Ricardo
Energy & Environment

Implementing Clean Air Zones and Real World Vehicle

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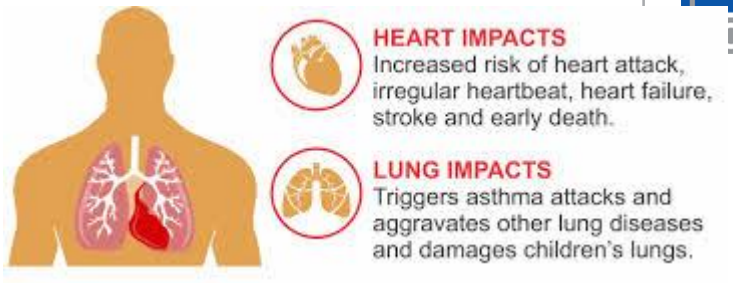
Air Quality in the UK today

- 40,000 premature deaths in the UK each year due to outdoor air pollution
- Air pollution linked to cancer, asthma, stroke and heart disease, diabetes, obesity and dementia
- The health problems resulting from exposure to air pollution have a high cost to people who suffer from illness and premature death, to our health services and to business. In the UK, these costs add up to more than £20 billion every year.




FINANCIAL TIMES

UK COMPANIES MARKETS OPINION WORK & CAREERS LIFE & ARTS

Diesel engines + Add to myFT

UK plans to ban sale of new petrol and diesel cars by 2040

Michael Gove prepares to follow lead set by France two weeks ago

The announcement will be seen as a milestone in the shift towards electric cars and the beginning of the combustion engine © Bloomberg

