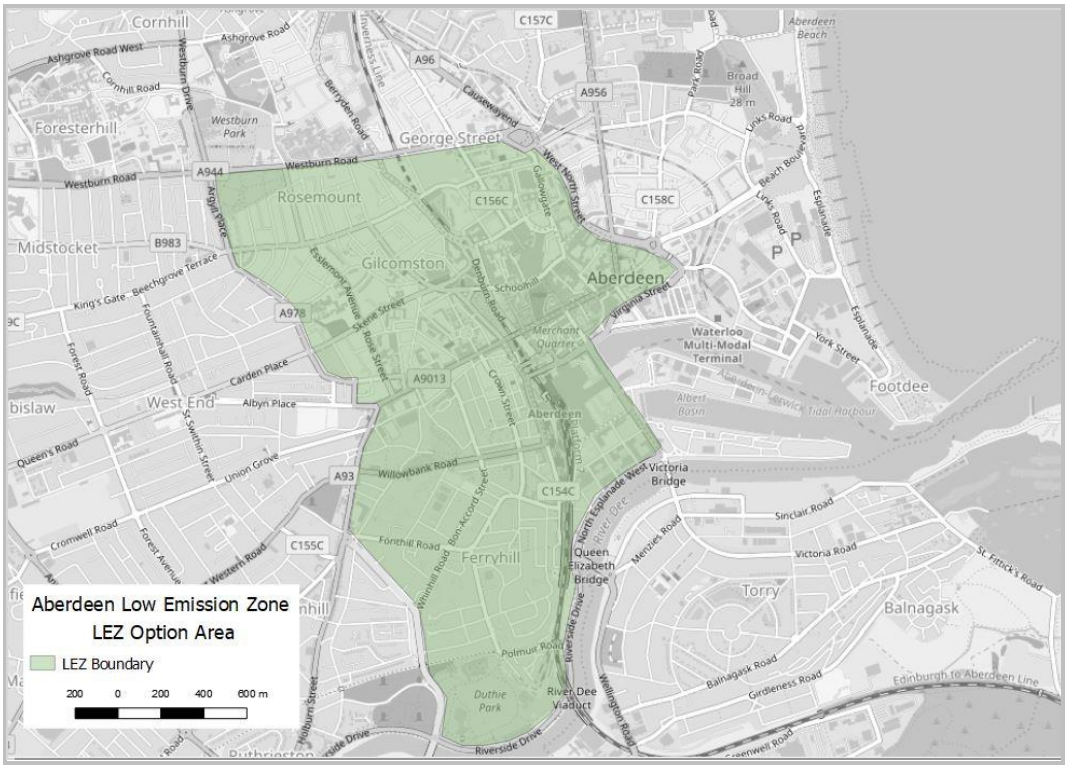

Figure A.12 : Westburn Road/Hutcheon Street to River Dee

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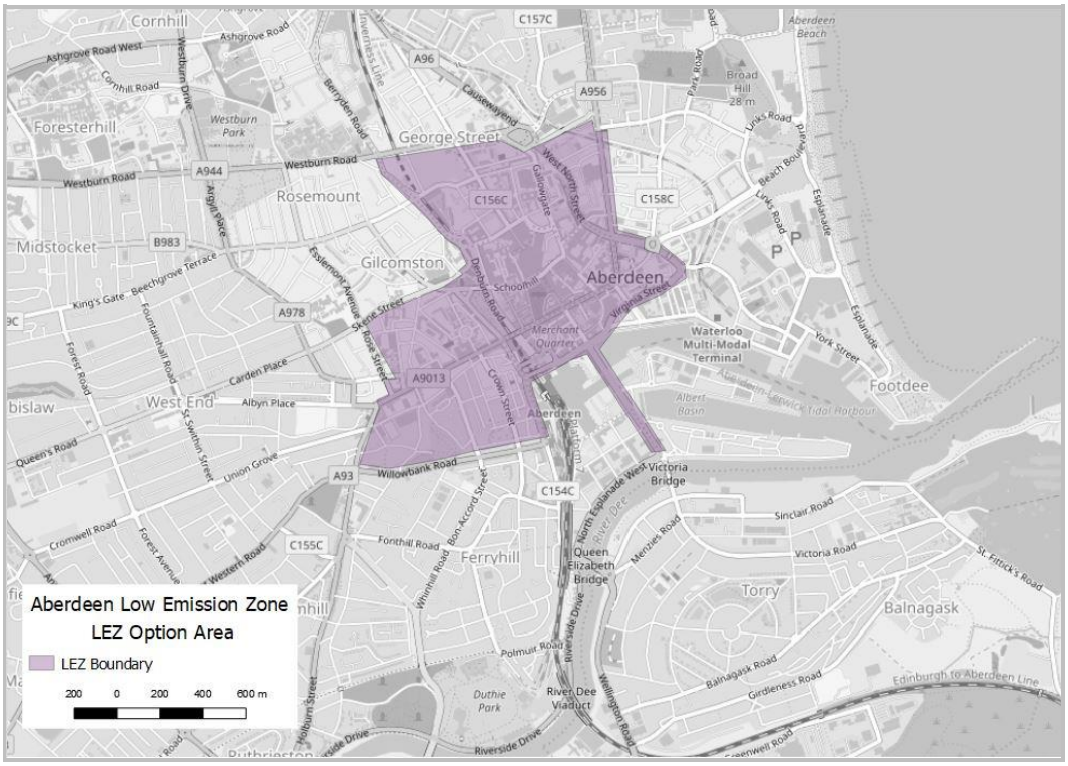

