Transport and Environment Committee

10.00am, Thursday, 27 January 2022

Low Emission Zone – Carbon Impact

Executive/routine	**Executive**
Wards	**All**
Council Commitments	18

1. Recommendations

1.1 It is recommended that the Transport and Environment Committee:

1.1.1 Note that this report responds to the actions approved by Committee on 26 October 2021 and follows Committee approval of the preferred Low Emission Zone scheme for consultation (the Scheme), on 17 June 2021;

1.1.2 Note that Low Emission Zones (LEZs) cannot directly reduce vehicular carbon dioxide (CO_2) emissions within Scotland's current LEZ structures. Managing demand, decarbonisation and modal shift will reduce CO_2;

1.1.3 Note that after further consideration of consultation feedback and emission modelling undertaken by Scottish Environment Protection Agency (SEPA) since October, no changes to the Scheme boundary or grace period could be justified, in relation to CO_2 emission reductions;

1.1.4 Agree to proceed with the Scheme and to publish it for a period of 28-days as per statutory requirements;

1.1.5 Approve further design and delivery of the Scheme, including its Network Management Strategy, to meet the national timeline agreed between the four cities and the Scottish Government; and

1.1.6 Note that the recently published Cleaner Air for Scotland 2 strategy agrees to explore opportunities for promoting zero carbon city centres within Scotland's LEZ structure by 2026. The Council's 2030 Climate Strategy agrees to explore this from 2022/23.

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Executive Director of Place

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Report

Low Emission Zone – Carbon Impact

2. Executive Summary

2.1 This report follows up on actions approved by the Transport and Environment Committee on 26 October 2021. It provides further analysis to evidence the Scheme's role in contributing to reductions in greenhouse gas emissions derived from transport, primarily carbon dioxide ('CO_2', 'carbon'). Assessments of changes to the boundary and grace period were made, in relation to consultation feedback on carbon impact.

2.2 The recent Low Emission Zone (LEZ) consultation, undertaken between June and September 2021, indicated that some stakeholders are concerned about the ongoing Climate Emergency and are aware of the challenges faced in achieving the Council's ambitious net zero target by 2030. Some stakeholders also recognised that current LEZ structures do not directly contribute to reducing carbon emissions or tackle congestion.

2.3 The National Modelling Framework (NMF) requires LEZs to be evidence-led. Appraisal work to support a preferred LEZ design, as presented in June and October 2021, confirmed that the Scheme will reduce harmful nitrogen dioxide (NO_2), to achieve statutory air quality objectives and protect public health.

2.4 CO_2 emission modelling has also been completed via the evidence-led NMF, since October 2021, which confirms that the enforcement of the vehicle emission standards will not directly reduce CO_2 emissions. Contributions to reducing CO_2 emissions will only be achieved via the Scheme's discretionary objectives, unless statutory changes are made to the national LEZ enforcement regime.

2.5 After considering consultation feedback regarding the Scheme's potential to reduce CO_2 emissions and the results of the NMF CO_2 emission modelling, changes to the Scheme boundary or grace period cannot be justified.

2.6 The Scheme will be evaluated annually to understand its contributions to reducing NO_2 and CO_2 emissions, alongside progress towards achieving other Scheme objectives. Evaluation methodologies will integrate with the City Mobility Plan (CMP), 2030 Climate Strategy and the Local Air Quality Management regime.

2.7 Actions contained within the CMP and Climate Strategy will deliver significant reductions in CO_2 emissions associated with transport, through demand management, decarbonisation and modal shift.

2.8 The Council will explore future opportunities with Scottish Government for zero carbon city centres within Scotland's LEZ structure by 2026, as per the national Cleaner Air for Scotland 2 strategy and the Council's 2030 Climate Strategy.

3. Background

3.1 On 26 October 2021, Transport and Environment Committee considered a report on Low Emission Zone – Consultation and Development. This report set out the findings of the consultation undertaken between 28 June and 20 September 2021 as well as development of the Scheme. The approved recommendations are included in Appendix 1.

3.2 During the 12-week consultation period, stakeholders were asked to review key aspects of the Scheme, as summarised in a consultation document published on the Council's webpages, social media and reported in June 2021.

3.3 The scheme objectives are summarised below:

3.3.1 Contribute towards meeting the air quality objectives prescribed under Section 87(1) of the Environment Act (1995);

3.3.2 Contribute towards reduction of emissions in fulfilment of Part 1 of the Climate Change (Scotland) Act 2009;

3.3.3 Minimise the impact from traffic displacement across the city's transport network, related to LEZ scheme;

3.3.4 Strategically align with the Council's sustainable transport, active travel and placemaking objectives; and

3.3.5 Strategically align with national funding provision policies, supporting individual and business adaptation.

3.4 Objectives listed in 3.3.1 and 3.3.2 are statutory objectives, to contribute to reductions in NO_2 and CO_2 emissions, respectively. These have been amended to align fully with Scotland's LEZ regulations ('the Regulations'). Objectives listed from 3.3.3 to 3.3.5 are discretionary Scheme objectives.

3.5 The cyberattack on the SEPA significantly impacted their internal systems and air quality modelling capabilities, though the NMF obligations were prioritised during recovery. The NMF outputs produced to date for Edinburgh have primarily focused on NO_2. These results were reported in full to Committee, in June and October 2021.

3.6 Following October Committee meeting, SEPA, via the NMF, analysed the modelled CO_2 emissions of the Scheme and of LEZ variations to understand its carbon impact which is described herein.

3.7 The Council declared a Climate Emergency setting a vision for Edinburgh to be net zero by 2030. Delivering net zero emissions by 2030 and adapting to the impacts of climate change will require system-wide and transformational change across all sectors of the city. The CMP and 2030 Climate Strategy and Implementation Plan represent substantial programmes of work to deliver reductions in CO_2 emissions.

Delivery of actions to manage demand, decarbonise transport and accelerate modal shift will require support from key partners, including citizens, businesses, communities, Transport Scotland, Scottish and UK Governments.

3.8 Carbon impact analysis relating to the Scheme highlights the challenges in reducing CO_2 emissions derived from transport across Edinburgh. This analysis provides further evidence that comprehensive actions will be required to reach net zero emissions by 2030.

3.9 The Scheme is recognised as a major deliverable of the CMP to improve air quality by reducing harmful NO_2, by supporting behaviour change to encouraging modal shift and the uptake of lower emission vehicles. The Scheme will reduce harmful NO_2, within and beyond the Scheme boundary, as evidenced by the NMF and in June 2021.

4. Main Report – Carbon Impact

Overview

4.1 The Regulations mandate that LEZs contribute towards the reduction of greenhouse gas emissions, including CO_2.

4.2 Notably, the Regulations utilise the Euro emission standards framework that was originally designed to address air quality objectives for pollution (NO_2) and does not enable enforcement based upon CO_2 emissions or engine size.