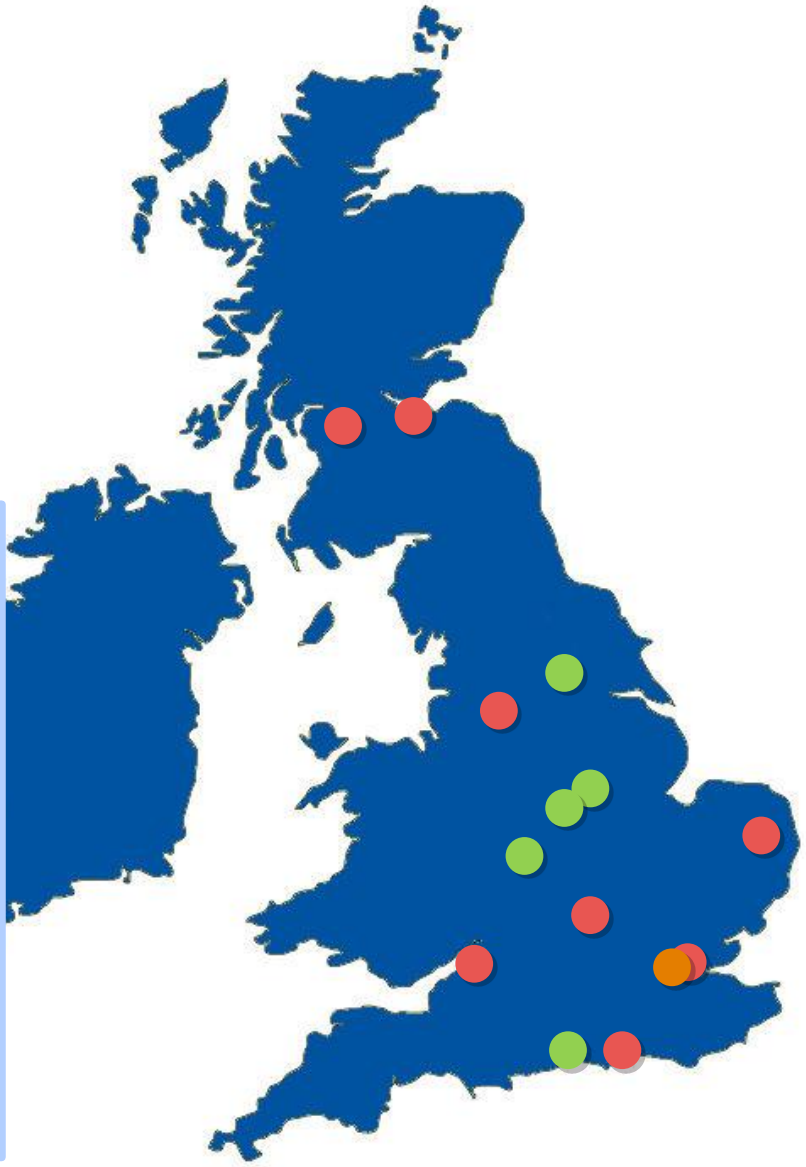
Emission Controlled Zones in the UK

Clean Air Zones

- Leeds
- Nottingham
- Derby
- Birmingham
- Southampton

Other Controlled Emission Zones
(Includes planned)

- Brighton and Hove
- Bristol
- London
- Oxford
- Norwich
- Manchester
- Glasgow
- Edinburgh



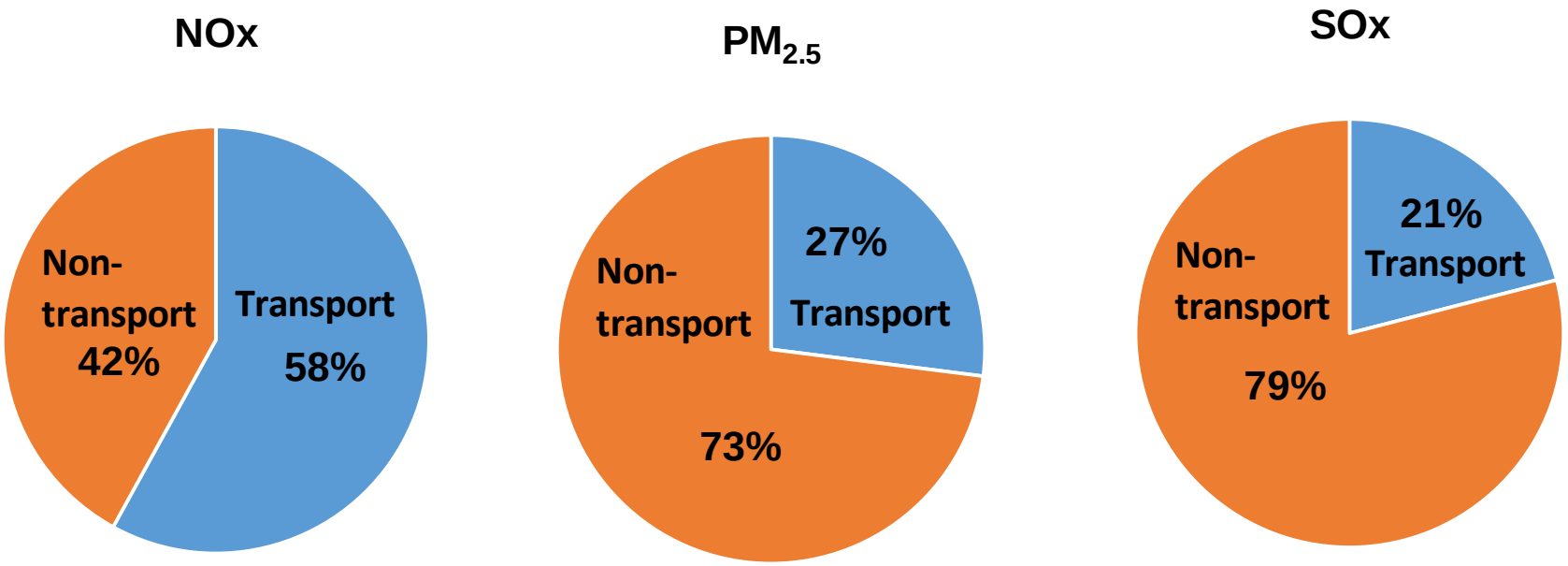
Emission Controlled Sites

- Heathrow Airport

Future Controlled Emission Zones

- 24 local authorities in Defra's new Air Quality Plan exceeding NO_2 emission levels
- Over 700 AQMAs across the UK
- No restriction on implementing a CAZ