Figure A.13 : City Centre Exceedances with extended boundary

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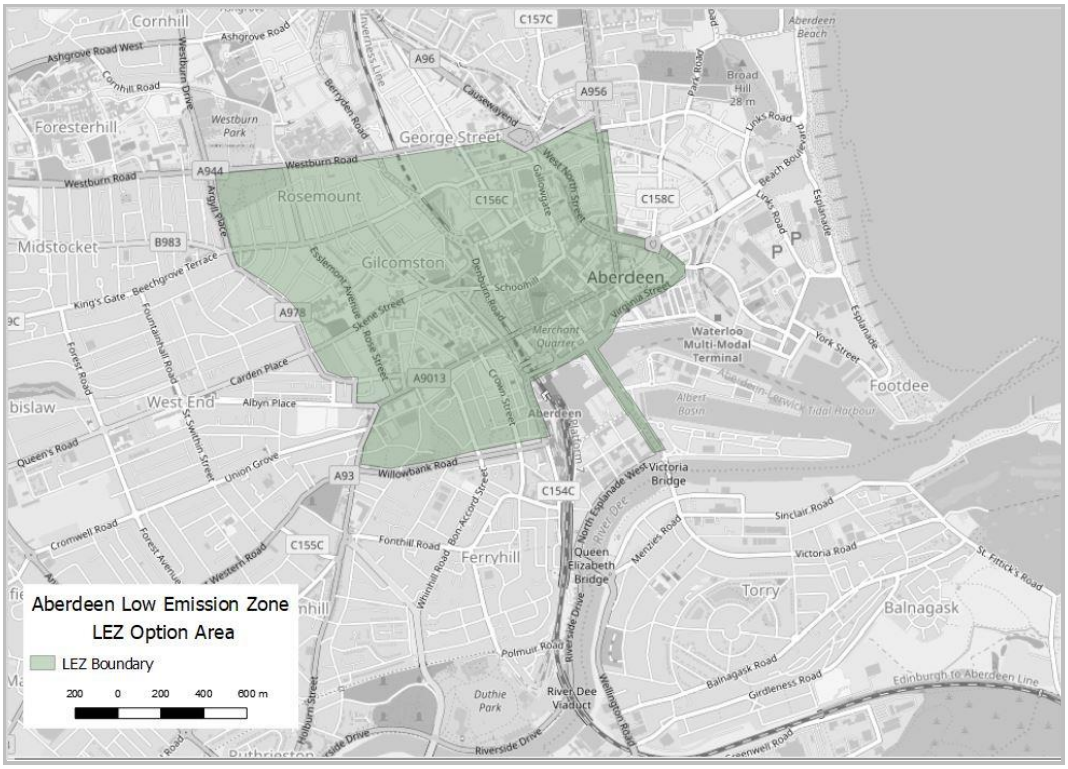