4.3 The minimum vehicle emission standards for LEZs is defined in the regulations and are categorised by Euro standard and fuel type:

4.3.1 Euro 6: diesel cars and light goods vehicles (generally those registered from September 2015);

4.3.2 Euro 4: petrol cars and light goods vehicles (generally those registered from January 2006); and

4.3.3 Euro VI: HGVs, buses/coaches.

4.4 These represent the highest Euro standards currently available and assess vehicles according to tailpipe emissions of the following pollutants that are harmful to human health: carbon monoxide (CO), oxides of nitrogen (NOx) including NO_2, total hydrocarbon emissions (THC), non-methane hydrocarbons (NMHC), and particulate matter (PM).

4.5 Future Euro standards (Euro 7) are expected to come into force and will include measures based on CO_2 emissions, in addition to pollutants that address air quality objectives (NO_2) in the current Euro standards (Appendix 2). When developed, the Council could explore an update to the Scheme to include these new Euro standards or other measures, as soon as LEZ regulations allow, in partnership with SEPA and Transport Scotland.

4.6 Therefore, the Scheme's enforcement regime is not directly correlated with CO_2 emission output and the Scheme cannot directly preclude the use of Internal

Combustion Engine (ICE) vehicles within its boundary. Most fossil-fuelled vehicles can freely access the Scheme, so long as they meet the minimum Euro standards and are compliant with the Regulations.

4.7 Furthermore, Scotland's LEZ structure does not currently allow users to pay an access charge within the current legislative framework, but rather charges a penalty notice for non-compliant vehicles. Under England's model for its Clean Air Zones (CAZ), non-compliant vehicles may pay an access charge to enter.

4.8 England's CAZ legislative framework means that all ICE vehicles must pay a daily access charge and zero emission EVs may enter freely. A Zero Emission Zone (ZEZ) in Oxford is due to be piloted in February 2022 and London's 2018 Transport Strategy roadmap seeks implementation of access charged ZEZs in Central London from 2025. In Europe, the Netherlands Government has agreed to allow only zero emission commercial vehicles to enter 14 urban centres from 2025, with support funds available for business adaptation.

4.9 The Council's Parking Action Plan, approved in 2016, allocates parking permits based on vehicle engine size or CO_2 emissions and includes a surcharge for diesel vehicles to improve air quality. All vehicles in Edinburgh are also subject to the DVLA's Vehicle Excise Duty that taxes vehicles based on their CO_2 emissions.

Consultation Feedback

4.10 Key stakeholders recognised the Scheme's role in addressing the Climate Emergency during summer 2021 consultation, though some other stakeholders acknowledged that current LEZ structures do not allow them to directly contribute to reducing carbon emissions or tackle congestion.

4.11 Some key stakeholders were concerned about the coverage of electric vehicle (EV) charging infrastructure. This confirms a misconception about which vehicles are in the scope of LEZ enforcement.

4.12 All consultation questionnaire responses (5,051) were re-analysed to assess comments relating to CO_2 emissions and the Climate Emergency.

4.13 A total of 18 individuals (0.35% respondents) commented about carbon impact in the proposed boundary section of the questionnaire; generally, they wanted to see a larger boundary. A total of 71 individuals (1.41% respondents) commented about carbon impact in the proposed grace period section of the questionnaire; these respondents generally wanted to see grace period reduced in length.

4.14 Generally, consultation respondents were concerned about the barriers to adapting to the Scheme and road network impacts but were supportive of improving air quality.

4.15 Consultation highlighted limited general public knowledge of LEZ Support Funds, provided by Scottish Government for identified impacted groups. Funds provide 'travel better' vouchers incentives, for eligible low-income households and microbusinesses to encourage modal shift to sustainable transport.

4.16 Concerns about the Climate Emergency raised by respondents, in relation to the Scheme, are in line with those raised during recent CMP and Climate Strategy consultations. 93% of respondents to the Climate Strategy consultation believed that climate change is an immediate and urgent problem, evidencing the desire to make Edinburgh a more sustainable and inclusive city.

National Modelling Framework

4.17 SEPA completed further modelling analysis via the NMF, to provide clear evidence as to what extent the Scheme will meet its statutory objectives on greenhouse gas emissions, primarily CO_2, in fulfilment of the Regulations.

4.18 Using the same methodological basis as used to calculate NO_2 and PM emissions in the NMF, as presented to Committee in June and October 2021, CO_2 emissions have been calculated for each road in the LEZ model domain. A number of scenarios were tested and findings are detailed in full in SEPA's report (Appendix 2).

4.19 These main scenarios are summarised below:

4.19.1 The Scheme (City Centre LEZ);

4.19.2 The Scheme and Extended Urban Area (not taken forward as preferred option for consultation, as agreed in June 2021); and

4.19.3 Extended City Centre LEZ Options (in response to consultation, October 2021).

4.20 Results of the evidence-led NMF modelling highlight that carbon emission scenarios considered for all LEZ options, including the Scheme, will have a negligible impact in directly reducing carbon emissions alone.

4.21 SEPA's carbon impact analysis also indicates that extensions to a city centre boundary generally increase carbon emissions, due to the lengthening of diversion routes for non-compliant traffic (see Boundary and Appendix 2).

4.22 Other CMP projects are not included in this NMF assessment to give clarity on how much LEZ, as a standalone project, could directly contribute to CO_2 emission reductions.

Achieving Net Zero Emissions for Transport

4.23 Reducing traffic flows by managing demand, decarbonising transport and modal shift are the three main routes to significantly reduce carbon emissions derived from transport in Edinburgh, as identified in the CMP and reflected in the Climate Strategy:

4.23.1 *Managing demand* to reduce car dominance, congestion and vehicle kilometres; including the expansion of Controlled Parking Zones (CPZ), Workplace Parking Levy (WPL), and a Pay as you Drive Scheme, if necessary;

4.23.2 *Decarbonising transport* by investing in zero emission fleet and infrastructure and on-street EV charging infrastructure; and

4.23.3 *Modal shift* such as by prioritising active travel/public transport investments, integrating public transport, exploring 'last mile' delivery solutions, creating mobility hubs and reducing the need to travel via 20Minute Neighbourhoods.

4.24 Transport Scotland have allocated significant national funds to cities progressing LEZs, to support reductions in CO_2 emission reductions via modal shift. Acknowledging the scale of changes needed, climate change objectives are considered medium to long term, according to Transport Scotland's LEZ Guidance.