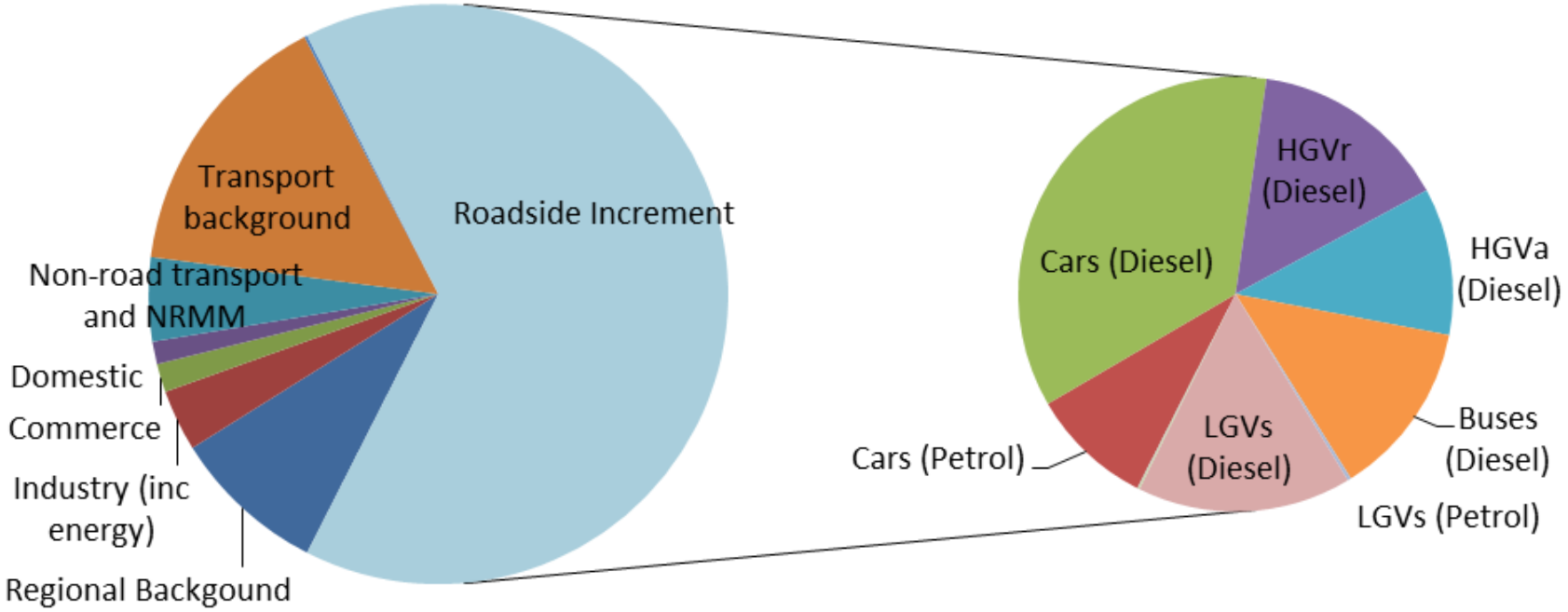
Contribution of transport emissions to overall emissions



- NOx emissions in Europe are predominantly from the transport sector
- For other pollutants, other sources dominate

