2. Setting the Scene

Air quality in Scotland

2.1 Levels of the main transport-related air pollutants are declining with cumulative emission from nitrogen oxides (NO_x) having decreased by 39% and fine particulate matter (PM) by 2% between 2007 and 2014. However, we are not meeting European limit values or Scottish Air Quality objectives at a number of locations across towns and cities in Scotland, primarily as a result of transport emissions which contribute 39.1% of nitrogen oxides emissions[3].

2.2 The Scottish Air Quality website provides a summary of the Scottish Air Quality objectives and standards - as set out in the Air Quality (Scotland) Regulations 2000 - along with the locations of Air Quality Management Areas and a short glossary description on both PM and oxides of nitrogen e.g. the relationship between NO_x and NO2.

Air pollution and health

2.3 Transport-related air pollution caused by fine particulate matter ($PM_{2.5}$ and PM_{10}) and gases such as nitrogen oxides (NO_x) impact on human health. Air pollution can have a particular impact on the very young and old, and those with existing respiratory and cardiovascular conditions, where air pollution can exacerbate existing health conditions (especially heart disease and respiratory illnesses) of vulnerable individuals. More detail on this topic can be found in Chapter 5 of Cleaner Air for Scotland.

2.4 Air pollution is a health inequalities and social justice issue, given that vulnerable groups are disproportionately affected. There is a positive relationship between air quality and social deprivation, with the most socially deprived communities more likely receive a disproportionate share of poor air quality (see Namdeo & Stringer, 2008; King & Healy, 2013; Mitchell, et al 2015)

2.5 In 2010, the UK Government Department of Health's expert advisory committee, the Committee on the Medical Effects of Air Pollution (COMEAP) produced estimates of the burden of added mortality associated with ambient fine particulate pollution at UK level. COMEAP estimate that poor air quality shortens average life expectancy in Scotland by 3-4 months (compared to 6-7 in England and Wales), although vulnerable groups are disproportionately affected (Health Protection Scotland, 2014).

[3] Transport sector contributions are outlined in Table 1 of Cleaner Air for Scotland. The Scottish Transport Statistics can be found on the Transport Scotland website, to enable comparison between transport and emissions, with the latest data available at https://www.transport.gov.scot/publication/scottish-transport-statistics-no-35-2016-edition/

Responsibilities under air quality legislation

2.6 With respect to domestic legislation, the Environment Act 1995 and associated regulations require local authorities to review and assess air quality in their areas against objectives and standards for a range of averaging periods for a number of air pollutants.

2.7 Assessment of air quality is focused on locations where members of the public are regularly present and where there is exposure to the pollutant in question over the timescale for which the air quality objective is defined. Authorities are legally obliged to demonstrate that they are doing all that is reasonably possible to work towards the legal objective values. Authorities are expected to liaise with Transport Scotland, Scottish Environment Protection Agency and other relevant organisations when developing action plan measures.

2.8 With respect to European legislation, the Ambient Air Quality Directive 2008/50/EC requires the Scottish Government to secure compliance with the European Directive limit values, at locations where the public has access (but not including factory premises or industrial installations where legal provisions regarding health and safety at work apply, locations with no fixed habitation, and road carriageways) as soon as possible. The work of local authorities in relation to Local Air Quality Management (LAQM) makes an important contribution to actions being implemented by the Scottish Government.

Local Air Quality Management

2.9 The LAQM system is detailed in the LAQM Policy Guidance PG(S)16 (Scottish Government, 2016). It sets out the policy framework for improving local air quality, with local authorities holding the responsibility to deliver LAQM objectives and Scottish air quality assessments.

2.10 A number of local authorities with Air Quality Management Areas (AQMAs) now have action plans, and the Scottish Government is working closely with these authorities, to help implement the plans and deliver air quality improvements. The majority of Air Quality Management Areas declared in Scotland are due to nitrogen dioxide (NO2) and/or particulate matter (PM) emissions from road traffic. For this reason, air quality mitigation related to transport has been a longstanding focus of AQMAs, including action on vehicle idling, traffic management (using Intelligent Transport Systems (ITS)), improved cycling uptake/active travel measures, introduction of cleaner low emission vehicles and parking policies. A number of local authorities have also outlined their interest in a LEZ (feasibility and appraisal) option within previous LAQM annual reports.