4.25 In February 2020, Committee noted that the Council and its regional partners received funds from Transport Scotland through the LEZ Public Transport Provision Fund (PTP) to promote modal shift and support the Scheme's objectives. In total, approximately £3.7m of PTP funds were claimed across SEStran region by the Council and regional local authorities to: create a mobility hub (Brunton Hall), develop Park and Rides, upgrade bus shelters, improve bus prioritisation measures, and install new bus lane enforcement cameras, among other measures.

4.26 In addition, Scottish Government has provided a total of £1.5m in LEZ Support Funds to promote modal shift, for over 450 microbusinesses/low-income households located within 20 kilometres (kms) of the Scheme. Funds have also been allocated for taxi retrofit.

4.27 Lothian Buses are committed to achieving 100% LEZ compliance (Euro 6 or better) across its fleet ahead of enforcement, with support from the Scottish Bus Emissions Abatement Retrofit Fund (BEAR) scheme that has issued over £12m across Scotland since 2018 In the 2021/22 financial year, Transport Scotland provided over £2.7m to retrofit buses and coaches companies that operate in Edinburgh, through BEAR phase 4 (BEAR4).

4.28 Lothian Buses will deliver two pilots for zero tailpipe emission EV and hydrogen vehicles to inform a costed plan for decarbonising their fleet, as outlined in the Climate Strategy. Lothian Buses are committed to achieving 100% LEZ compliance (Euro 6) across its fleet ahead of LEZ enforcement.

4.29 The Council is developing a fleet decarbonisation plan with a target for all cars and vans to be 100% decarbonised by 2023 and larger vehicles by 2030. Lothian Buses and the Council will explore all funding streams available to accelerate fleet decarbonisation, such as the recent award from Zero Waste Scotland for five fully electric waste collection vehicles.

4.30 Many initiatives will intersect across all three CMP themes, including the delivery of programmes such as the City Centre Transformation (ECCT), City Centre West-East Link (CCWEL), rollout of EV charging points and installation of secure on-street cycle storage. Such strategic projects, promote modal shift in combination, improve public realm and support the reduction of harmful emissions from transport.

4.31 Committee recently approved the CMP Citywide Mode Share Targets, to reduce car kms across Edinburgh by 30% by 2030, ahead of the national target for a 20% reduction car kms by 2030.

4.32 Preliminary and high-level analysis by the Council suggests that significant CO_2 reductions would occur if a 30% reduction in car kilometres travelled target is achieved by 2030, as a measure of modal shift. Further reductions would be achieved if EV uptake is in line with projections for Edinburgh, as a measure of decarbonisation. SEPA ran a scenario to explore the impact of demand management on carbon emissions. Initial findings suggest that CO_2 reductions can be made if demand is reduced (see Appendix 2).

Scheme Considerations

4.33 Key issues raised during consultation focused on the boundary, specifically around: displacement impacts of traffic and air quality considerations, impact of parking displacement, and whether air quality would improve in areas beyond the boundary.

4.34 Following October Committee, minor amendments to the Scheme boundary based on consultation feedback were analysed by SEPA to understand the carbon impacts of proposed changes.

4.35 Notably, options focused on minor boundary alterations in areas identified by key stakeholders during consultation, primarily in relation to traffic displacement and network management rather than carbon impact.

4.36 All boundary alterations considered were excluded based on the NMF carbon emission scenario analysis, as previously outlined. Any boundary change in the West End and south east were found to lead to significant increase in the length of diversion route for non-compliant traffic and did not resolve displacement impacts. Extending the boundary in the north east to include Calton Hill would have negligible carbon impact (see Appendices 2 and 3).

4.37 Following October Committee, officers have further reviewed the consultation feedback received in respect of the boundary and carbon emissions and have concluded that there is no evidence to justify any alteration to the boundary.

4.38 Key stakeholders were generally supportive of the grace period approach and two-year grace period that will see enforcement from June 2024 onwards.

4.39 Other stakeholders stated that a two-year grace period should be longer, generally based on cost of adapting. Other stakeholders stated that a two-year grace period should be shorter, generally to accelerate air quality improvements.

4.40 Changes to the grace period are not anticipated to directly contribute towards reductions in carbon emissions (see Appendix 2).

4.41 Following October Committee, officers have further reviewed the consultation feedback received in respect of the grace period length and carbon emissions and have concluded that there is no evidence to justify any alteration to the grace period approach or grace period length on this basis.

4.42 Without this evidence base any changes to main Scheme elements (boundary, grace period) represent considerable risk for the process or the Scheme to be legally challenged.

4.43 Any alterations to the boundary would require further consultation for 12 weeks, to satisfy the Council's Consultation Policy requirements and would significantly delay programme delivery. Alterations to the grace period would also require a 12 week consultation and would significantly delay programme delivery.

4.44 The main Scheme elements, as proposed, can meet the national timelines, for programme delivery and to ensure that local air quality benefits are realised.

4.45 Considering the Council's risk appetite statement, officers cannot recommend that alterations are made to the Scheme boundary or grace period. There is no evidence to support such a recommendation or to justify such alterations (i.e. minor/major) in respect of the Scheme objectives.

Evaluation

4.46 An annual progress report on Scheme operation and effectiveness will evaluate air quality reductions (NO_2), Network Management impacts and uptake of LEZ Support Funds as outlined in June 2021.

4.47 The 2030 Climate Strategy Implementation Plan sets out a framework for assessing and measuring progress towards the strategy's comprehensive outcomes. Transport emissions will be reported on an annual basis as part of the city-wide emissions monitoring, as outlined in the 2030 City Target Monitoring Approach.

4.48 The Scheme is exploring ways to assess carbon impact but is likely to do so indirectly, for example by analysing vehicle class and traffic flows within or near to the boundary (see Appendix 3). The Scheme will continue to develop methodologies for carbon evaluation, in collaboration with SEPA and Transport Scotland and in alignment with the CMP and 2030 Climate Strategy's emission methodologies (e.g. Emission Factor, Carbon Scenario Tool etc.).

4.49 Financial impacts of the LEZ Scheme, in relation to operation and effectiveness, will be assessed as part of the annual progress report – see also Financial Impact.

Policy Development

4.50 In July 2021 Scottish Government published the Cleaner Air for Scotland 2 strategy (CAFS2). This strategy aims to tackle poor air quality by linking with wider policies and strategies across transport, climate change, environment, health, planning energy and land use.

4.51 The Council has committed to work alongside the Scottish Government, Transport Scotland, citizens and other relevant partners to explore opportunities to promote zero carbon city centres, in line with CAFS2 and national partners. The Council's 2030 Climate Strategy Implementation Plan agrees to explore opportunities for zero carbon city centres using the LEZ structure, from 2022/23 onwards.