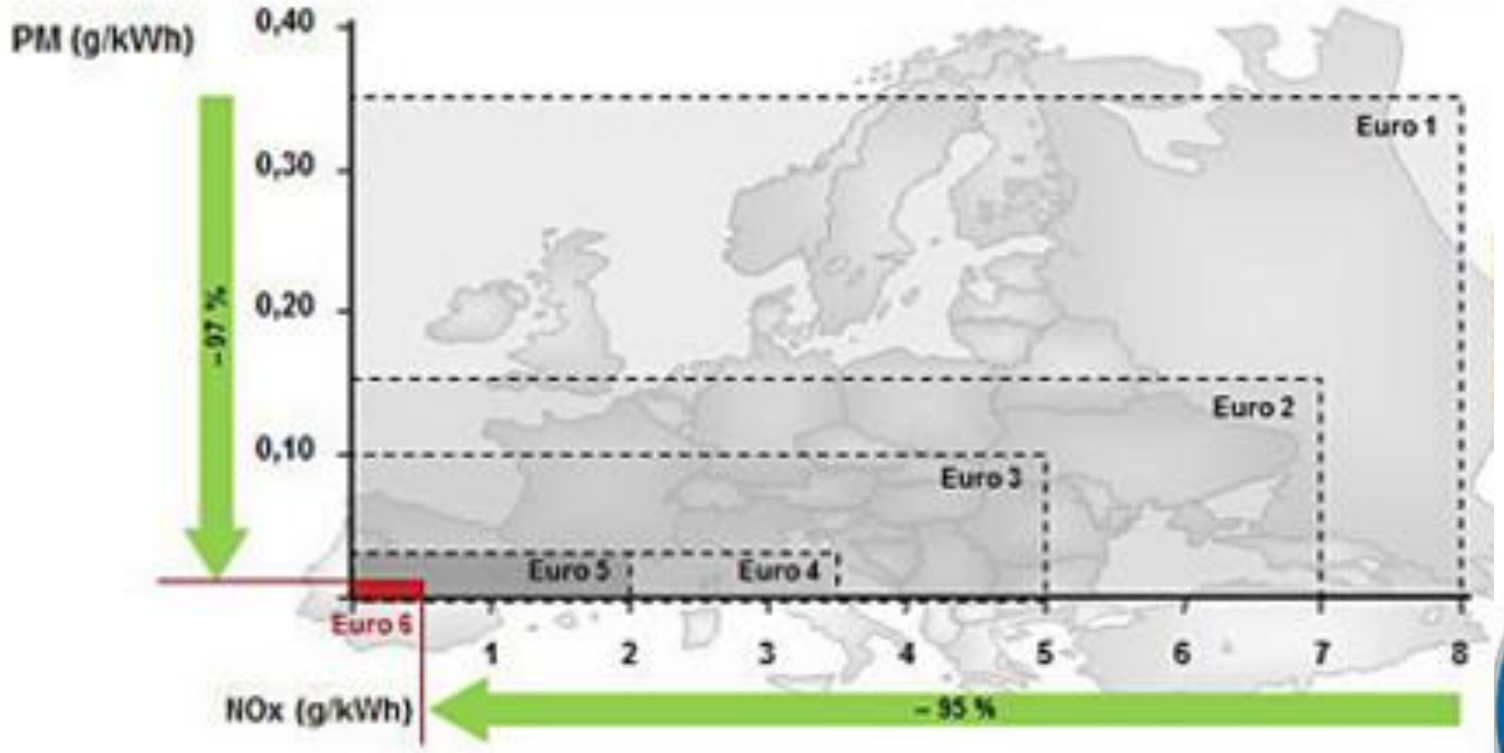
Emission contributions in urban areas

- Close to roads the contribution from road vehicles easily dominates concentrations and exposure – across the EU, road transport emissions account for 64% of NO2 concentrations
- Emissions are released at ground level where they have maximum impact on exposure



Emissions Regulation

Emission regulation Euro 6



#Dieselgate

What is a clean air zone?

Clean Air Zones are areas where action is focussed to improve air quality and the cleanest vehicles are encouraged. They aim to:

- Focus on immediate actions to improve air quality
- Support local growth and ambition
- Accelerating transition to a low emissio

CAZ locations are **areas** where an a access restrictions for the most polluting vehicles in r ventions to improve air quality.

Two types of Clean Ai d

- Non-chargi ocus for action to improve air quality, does use of charge based access restrictions.