2.11 Scottish Government (2016) made reference to significant new component parts of the LAQM process, including the forthcoming National Low Emission Framework (NLEF) and the National Modelling Framework (NMF). The NMF, informed by robust local traffic data, will provide modelled kerbside pollution concentrations that can be assigned to emissions across the fleet. The NMF will inform traffic-related actions through the NLEF appraisal process to reduce

kerbside concentrations, and thus improve local air quality and minimise public exposure. As such, LEZs should be considered as an additional action to the current LAQM regime, with LEZs being put in place where NMF/NLEF evidence helps to determine both the exact extent and focus of the LEZ area, and the LEZ implementation towards achieving the LAQM objectives.

2.12 Early NMF outputs for a hypothetical LEZ in Glasgow are shown in Figures 1 to 3, to provide an indication of the impact that could result from a LEZ in relation to achieving the Scottish Air Quality Objective for nitrogen dioxide. The NMF outputs are based on the application of the proposed Euro emission standards (as described in Table 2), but are provided here for illustration only in relation to the topics outlined in Section 3. Whilst several scenarios in Figure 3 have focused on a hypothetical bus-only LEZ, **bus-only LEZs are not being proposed in this consultation for any location in Scotland**. Individual town or city-specific LEZs will be consulted upon in due course. As noted later in Section 4, LEZ implementation could play a key enabling role to tackle urban congestion and support the bus sector to increase patronage, by supporting actions to reduce both private car journey emissions and congestion caused by cars. The NMF modelling work, in tandem with traffic modelling, will be central to the analysis of future Scottish LEZs.