Figure A.14 : City Centre Exceedances with additional extended boundary

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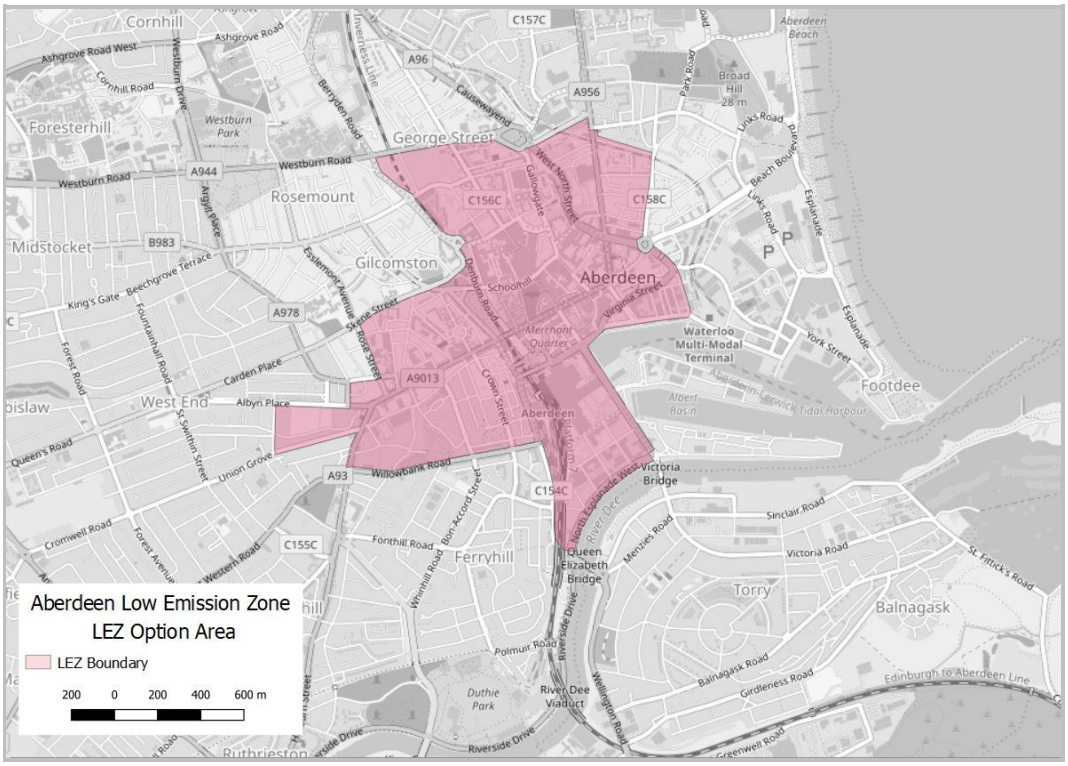