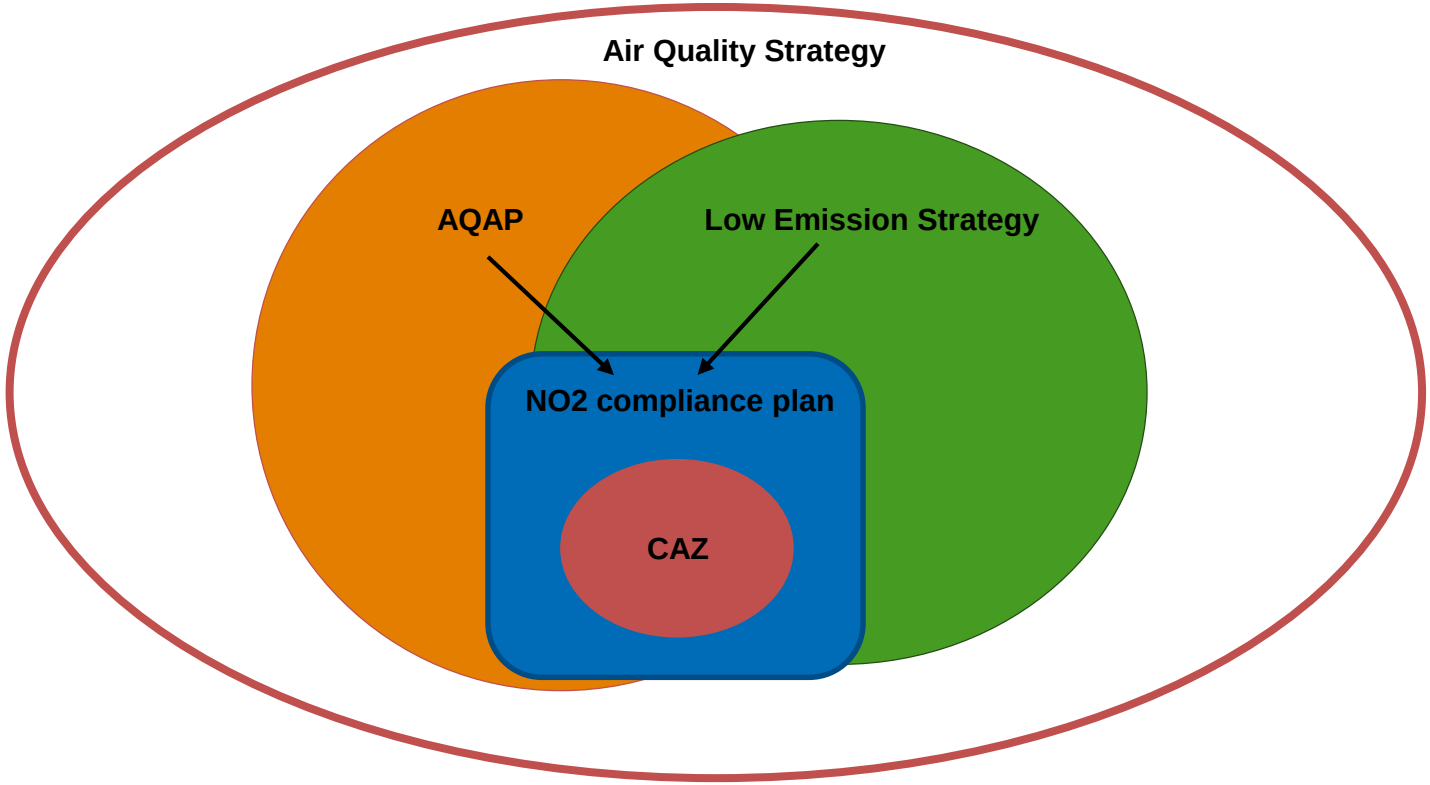
- **Charging Clean Air Zones** – Zones where, in addition to the above, vehicle owners are required to pay a charge if vehicle does not meet the particular standard in that zone.

Defined geographical area

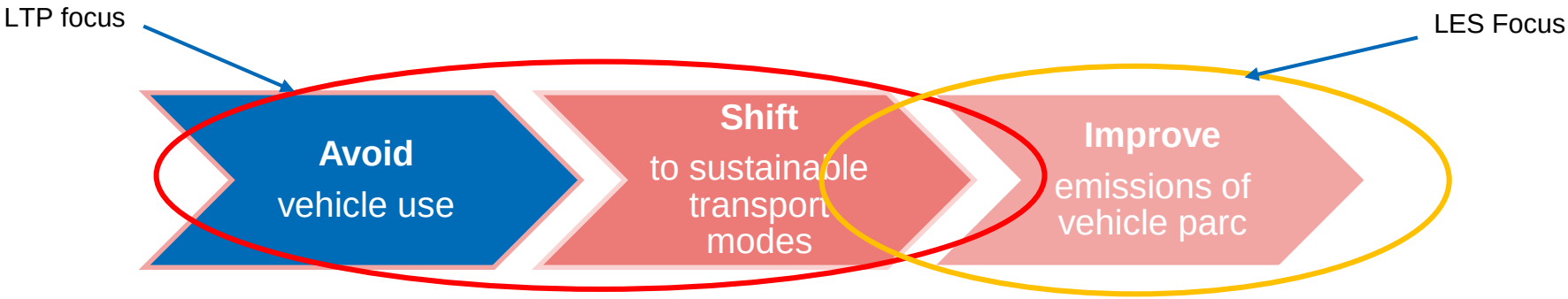
Charging or access restriction at its core