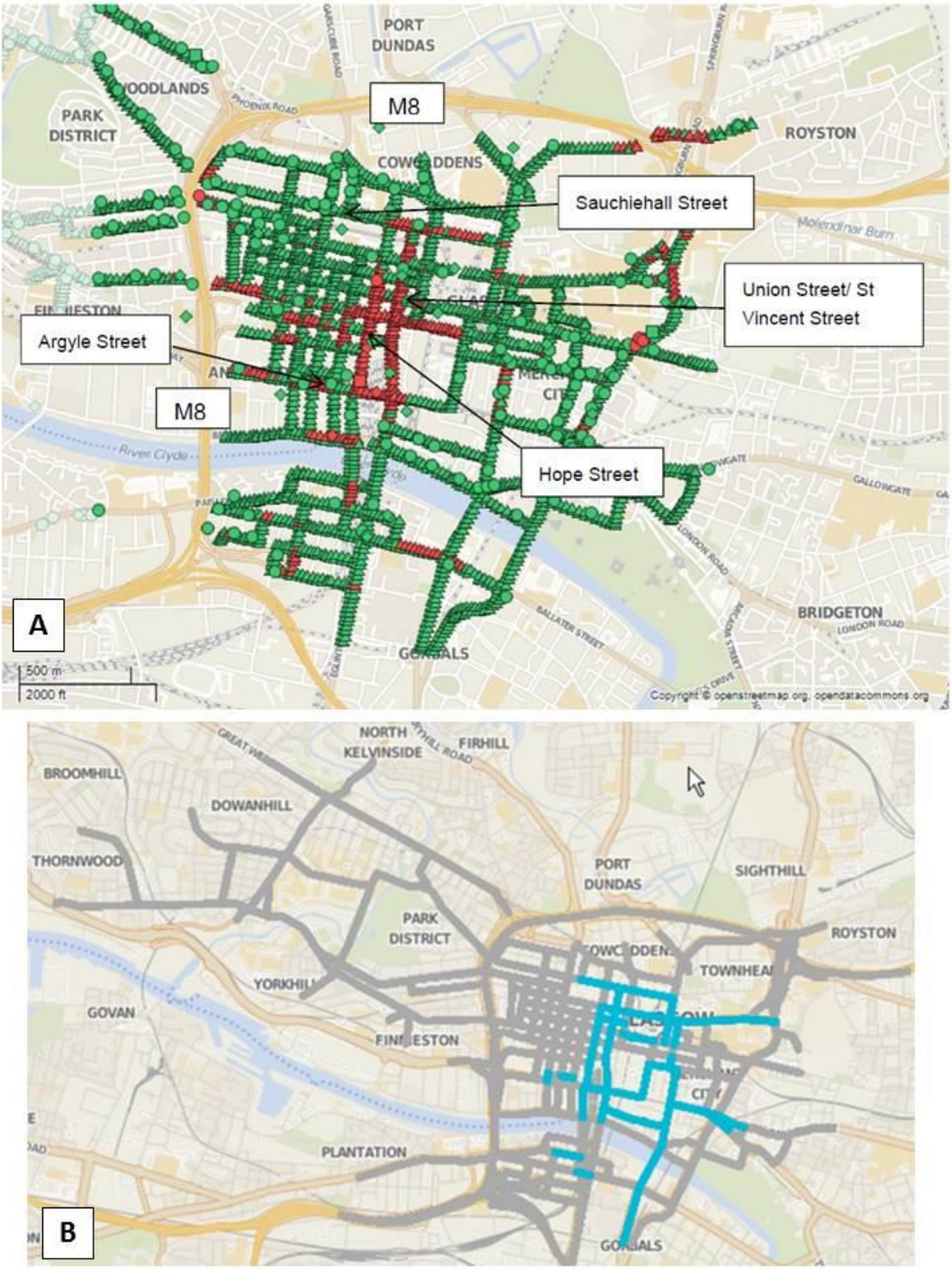

Figure 1 – Map A shows NOx emissions within a hypothetical LEZ in Glasgow City Centre modelled for the year of 2015 using the NMF, based on 2015 observed traffic

data e.g. before LEZ mitigation is put in place. The red colouring shows locations where NOx levels exceed a limit of 40 µgm-3, whilst green colouring shows locations where these levels are below this limit. Map B shows the main sources of NOx emissions in Glasgow city centre. Roads shown in blue represent the locations where buses contribute more than 40% of the emissions. The roads shown in grey represent locations where private cars contribute more than 40% of the emissions. In summary, buses are the dominant source of road emissions on specific city centre streets, whilst private vehicles are the dominant source across the wider road network. Maps created using OpenStreetMap and published on OpenDataCommons. © OpenStreetMap.