5. Next Steps

5.1 If the recommendations of this report are approved, officers will:

5.1.1 Proceed with the Scheme, as presented to Committee on 26 October 2021, and to publish the Scheme for a period of 28-days in line with statutory requirements;

5.1.2 Return to Committee following the statutory period for approval of the Scheme, for submission to Scottish Ministers; and

5.1.3 Further develop Scheme designs, including for the Network Management Strategy, to deliver the Scheme to the national timeline, as agreed between the four cities and the Scottish Government;

6. Financial Impact

6.1 Any revenue generated from the Scheme's enforcement regime will be used to support its operational running costs, primarily.

6.2 Any revenue surplus to covering operational costs will be re-invested to support the Scheme's objectives to reduce harmful emissions. Revenue will be allocated to appropriate transport initiatives identified in the CMP and 2030 Climate Strategy.

6.3 All other financial impacts from the Scheme were set out in the October 2021 report.

7. Stakeholder/Community Impact

7.1 The stakeholder and community involvement in developing Edinburgh's LEZ were set out in the October 2021 report and in previous reports to Committee in June 2021 and in 2019.

7.2 An Integrated Impact Assessment and Strategic Environmental Assessment have also been completed, that consider the impacts of carbon emissions.

8. Background Reading/External References

8.1 Cleaner Air for Scotland 2 (Scottish Government, July 2021)

8.2 Policy and Sustainability Committee - 2030 Climate Strategy and Implementation Plan (Item 7.4, the City of Edinburgh Council, approved November 2021)

8.3 Policy and Sustainability Committee – 2030 City Target Monitoring Approach (Item 7.8, the City of Edinburgh Council, approved April 2021)

8.4 Transport and Environment Committee - City Mobility Plan (Item 7.1, the City of Edinburgh Council, approved February 2021)

8.5 Low Emission Zone Guidance (Transport Scotland, October 2021)

8.6 Low Emission Zones Scotland (Transport Scotland)

8.7 Low Emission Zone Support Funds Scotland (Energy Savings Trust/Scottish

Government)

8.8 London Mayor's Transport Strategy (Transport for London, 2018)

9. Appendices

9.1 Appendix 1 – Recommendations approved by Transport and Environment Committee (the City of Edinburgh Council, October 2021)

9.2 Appendix 2 – Carbon Emission Addendum (Scottish Environment Protection Agency, December 2021)

9.3 Appendix 3 – Network Management Strategy (the City of Edinburgh Council, December 2021)

Appendix 1 Recommendations Approved from Transport and Environment Committee on 26 October 2021

1.1 Note that the Council has now concluded the statutory consultation on the proposed Low Emission Zone (LEZ) scheme and has also completed non-statutory public consultation, as approved by Committee in June 2021;

1.2 Acknowledge that analysis and consideration of feedback from consultations has informed a review of the proposed LEZ scheme;

1.3 On consideration of the consultation feedback received regarding reduction of greenhouse gas emissions, to alter the LEZ scheme boundary and grace period and clearly evidence to what extent the scheme will meet the legal requirement to achieve the objective set by the Transport (Scotland) Act 2019: *Contribute towards reduction of greenhouse gas emissions in fulfilment of Part 1 of the Climate Change (Scotland) Act 2009.*

CLEANER AIR FOR SCOTLAND – NATIONAL MODELLING FRAMEWORK

Low Emission Zone: Edinburgh Report Addendum

December 2021

Section 1: Consideration of Carbon Dioxide changes within an LEZ scheme

The main objective of the Low Emission Zone (LEZ) is to improve air quality to meet current statutory air quality standards and objectives. There is also a statutory obligation to consider the contributions made towards greenhouse gas emissions (Transport (Scotland) Act 2019).

The Euro Classification of vehicles is designed to control Nitrogen Oxides (NO_x), Total Hydrocarbons, Non-methyl Hydrocarbons, Carbon Monoxide and Particulate Matter (PM) emissions (EUR-Lex - 32012R0459 - EN - EUR-Lex (europa.eu). Nitrogen Oxides and Particulate emissions (which are mostly by-products of the combustion process) are the main areas of concern as they either exceed or are at risk of exceeding Air Quality Standards. Therefore, LEZ's in Scotland will restrict access within the zone to lowest emitting Euro Class vehicles. These are Euro 6 for all vehicles, except petrol cars which are Euro 4.

Carbon Dioxide emissions are not currently controlled by the Euro Classification system. The introduction of Euro 7 standards by the European Union, expected to come into force in 2025, will include targets to reduce Carbon Dioxide emissions.

CO_2 emissions are linked the quantities of fuel burnt by a vehicle (e.g. miles per gallon), and reductions in CO_2 emissions are mainly linked to improved fuel efficiency. New vehicles tend to be more efficient than older vehicles, this is most noticeable for cars. Larger Euro 6 vehicles (e.g. buses) may emit fractionally more CO_2 than older buses, as the technology required to reduce NO_x and Particulate emissions requires energy to run. As there are no CO_2 abatement systems on vehicles, significant changes in CO_2 emissions are not expected as a result of the introduction of the LEZ.

Reducing Carbon Dioxide emissions will be achieved by modal shift, introduction of alternative vehicle fuels (e.g. electric, hydrogen) or reducing the number of vehicle journeys using diesel/petrol. This move to zero carbon emissions could be achieved by actions set out in CAFS2 or the introduction of zero emission zones.

Emissions Standards for Vehicles

Emissions Standards are currently based on European Union emissions standards. These regulate emissions of Nitrogen Oxides (NO_x), Total Hydrocarbons, Non-methane hydrocarbons, Carbon Monoxide (CO) and Particulate Matter (PM). Carbon Dioxide (CO_2) is not part of this framework.

Euro Class emissions standards are outlined in Table 1, Table 2 and Table 3 for Cars, LGVs and HGVs. Note that the same Euro 6 standards apply to all Euro 6 sub classes, however the move from laboratory testing to Real World Driving assessment (Real-driving emissions test procedure for exhaust gas pollutant emissions of cars and light commercial vehicles in Europe (theicct.org))

Table 1: Car Emission Standards (NO_x and PM) for different Euro Classes

g/km	Diesel Car		Petrol Car	
	NO_x	PM	NO_x	PM
Euro 1	-	0.14	-	-
Euro 2	-	0.08	-	-
Euro 3	0.5	0.05	0.15	-
Euro 4	0.25	0.025	0.08	0.005
Euro 5 (incl 5a and 5b)	0.18	0.0045	0.06	0.005 (5a) 0.0045 (5b)
Euro 6 (incl 6b, 6c, 6d-TEMP and 6d)	0.08	0.0045	0.06	0.0045