Designed to meet NO2 compliance in shortest possible time

Where do CAZ fit in?



Developing LES or non-charging measures



Reduce the need to travel
- Trip planning
- Tele working/shopping
- More efficient logistics

Mode shift
- Public transport
- Walking and cycling
- Rail/water

Shift vehicles away
- Restrict by TOD, size or vehicle type

- Improve traffic flow
- Better driving/eco-driving
- Cleaner vehicles
- Newer
- Retrofit
- Alternative fuels

Defining a charging scheme

Training and Technical Guidance from the Experts

- Define the boundary

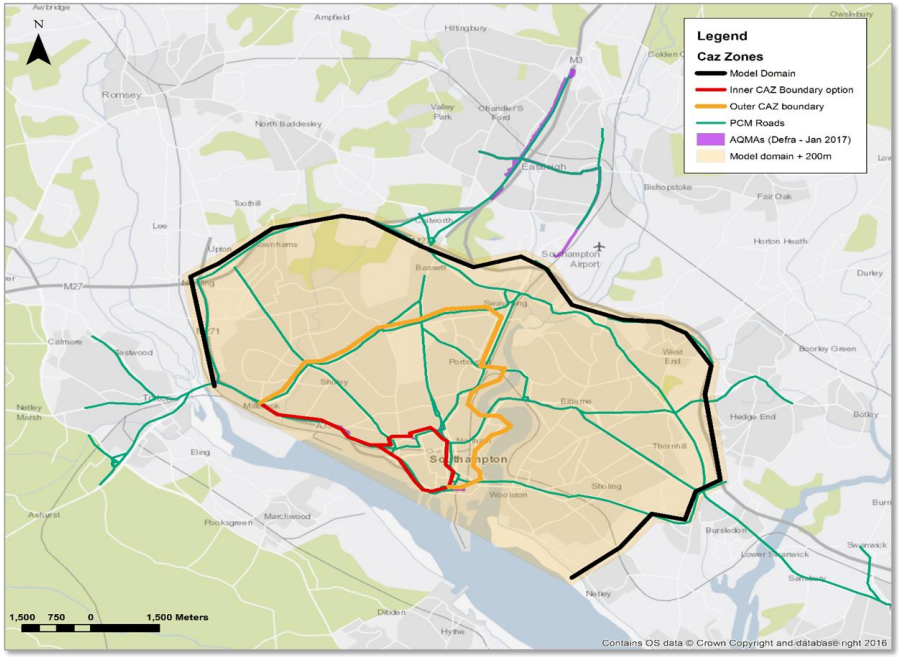
- Set a CAZ class

Class	Vehicle type	Vehicle	Nox emission limit
A	Buses, coaches, taxis	Buses/coaches	Euro VI
B	Buses, coaches, taxis, HGVs	HGV	Euro VI
C	Buses, coaches, taxis, HGVs, LGVs	Van (1305-3500kg)	Euro 6 (diesel) 4(petrol)
D	Buses, coaches, taxis, HGVs, LGVs and cars	Car/light comm. (1305kg)	Euro 6 (diesel) 4(petrol)

Defining a boundary

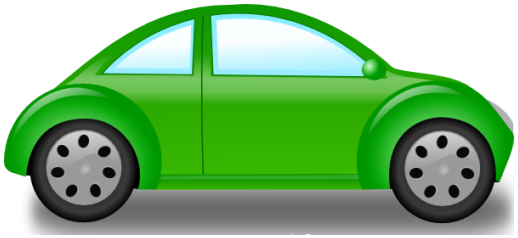
Training and Technical Guidance from the Experts