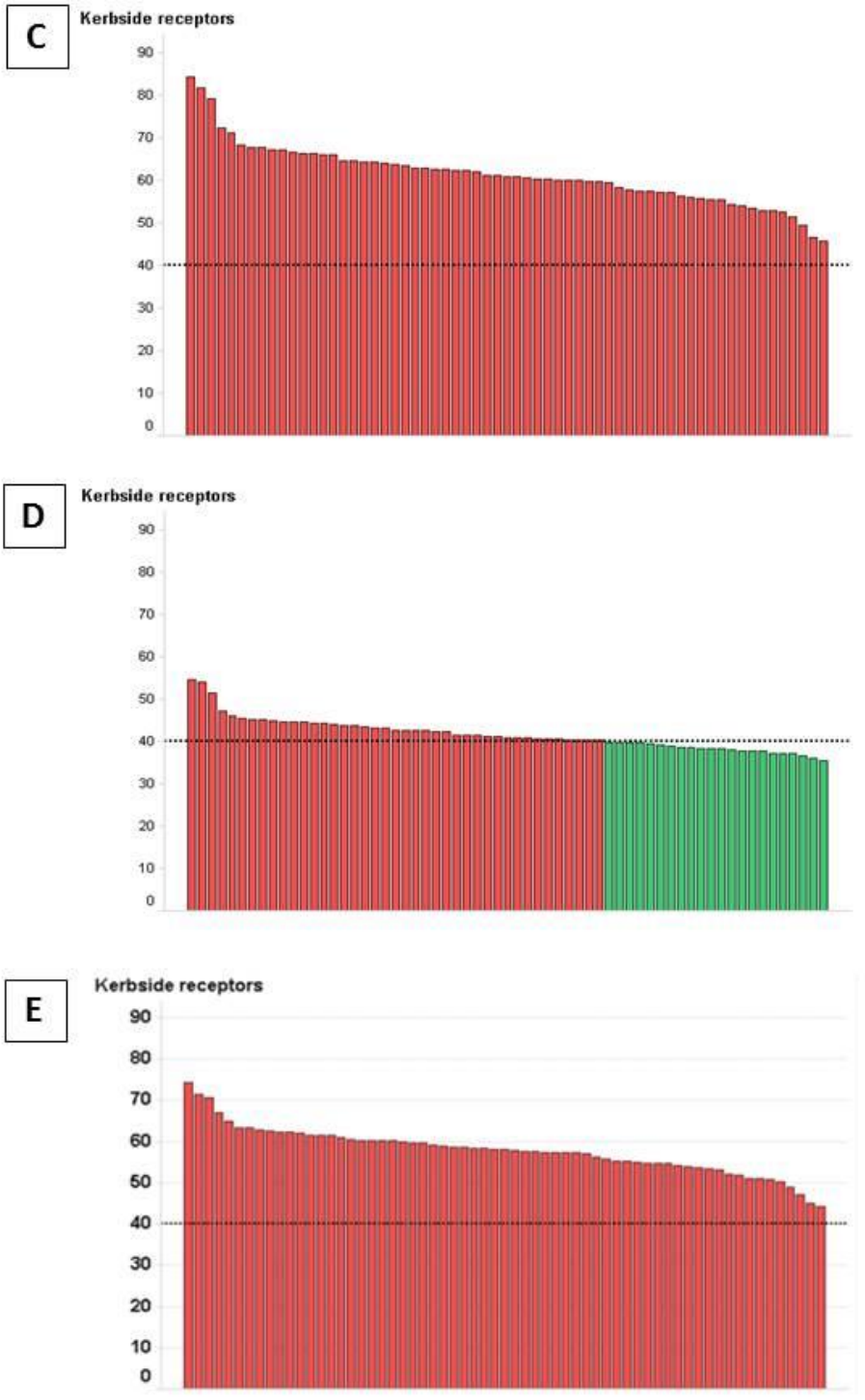

Figure 2 – Examples of air quality impact on Renfield Street in Glasgow for a hypothetical LEZ at a number of kerbside locations, noting that altering the Euro

emission standard for various vehicle types for a specific street can result in variable outcomes. Upgrading the bus fleet only to Euro VI is predicted to reduce kerbside NO_2 concentrations by an average of 19 µg m^{-3}, whilst upgrading the diesel car fleet only to Euro 6 on the same street would achieve more modest improvements in air quality, with average reduction in kerbside NO_2 concentrations of 3 µg m^{-3}. Graph C represents kerbside receptor model predictions with no action; Graph D represents kerbside receptor model predictions with action focused only on buses; Graph E represents kerbside receptor model predictions with action focused only on diesel private cars. The dotted line in graphs C, D and E represent the 40 µgm-3 mean Scottish Air Quality Objective value.