Figure A.15 : City Centre Masterplan with extended boundary

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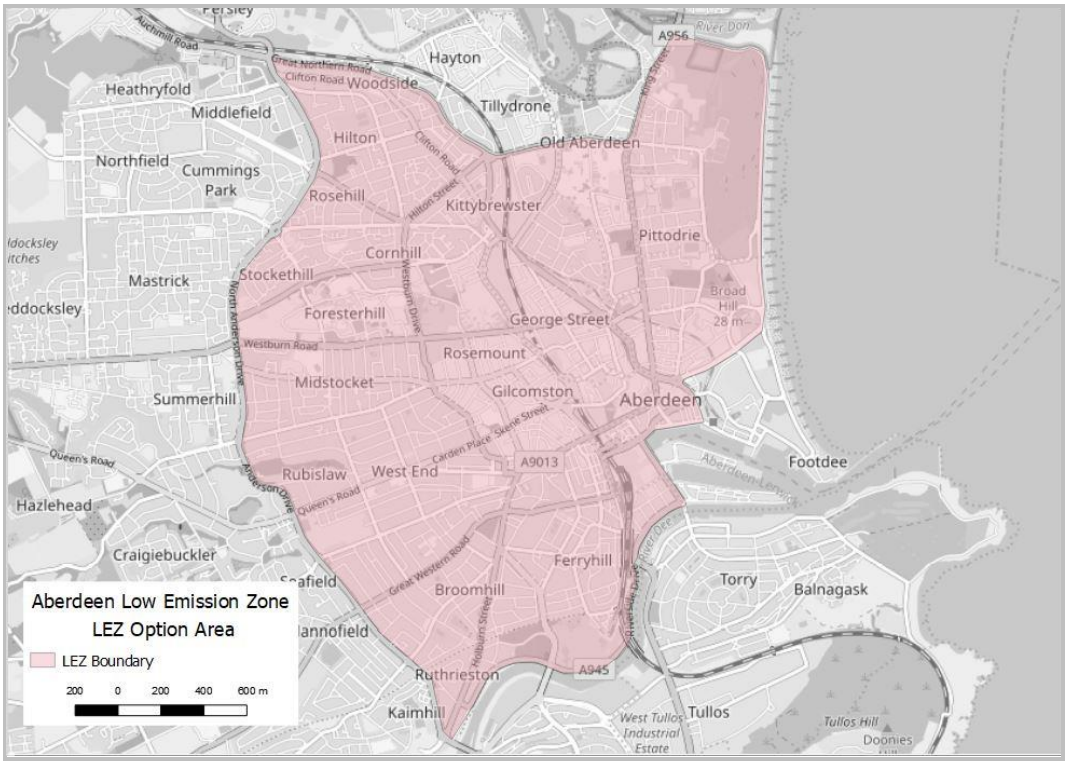

Figure A.16 : Inner City Cordon

APPENDIX B – EMERGING LEZ OPTIONS FOR DETAILED APPRAISAL

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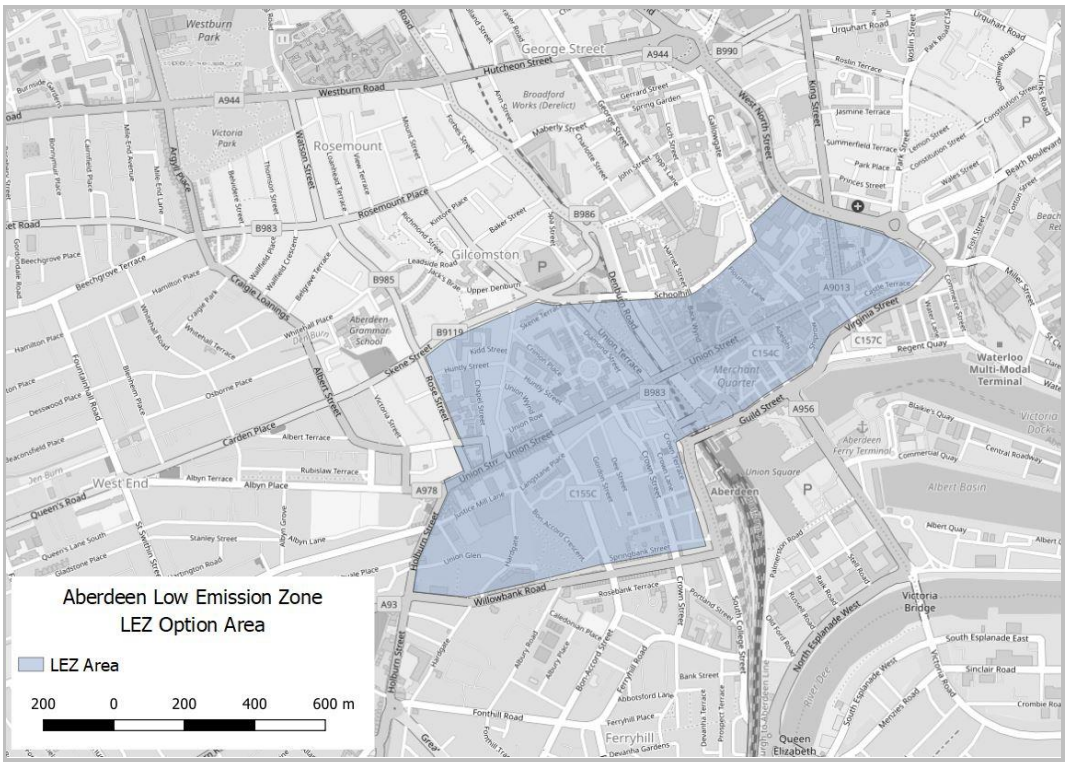