Table 2: LGV Emission Standards (NO_x and PM) for different Euro Classes

g/km	<1305kg		1305-1760kg		1760-3500kg	
	NO_x	PM	NO_x	PM	NO_x	PM
Euro 1	-	0.14	-	0.19	-	0.25
Euro 2	-	0.08	-	0.12	-	0.17
Euro 3	0.5	0.05	0.65	0.07	0.78	0.10
Euro 4	0.25	0.025	0.33	0.04	0.39	0.06
Euro 5 (incl 5a and 5b)	0.18	0.0045	0.235	0.005 (5a) 0.0045 (5b)	0.28	0.005 (5a) 0.0045 (5b)
Euro 6 (incl 6b, 6c, 6d-TEMP and 6d)	0.08	0.0045	0.105	0.0045	0.125	0.0045

Table 3: Bus and HGV Emission Standards (NO_x and PM) for different Euro Classes. Note that Bus and HGV emissions standards are defined as g/kWh)

	Vehicle Type	NO_x (g/kWh)	PM (g/kWh)
Euro I	All	8	0.36
Euro II	All	7	0.15
Euro III	EEV	2	0.02
	Non EEV	5	0.1
Euro IV	All	3.5	0.02
Euro V	All	2	0.02
Euro VI	All	0.4	0.01
Note: EEV is Environmentally Enhanced Vehicle			

Emission Factors for Vehicles

The Emission Factor Toolkit (EfT) is published by Defra and the Devolved Administrations (Emissions Factors Toolkit) so that emission rates and emission factors can be calculated for NO_x, PM and CO_2 for different vehicle types. This attempts to take into account real world emissions.

Further information can be found in the EfT user guide (EFTv10.1-user-guide-v1.0.pdf). These are derived from the EU standard vehicle emission calculator COPERT (COPERT | EMISIA SA)

For the purpose of this report, emission factors for different vehicle types have been extracted from EfT (version 10.1) for vehicles traveling at an average speed of 20 km/hr.

It is possible to directly compare NO_x and PM emission standards and emission factors for Petrol Cars, Diesel Cars and LGV's, but not for Buses and HGV's. It is not possible to make this comparison for CO_2 emissions for any vehicle type.

Comparison of NO_x and CO_2 Emission Factors

Figure 1 and Figure 2 show emission factors for NO_x and CO_2 for each Euro Class

Diesel Cars:

- **NO_x:** Emission factors fall by a factor of 3 when moving from Euro 5 to 6d
- **CO_2:** Emission factors fall by 8% when moving from Euro 5 to 6d

Petrol Cars:

- **NO_x:** Emission factors increase by 12% when moving from Euro 5 to 6c. It is important to note that emission factors are 4 times lower than Diesel car emissions
- **CO_2:** Emission factors fall by 8% when moving from Euro 5 to 6d. They are slightly higher than diesel cars

Diesel LGVs:

- **NO_x:** Emission factors fall by a factor of 10 when moving from Euro 5 to 6
- **CO_2:** Emission factors are unchanged when moving from Euro 5 to 6

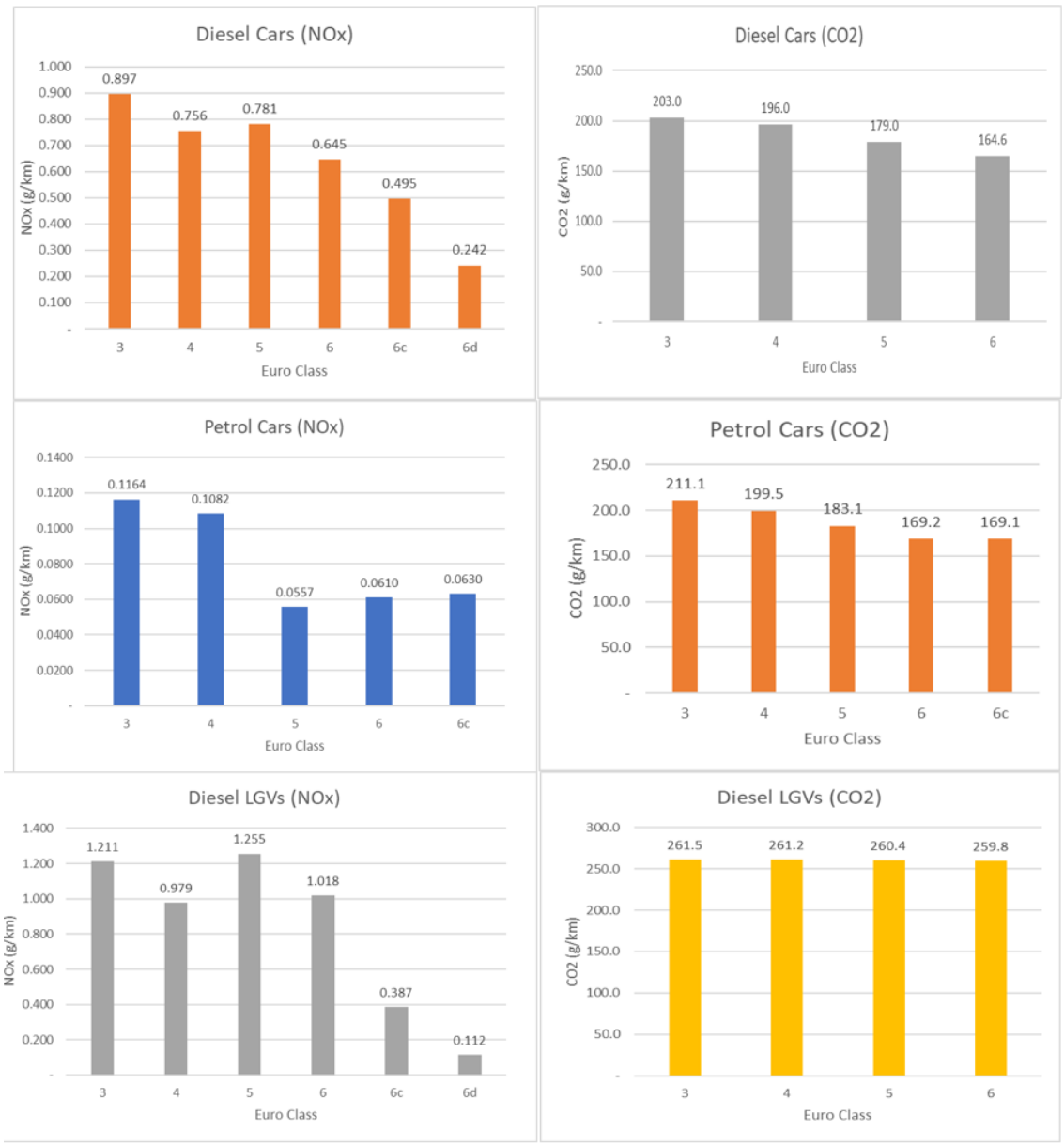

Figure 1: NO_x and CO_2 emission factors for Cars and LGV's

Buses/Coaches:

- **NO_x:** Emission factors fall by a factor of 10 when moving from Euro 5 to 6
- **CO_2:** Emission factors are unchanged when moving from Euro 5 to 6

Artic HGVs:

- **NO_x:** Emission factors fall by a factor of 8 when moving from Euro 5 to 6
- **CO_2**: Emission factors are unchanged when moving from Euro 5 to 6

Rigid HGVs:

- **NO_x:** Emission factors fall by a factor of 7 when moving from Euro 5 to 6
- **CO_2**: Emission factors are unchanged when moving from Euro 5 to 6

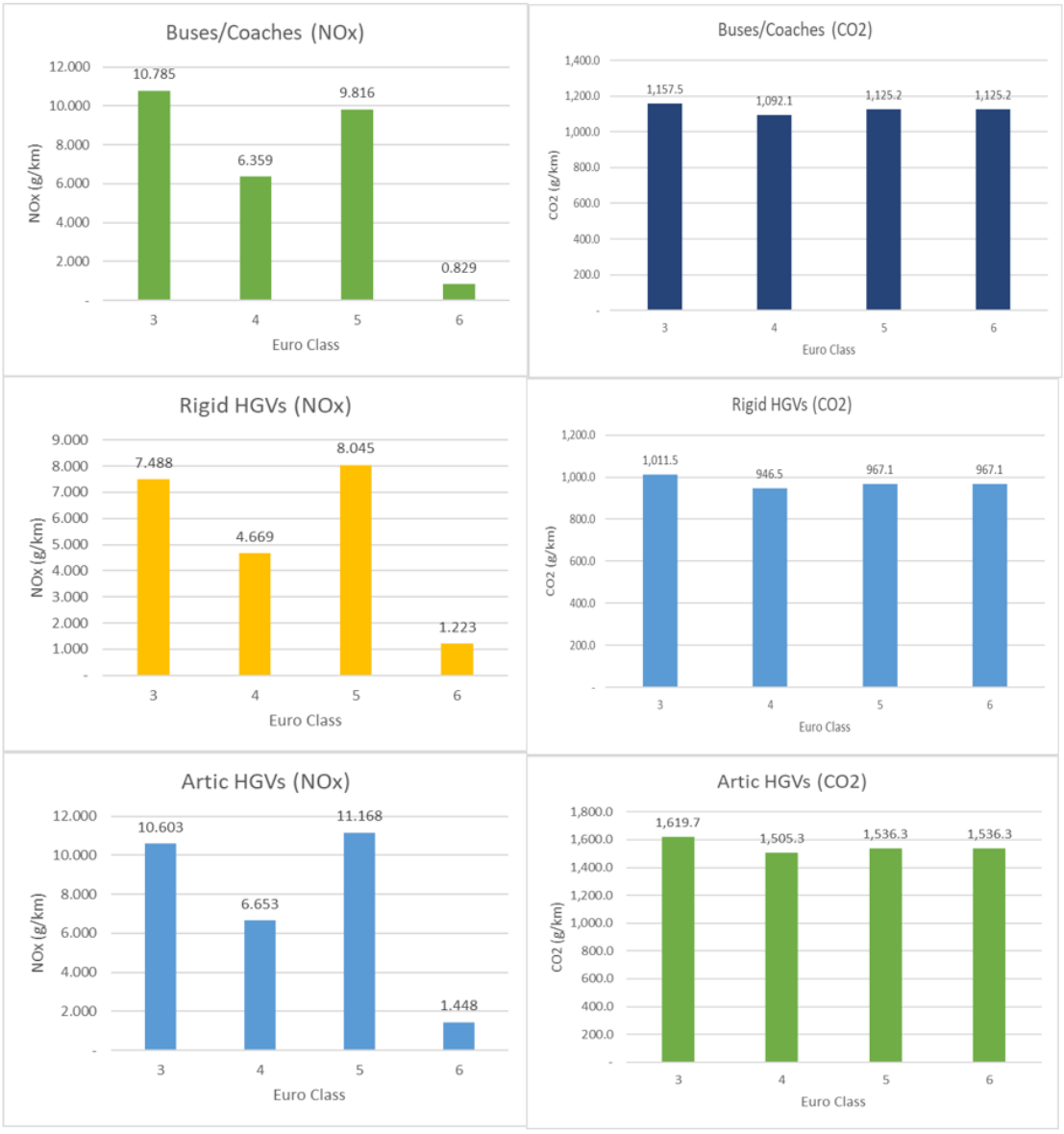

Figure 2: NO_x and CO_2 emission factors for Buses and HGV's

Section 2: Carbon Dioxide Emissions in Edinburgh NMF Model

Using the same methodology as was used to calculate NO_x and PM emissions in the National Modelling Framework (NMF), CO_2 emissions have been calculated for each road in the model. Note that this analysis only considers roads in the Edinburgh NMF model and should not be considered as total road traffic CO_2 emissions for the entire City of Edinburgh.

In this analysis it is assumed that all Buses and Taxis will be compliant (as is the case for the LEZ scenarios in the main report). A comparison has been made with the Base and LEZ scenario.

CO_2 emissions for LEZ

When looking at all the roads in the model, the net result is that there is negligible difference (0.04%) in CO_2 emissions due to the introduction of the LEZ (Figure 3).