Scenario	Description	Buses and Coaches	Taxis and Private Hire	HGVs	LGVs	Cars	Motorcycles
1	2018 do-nothing. i.e. natural fleet renewal projection from 2015 to 2018 using Emit factors	Standard emit assumption at 2018	Standard emit assumption at 2018	Standard emit assumption at 2018	Standard emit assumption at 2018	Standard emit assumption at 2018	Standard emit assumption at 2018
2	2028 do-nothing. i.e. natural fleet renewal projections from 2015 to 2028 using Emit factors	Standard emit assumption at 2028	Standard emit assumption at 2028	Standard emit assumption at 2028	Standard emit assumption at 2028	Standard emit assumption at 2028	Standard emit assumption at 2028
3	2018 hypothetical LEZ implementation based on Euro emission standards lower than those proposed in Table 2 (with no lead-in time and full enforcement immediately).	Euro IV	Euro 3 (diesel)	Euro 4	Euro 3 (diesel)	Euro 3 (diesel)	Euro 3
4	2018 hypothetical LEZ implementation based on Euro emission standards proposed in Table 2 for all vehicles (with no lead-in time and full enforcement immediately)..	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro 6 (diesel) Euro 4 (petrol)	Euro 3
5	As scenario 4 but with hypothetical LEZ not introduced until 2023 in order to show impact of natural fleet renewal versus LEZ implementation	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro 6 (diesel) Euro 4 (petrol)	Euro 3 Euro 3
6	2018 hypothetical LEZ implementation based on Euro emission standards proposed in Table 2 for buses only. All other vehicle fleets renewed using emit factors to 2019	Euro VI	Standard emit assumption at 2019	Standard emit assumption at 2019	Standard emit assumption at 2019	Standard emit assumption at 2019	Standard emit assumption at 2019
7	As scenario 4 but the LEZ is restricted to only Hope Street and Renfield/Union Street (only on section between Argyle Street and West Regent Street). EMIT factors for 2018 applied to vehicles in all other areas	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro 6 (diesel) Euro 4 (petrol)	Euro 3
8	As scenario 6 but with hypothetical LEZ for bus only not introduced until 2023 in order to show impact of natural fleet renewal versus LEZ implementation	Euro VI	Standard emit assumption at 2019	Standard emit assumption at 2019	Standard emit assumption at 2019	Standard emit assumption at 2019	Standard emit assumption at 2019
9	As scenario 7 but with hypothetical LEZ not introduced until 2023 in order to show impact of natural fleet renewal versus LEZ implementation	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro VI	Euro 6 (diesel) Euro 4 (petrol)	Euro 6 (diesel) Euro 4 (petrol)	Euro 3 Euro 3