Figure B.1 : Option 1 Union Street Area Bus Only

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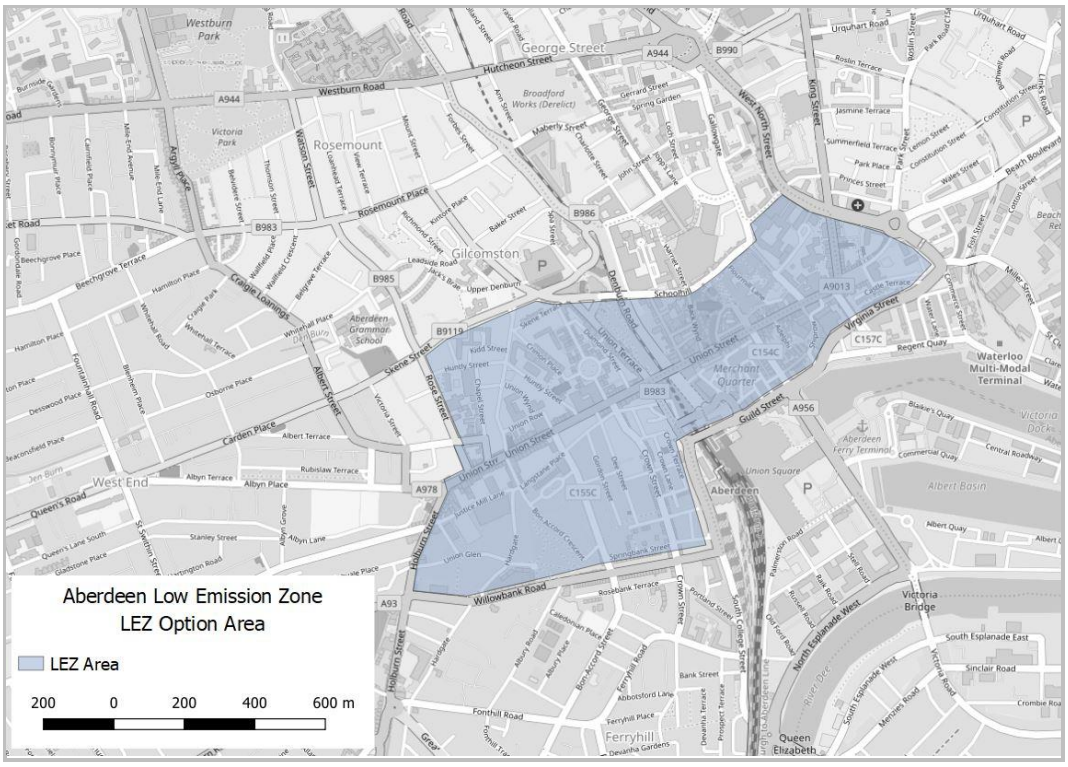