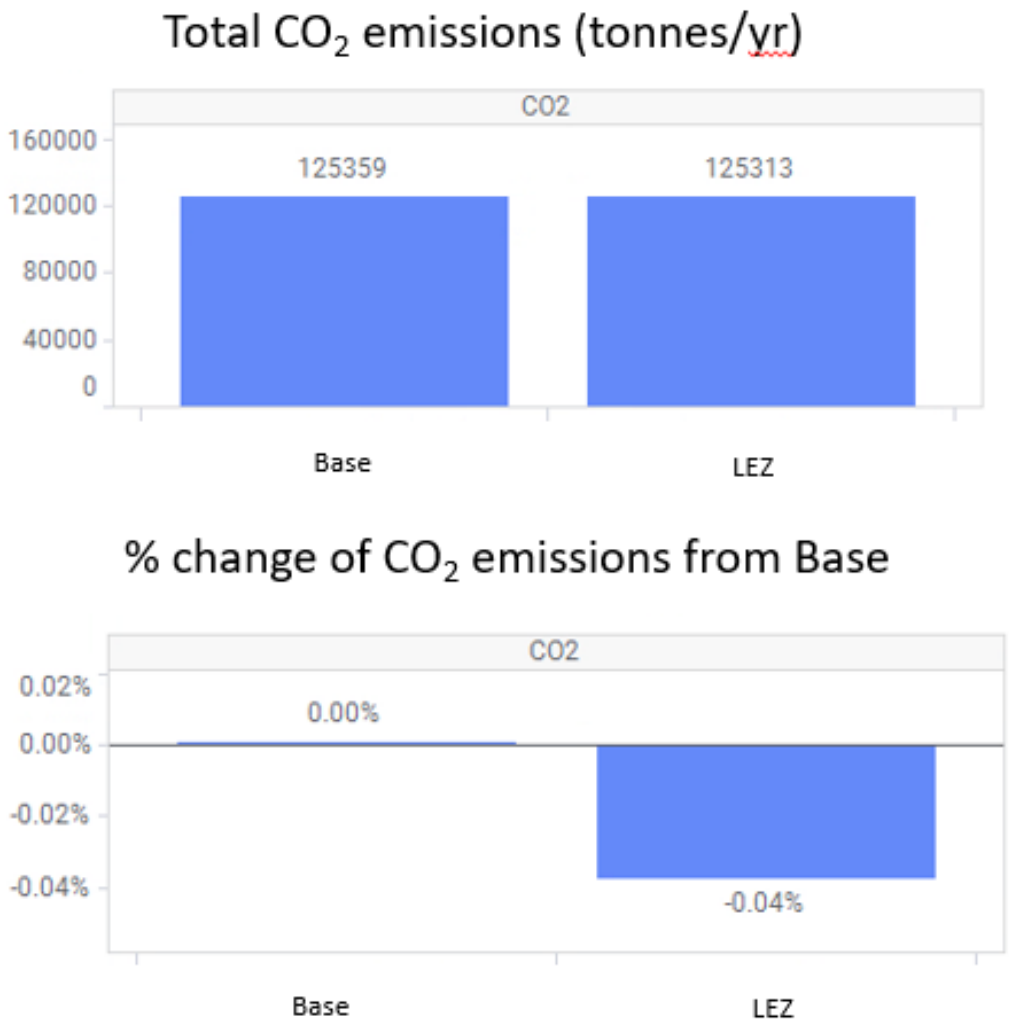

Figure 3: CO_2 emissions (tonnes per year) and percentage change from the Base scenario for 2 scenarios (Base, LEZ) for all roads in model

CO_2 emissions changes for Other Scenarios

Extended Urban Areas LEZ option – all roads in model

In this scenario, due to no traffic modelling data being available, it has been assumed that traffic flows are the same as the Base scenario. The fleet composition reflects the rules for this scheme (all vehicles compliant within the city centre boundary; all non-private cars compliant in rest of city).

A small reduction (0.58%) in CO_2 emissions is predicted when compared to Base (Figure 4).

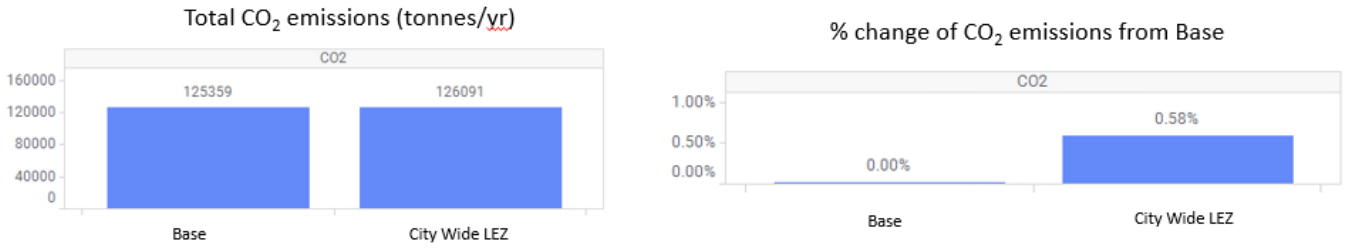

Figure 4: CO_2 emissions (tonnes per year) for 2 scenarios (Base and City Wide LEZ)

All Vehicles Compliant – all roads in model

In this hypothetical scenario, it is assumed that all vehicles are compliant (the highest Euro Class possible has been selected). The difference between this case and the Extended Urban Areas LEZ scenario is that all cars are considered compliant. Like the Extended Urban Areas LEZ, it is assumed that traffic flows are the same as the Base scenario

A small reduction (2.5%) in CO_2 emissions is predicted when compared to Base (Figure 5).

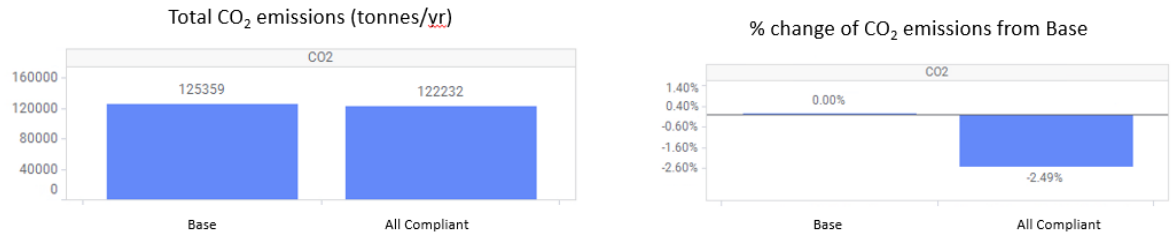

Figure 5: CO_2 emissions (tonnes per year) for 2 scenarios (Base and All Vehicles Compliant)

10% Reduction in Car Traffic – all roads in model

In this hypothetical scenario, it is assumed that 10% of cars are removed from each road section in the model for the City Wide/Extended Urban Areas LEZ and City Centre LEZ.

A reduction of 5.4% in CO_2 emissions is predicted for the City Centre LEZ option when compared to the Base (Figure 6). This is a slightly larger reduction than the City Wide LEZ option where a 4.8% reduction in CO_2 emissions is predicted when compared to the Base.

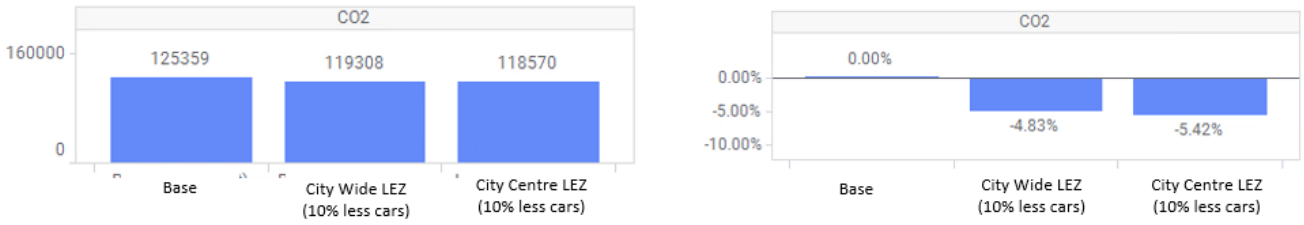

Figure 6: CO2 emissions (tonnes per year) for 3 scenarios (Base, City Wide LEZ less 10% cars and City Centre LEZ less 10% cars)

Summary of CO_2 emissions

It is predicted that there will be a negligible change in total CO_2 emissions (0.04% reduction) due to the introduction of the LEZ.