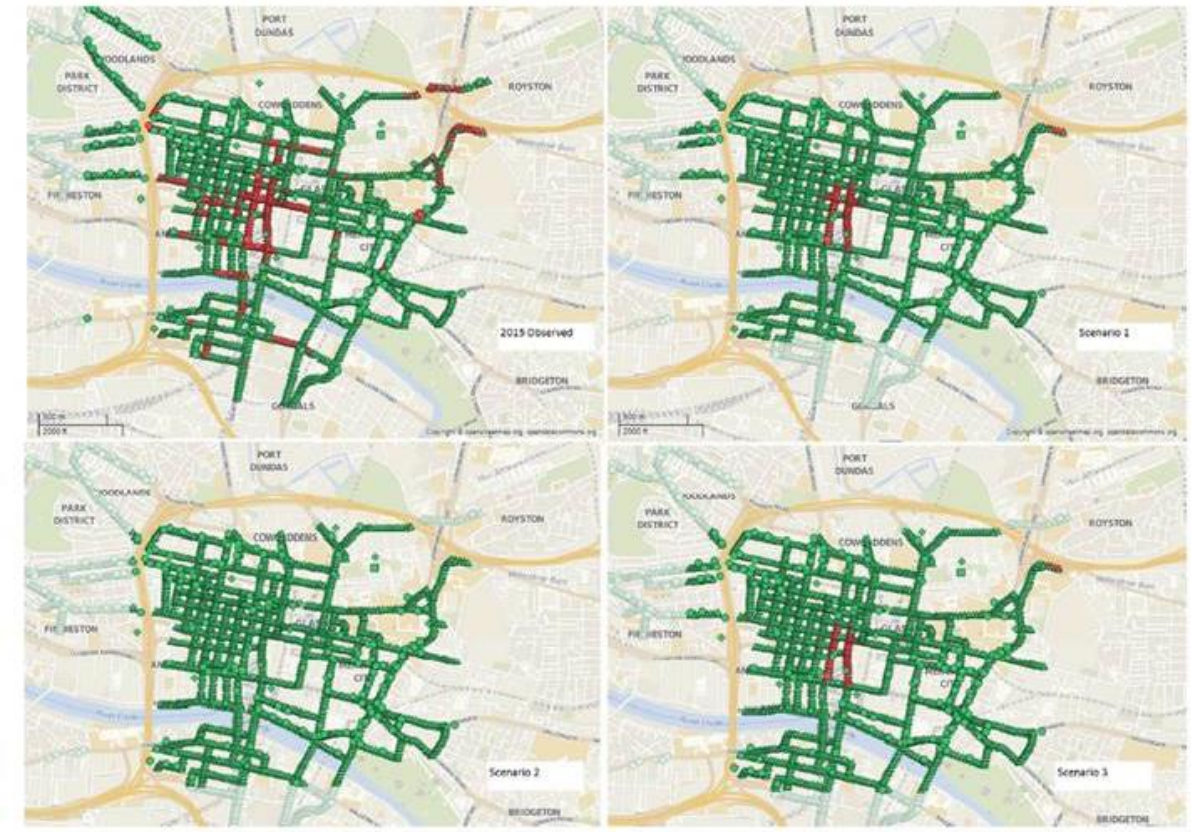

Figure 3a – NMF outputs showing a variety of potential scenarios for a hypothetical Glasgow LEZ, based on work commissioned by Transport Scotland to estimate LEZ costs. The scenarios are shown in the table of page 11. The green areas represent locations where the NOx mean level would be lower than the 40 µgm-3 mean Scottish Air Quality Objective value if the scenario was implemented. Note that scenario 6 in Figure 3b (which focuses on buses) would still result some exceedance of the Scottish Air Quality Objective value on Hope Street and Argyle Street. The NMF calculations utilised EMIT, which is a comprehensive emissions inventory toolkit and included road traffic emissions factors from DfT and from Defra's Emission Factor Toolkit. Maps created using OpenStreetMap and published on OpenDataCommons. © OpenStreetMap.

Figure 3b - NMF outputs showing a variety of potential scenarios for a hypothetical Glasgow LEZ. Maps created using OpenStreetMap and published on OpenDataCommons. © OpenStreetMap.

Transport strategy and air quality

2.13 The refreshed National Transport Strategy 2016 (NTS; see Transport Scotland 2016), reiterated the primacy of three Key Strategic Outcomes to be used as the guiding principles at national, regional, and local level when developing transport strategy and prioritising resources. One Key Strategic Outcome has a clear link to LEZs, which is to seek "Reduced emissions, to tackle climate change, air quality, health improvement".

2.14 A full review of the National Transport Strategy is currently underway and will aim to set out an updated vision for what kind of transport system we want for the whole of Scotland over the next 20 years and how it can be delivered. The Review will seek to identify the most effective means of reducing transport's local (air quality) and global (climate change) emissions.

What is a LEZ?

2.15 LEZs were first introduced in 1996 in Sweden to improve air quality, and there are now over 250 LEZs across 15 European countries in either an operational or planning phase, as outlined in Table 1.

2.16 LEZs are a form of Vehicle Access Regulation Scheme which set an environmental limit on certain road spaces, to improve air quality by allowing access to only the cleanest vehicles, particularly at locations where there is public exposure. LEZs help to accelerate the move to lower emission vehicles and encourage earlier renewal of the fleet. LEZ can also act as a catalyst to the introduction of non-technological air quality mitigation, as outlined in more detail in Section 4.

2.17 European LEZs cover a variety of vehicle types, but there is no single model for determining which vehicles to include in a LEZ. Some European LEZs initially focus on heavier vehicles, such as HGVs, buses and coaches, before subsequently placing vehicle access restrictions on private cars. The key principles of a LEZ are outlined in Box 1.

Country	Number	Applicable vehicles	National Framework or legislation
Implemented Schemes			
Austria	7	HGVs	Yes
Belgium	1	All vehicles with 4 or more wheels	Yes
Denmark	4	HGVs	Yes
Finland	1	Buses and refuse trucks	-
France*	1	HGVs***	No
Germany	73	All vehicles with 4 or more wheels	Yes
Greece	1	All vehicles with 4 or more wheels	Yes
Italy	102**	Various	No
Netherlands	13	All vehicles with 4 or more wheels	Yes
Portugal	1	All vehicles with 4 or more wheels	No
Sweden	8	HGVs	Yes
England and Wales	5	Various	Yes****
Planned Schemes			**Implementation year**
Czech Republic	1	HGVs	2017
Norway	3	Unknown	Unknown

Notes:

* The Mont Blanc Tunnel LEZ is between France and Italy but is included in Italy's LEZs. An odd-even number plate scheme restricts vehicles during high pollution events.