Figure B.2 : Option 2 Union Street Area All Vehicle

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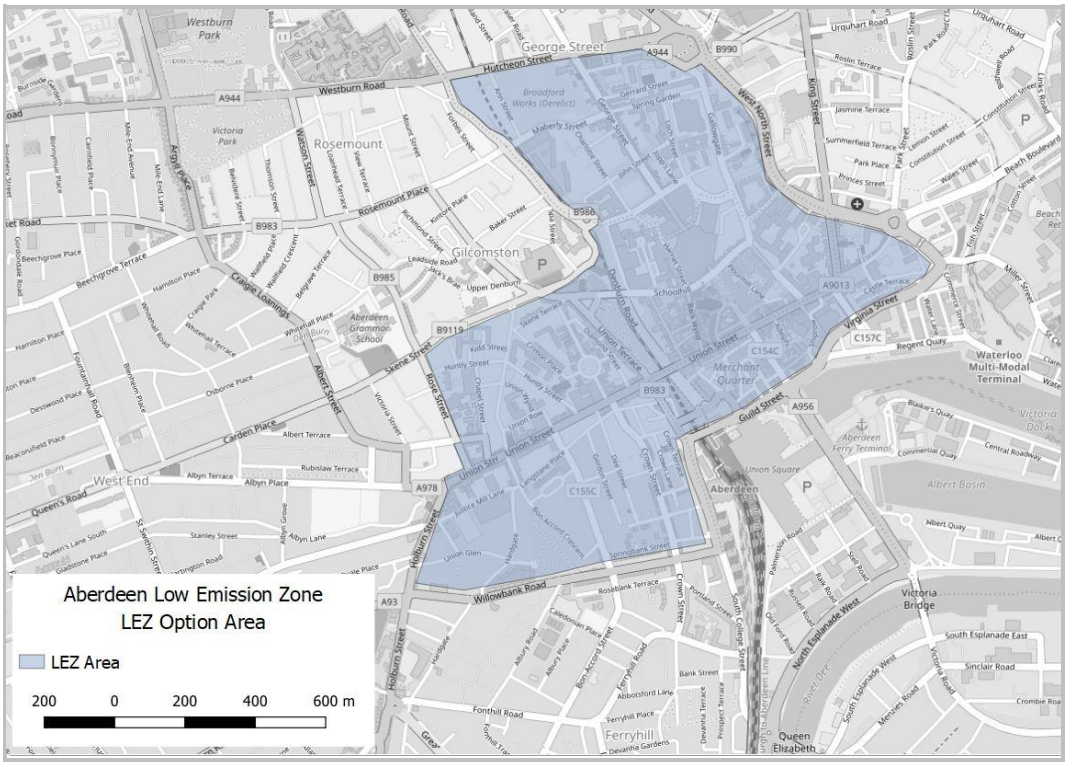

Figure B.3 : Option 3 Union Street & George Street Area All Vehicle

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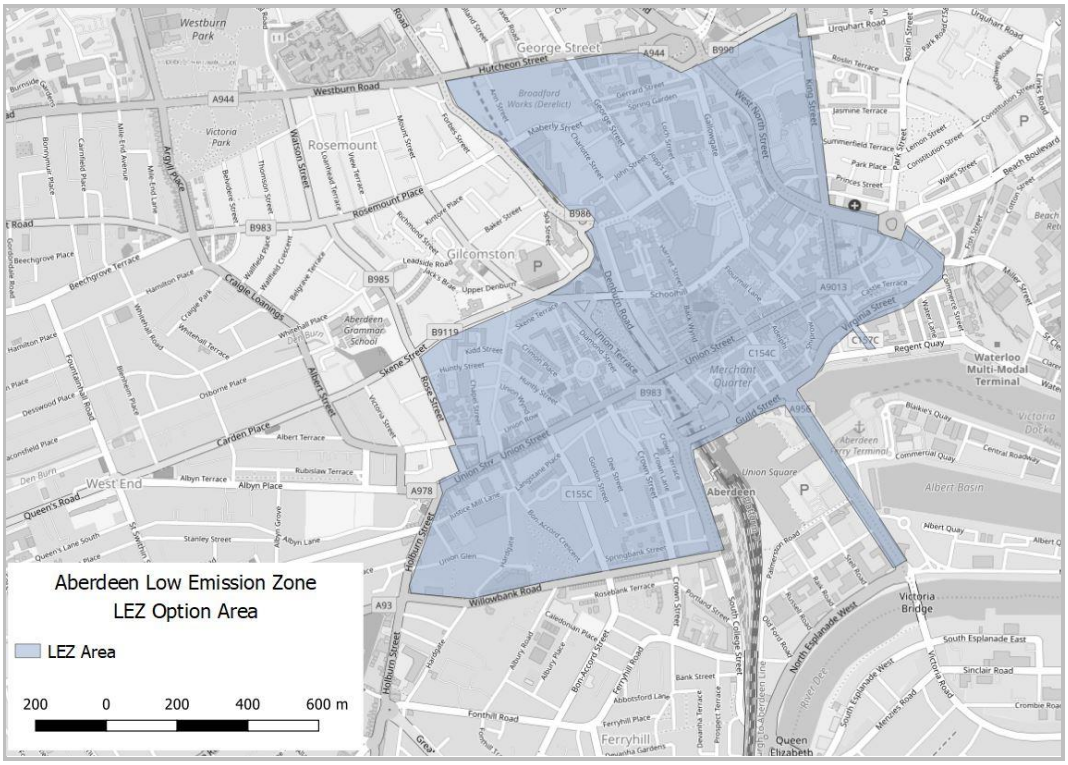