If the Extended Urban Areas approach was selected, it is predicted there will be a small increase in CO_2 emissions of about 0.6%. This is in part due to Euro 6 HGV/Buses emitting slightly more CO_2 than older vehicles.

Even in the hypothetical scenario where all vehicles are compliant, there is only a small reduction in CO_2 emissions of around 2.5%. This is mostly due to lower CO_2 emissions from newer cars.

The most effective way to reduce CO_2 emissions is to reduce fossil fuel vehicles on the road or replace with non-fossil fuel powered vehicles.

Section 3: Expanding LEZ boundary to include Calton Hill

We are not proposing to run the air quality model to account for any extension to the LEZ boundary which includes Regent Road and Royal Terrace (Calton Hill) because:

- Air Quality modelling on Regent Road predicts that air quality is compliant with air quality standards.
- The modelling was based on the LEZ boundary at the roundabout where Waterloo Place and Regent Road meet at St Andrews house. Traffic modelling used in air modelling scenarios assumes that non-compliant traffic is diverted along Queen Street, London Road and Easter Road to Abbeyhill. This will remain unchanged in the new scenario, and therefore changes in traffic flow and air quality along the LEZ diversion route will be negligible.
- Therefore, the current air quality modelling will be applicable to the scenario which includes Regent Road and Royal Terrace (Calton Hill).

Section 4: Expanding LEZ boundary to include Haymarket

If the LEZ boundary was extended to include Haymarket, a new air modelling assessment would be required because:

- A diversion route around the LEZ boundary is likely to include Ravelston Dykes, Roseburn, Balgreen Road and Gorgie Road. High vehicles may be required to divert even further due to low bridges, with Meadow Place Road being the nearest suitable alternative route.
- At some of these locations, air quality has not been compliant with air standards in previous years. There is therefore a risk that at some of these locations, air quality concentrations may increase.
- There is a risk that where air quality standards are now being achieved, increased traffic flows may result in a return to non-compliance.
- Therefore, new modelling would be required to assess any large changed to the boundary which includes Haymarket. This could take up to 6 months.
- Additionally, if the LEZ is larger, more vehicles will be required to divert around the LEZ boundary and the total vehicle kilometres will increase. This will result in increased overall CO_2 emissions.

Appendix 3 - Network Management Strategy (NMS)

1.1 In response to analysis of air quality (NO_2) and traffic modelling undertaken by the Scottish Environment Protection Agency (SEPA) and consultation with key stakeholders, potential displacement impacts and mitigations have been identified, as part of a wider Network Management Strategy (NMS).

1.2 Central to the NMS is to monitor and evaluate displacement impacts strategically around the entire boundary following an evidence-led approach, before specific solutions can be identified.

1.3 Consultation and engagement highlighted additional areas at/near to the boundary for which enhanced monitoring and evaluation could be utilised to inform the process of identifying potential solutions, as outlined below. Convincing evidence and wider stakeholder support for such solutions is required

1.4 Mitigation measures across all areas, including the West End, north-east and south-east, alongside previously identified measures will be further developed, following an evidence-led approach and with stakeholder support.

1.5 All mitigation measures will be delivered before LEZ enforcement begins in June 2024 and in line with other project programmes.

1.6 Intelligent Infrastructure Project (Smart Cities) will install new, moveable air quality monitoring sensors across Edinburgh's AQMAs and the LEZ. It will also install fixed camera locations (public CCTV), to analyse traffic flows. It is anticipated that project delivery will commence from December 2022 and synergies with the LEZ NMS will be sought throughout its project lifecycle to support Scheme evaluation.

West End

1.7 The West End (generally but not exclusively streets between the A8 at Haymarket Terrace and A90 at Queensferry Road) has been previously cited as an area of concern by stakeholders. The area has long-standing and historic traffic patterns and serves key routes within the city centre, despite its residential character. Potential displacement impacts of LEZ in this location should be considered strategically and in relation to wider complexities of citywide network management.

1.8 Officers recommend exploring potential solutions in the West End, considering that further traffic modelling assessments and stakeholder support would be required before design and implementation and that there are other significant projects planned in this area (CCWEL).

1.9 LEZ will collaborate with CCWEL to collect further traffic modelling evidence to inform any future potential impacts the Scheme will have on the road network. Evidence from future traffic modelling and surveys could be used to

determine a separate project, using instruments such as Experimental Traffic Regulation Orders (ETROs).

1.10 An interim solution for Tollcross Junction is being costing in the first instance, logical and effective diversion route for non-compliant traffic. Measures being costed include, re-alignment of kerbs/resizing of island, repositioning of bollard and signal heads and carriageway patch. It is recognised that a major overhaul of Tollcross Junction is required in the long term.

1.11 Changes to Morrison Street are being costed to provide a logical and effective diversion route for non-compliant traffic. Measures being costed include redesign of junction at Morrison Link/Morrison Road, redesign of junction at Torphichen Street/Morrison Street/Gardner's Crescent and road markings on Morrison Street to permit two-way traffic. Any changes would consider other requirements such as for loading and taxi rank access.

1.12 LEZ will continue engagement with Tollcross Primary School and other stakeholders in the area around planned Active Travel measures, in relation to LEZ delivery timelines.

North-East

1.13 The NMS will take on board key stakeholder concerns about displacement impacts around Calton Hill and Holyrood Park, including Historic Environment Scotland

1.14 A signposted diversion route will be made around the whole Scheme boundary. In the north-east this will follow London Road and Abbeyhill/Abbeymount to mitigate potential displacement impacts through residential areas on Calton Hill.

South-East

1.15 At Preston Street Primary School mitigations will be explored to address concerns relating to safety, improving amenity for school children and parents following lessons learned by Travelling Safely measures already in place.

1.16 Preliminary analysis has outlined various potential measures including but not limited to: permanent widening of pavements around the school, prioritisation of traffic signalling around school pick up/drop off times to pedestrians, additional traffic calming measures and others.

1.17 Such measures will be delivered as part of the Road Safety programme, in collaboration with the LEZ.