** Lombardia Region LEZs, outside cities, are counted as a single LEZ.

*** Expanded to all vehicles from 1 July 2016.

**** Known as the Clean Air Zone Framework.

HGVs = heavy goods vehicles, with a gross vehicle weight (GVW) > 3.5 tonnes. Where the restriction includes all vehicles > 3.5t it includes buses and coaches

Table 1 - Summary of European Low Emission Zones, based on 2015 data from the Urban Access Regulations in Europe Website.

Box 1 – Key principles of LEZs in Europe

The key design objectives of a LEZ are to accelerate the move to low emission vehicles, and encourage modal shift, thereby improving air quality in the area as soon as possible. The choice around vehicle restrictions is typically based on emissions per vehicle-kilometre, although Begg (2017) has recently highlighted the importance of emissions per passenger-kilometre.

A number of European LEZs have, over time, increased both the vehicle type, scope and Euro emission standard criteria (as described in Table 2) to ensure continual improvement. Key principles of European LEZ design are as follows:

- Emission modelling is required to quantify the potential impact, with some countries developing a national LEZ framework to provide a consistent approach
- Most LEZs have started with a restriction on heavy duty diesel vehicles, but over time their scope has widened to target a wider range of vehicles
- The LEZ area chosen depends on a number of factors including the magnitude of the contribution of traffic – and particular vehicle types - to the urban background, the city's road network and administrative boundaries

Do LEZs improve air quality?

2.18 LEZs can be a viable option to improve air quality. The Airuse (2017) literature review found that LEZ outcomes are highly dependent on the scale, operational scope and traffic data robustness, along with the variable air quality issues that particular cities or countries are trying to address.

2.19 Gehrsitz (2017) found that German LEZs reduced average PM levels by about 4%. The Berlin LEZ was introduced over two stages, creating a 7-10% reduction in NO_x, with traffic adjusted black carbon concentrations decreasing by 14-16% (Lutz, 2009; Airuse, 2017), whilst a 4% reduction in NO_x concentrations was achieved across 17 German cities with LEZs. PM10 was reduced by 4% in Milan, 1-2% in Hanover, 2-4% in the Rhur area of Germany, with reductions in PM10 also detected at 22 out of 29 monitoring sites in Baden in 2008, albeit with meteorological factor contributions (derived from Sadler, 2011). However LEZs in 11 Dutch cities and London did not impact on NO2 concentrations.

Scottish Parliament scrutiny of LEZs

2.20 Air Quality and LEZs have been the focus of Questions, Committee discussions, and debates in the Scottish Parliament. During 2017, a Members' debate on the 14 June, led by the Scottish Green Party, highlighted the interlinkages between air quality and health as part of the National Clean Air Day 2017. The Environment, Climate Change and Land Reform (ECCLR) Committee subsequently heard evidence from cross-professional experts on the 2 May, which led to an ECCLR Committee Air Quality in Scotland Inquiry. The Inquiry received more than 50 written submissions[4].

2.21 There is broad political consensus to maintain the joined-up approach across national government, local government and Regional Transport Partnerships – in tandem with commercial fleets and bus operators - to target the urban air pollution hotspots in Scotland's towns and cities.

[4] http://www.parliament.scot/parliamentarybusiness/CurrentCommittees/105527.aspx

Legislation, Orders and Conditions related to LEZs

2.22 There are currently three potential mechanisms that might support the creation of a LEZ:

- The Environment Act 1995 enables the Scottish Ministers to make Regulations prohibiting or restricting the access of vehicles or mobile equipment to areas prescribed in the Regulations
- The Road Traffic Regulation Act 1984 enables local authorities through the mechanism of making a Traffic Regulation Order (TRO) to prohibit or restrict the use of certain vehicles on certain roads for certain purposes including air quality management. Contravention of a TRO is a statutory criminal offence. Police Scotland lead on the enforcement of TROs (with the exception of decriminalised parking matters). The 1984 Act does not provide for enforcement of a TRO through a civil penalty
- Air quality related Traffic Regulation Conditions (TRCs) can be attached as licence conditions in respect of buses by the Traffic Commissioner for Scotland, on the application of the local authority.

Question 1

Do you support the principle of LEZs to help improve Scottish air quality? Please be as specific as possible in your reasoning.