Figure B.4 : Option 4 City Centre Air Quality Exceedance

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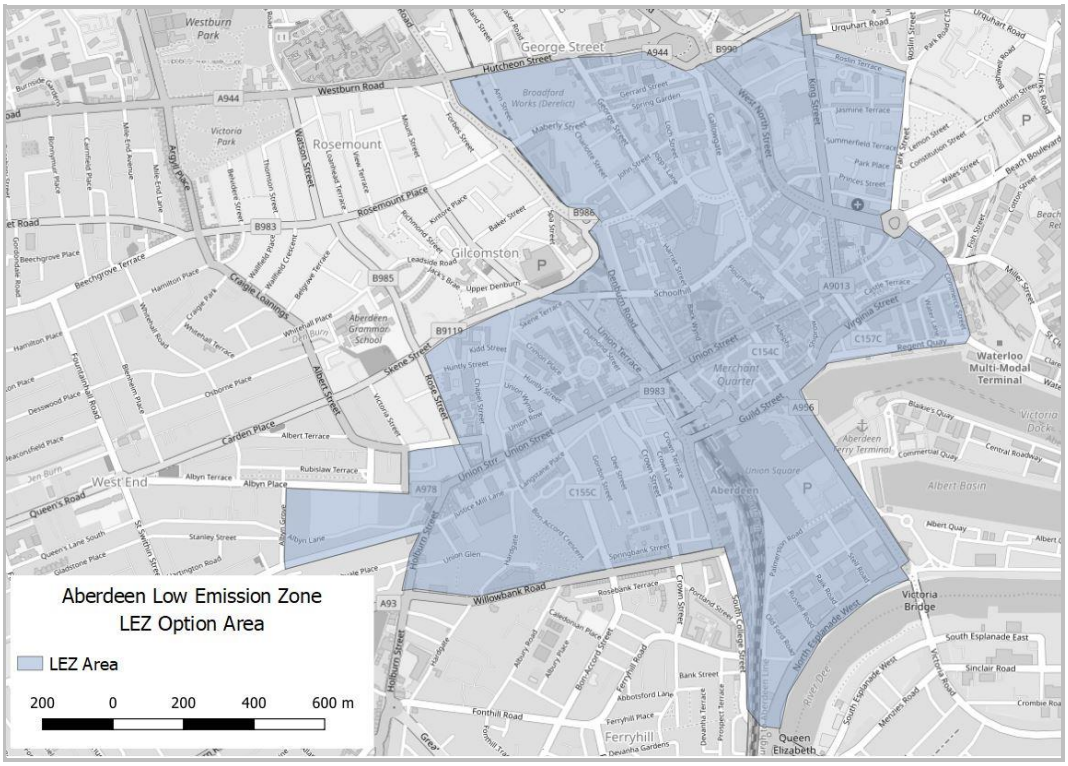

Figure B.5 : Option 5 City Centre Masterplan

APPENDIX C – ROADS WHICH FORM PART OF ABERDEEN LEZ

A list of all roads which form part of the zone, as required by the Transport (Scotland) Act 2019 is listed below

Road Name	Detail
Academy St	Full length
Adelphi	Full length
Affleck Pl	Full length
Afflect St	Full length
Albany Ct	Full length
Albyn Ln	From Albyn Grove Junction to end of lane by Holburn St
Albyn Pl	From Albyn Pl Junction to Albyn Pl Junction (semi crescent by Harlaw Academy)
Alford Pl	Full length
Back Wynd	Full length
Bath St	Full length
Belmont St	Full length
Board St	Full length
Bom-Accord Cres	Full length
Bom-Accord Cres Ln	Full length
Bon-Accord Ln	Full length
Bon-Accord Square	Full length
Bon-Accord St	Full length
Bon-Accord Terrace	Full length
Bridge Pl	Full length
Bridge St	Full length
Carmelite Ln	Full length
Carmelite St	Full length
Castle St	Full length
Castle Terrace	Full length
Castlehill	Full length
Chapel St	Full length
College St	From Windmill Brae Junction to Wapping St
Commerce St	From Beach Blvd Rdb to Mearns St Junction
Concert Ct	Full length
Correction Wynd	Full length
Craibstone Ln	Full length
Crimon Pl	Full length
Crown Ln	Full length
Crown St	Full length
Crown Terrace	Full length
Dee Pl	Full length
Dee St	Full length
Denburn Rd	Full length
Diamond Ln	Full length
Diamond Pl	Full length
Diamond St	Full length
E Craibstone St	Full length
E Green	Full length

E N St	Full length
Exchange Ln	Full length
Exchange St	Full length
Flourmill Ln	Full length
Gaelic Ln	Full length
Gallowgate	From Upperkirkgate Junction to Littlejohn St Junction
Gilcomstoun Ct	Full length
Golden Square	Full length
Gordon St	Full length
Guild St	Full length
Hadden St	Full length
Hardgate	Full length
Holburn St	From Union St Junction to Ashvale Pl Junction
Huntly St	Full length
Imperial Pl	Full length
Justice Mill Brae	Full length
Justice Mill Ln	Full length
Justice St	Full length
Kidd St	Full length
King St	From Marischal St Junction to W N St Junction
Langstane Pl	Full length
Lindsay St	Full length
Little Belmont St	Full length
Little Chapel St	Full length
Littlejohn St	Full length
Marischal St	Full length
Market St	From Union St Junction to Union Square bus station
Market Stance	Full length
Marywell St	Full length
Minister Ln	Full length
N Silver St	Full length
Netherkirkgate	Full length
Oldmill Rd	Full length
Peacock's Cl	Full length
Poultry Market Ln	Full length
Queen St	Full length
Rennie's Ct	Full length
Rennie's Wynd	Full length
Rose Pl	Full length
Rose St	From Thistle St Junction to Union St Junction
Ruby Ln	Full length
Ruby Pl	Full length
S Silver St	Full length
Schoolhill	From Upperkirkgate to Back Wynd Junction
Shiprow	Full length
Shoe Ln	Full length
Shore Brae	Full length
Shore Ln	Full length
Skene Terrace	Full length
Springbank St	Full length
Springbank Terrace	Full length

St John's Pl	Full length
St Mary's Pl	Full length
St Nicholas Ln	Full length
St Nicholas St	Full length
Stirling St	Full length
Strawberry Bank Parade	Full length
Summer St	Full length
The Green	Full length
Theatre Ln	Full length
Thistle Pl	Full length
Thistle St	From Rose St Junction to Chapel St Junction
Trinity Ln	Full length
Trinity Quay	Full length
Trinity St	Full length
Union Bridge	Full length
Union Glen	From Holburn St Junction to Bon Accord Gardens
Union Glen Ct	Full length
Union Grove	From Albyn Grove Junction to Holburn St Junction
Union Row	Full length
Union St	Full length
Union Terrace	Full length
Union Wynd	Full length
Upprtkirkgate	Full length
Virginia Ct	Full length
Virginia St	Full length
W Craibstone St	Full length
Wapping St	Full length
Weigh-House Square	Full length
Whitehouse St	Full length
Willowbank Rd	Full length
Willowgate Cl	Full length
Windmill Brae	Full length
Windmill Ln	Full length