- Consider air quality problem areas
  - Non-complaint roads in national model
  - AQMAs
- Diversionary routes
- Access points and enforcement
- Impacts on key amenities and businesses

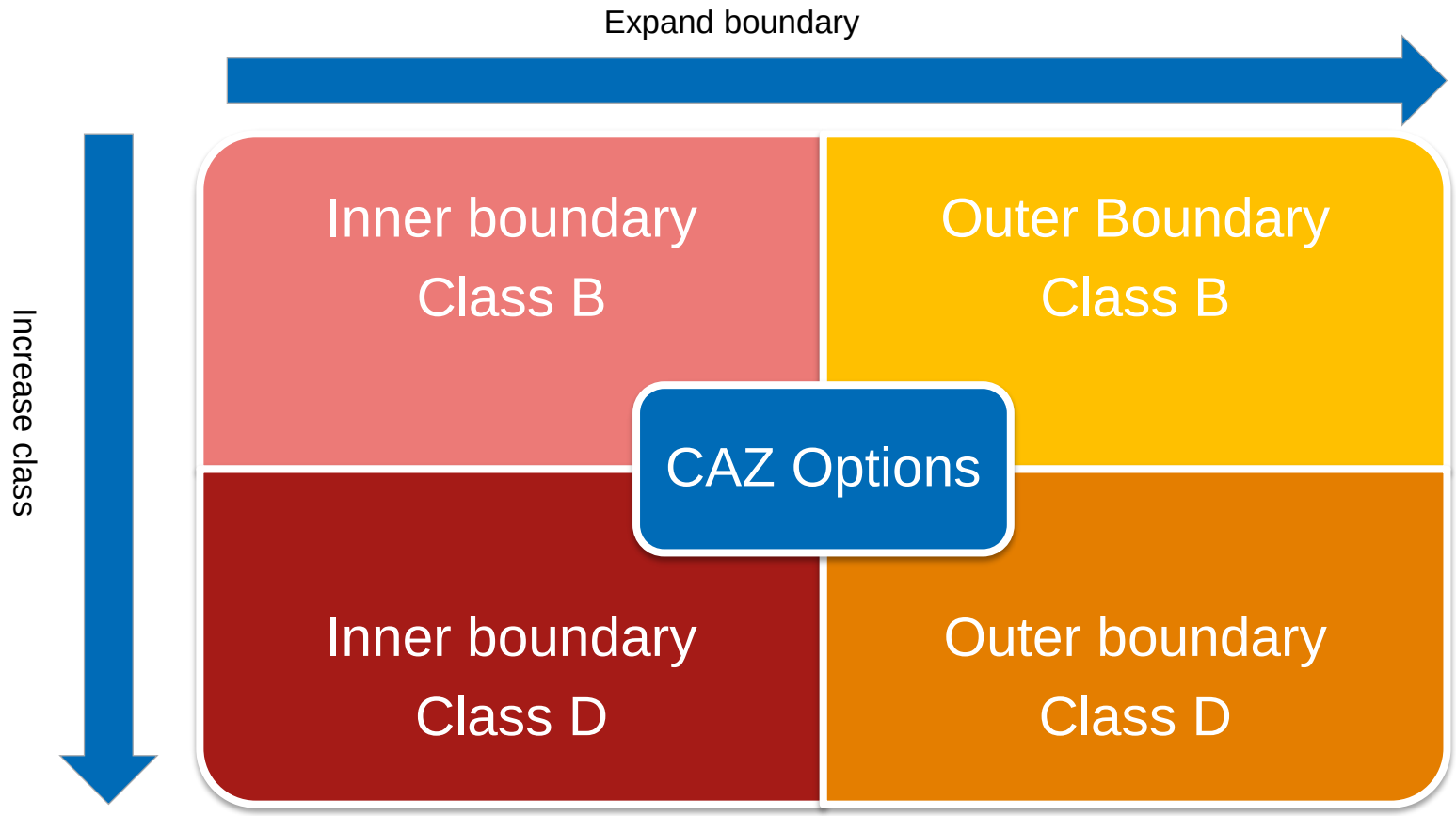


Deciding a CAZ class

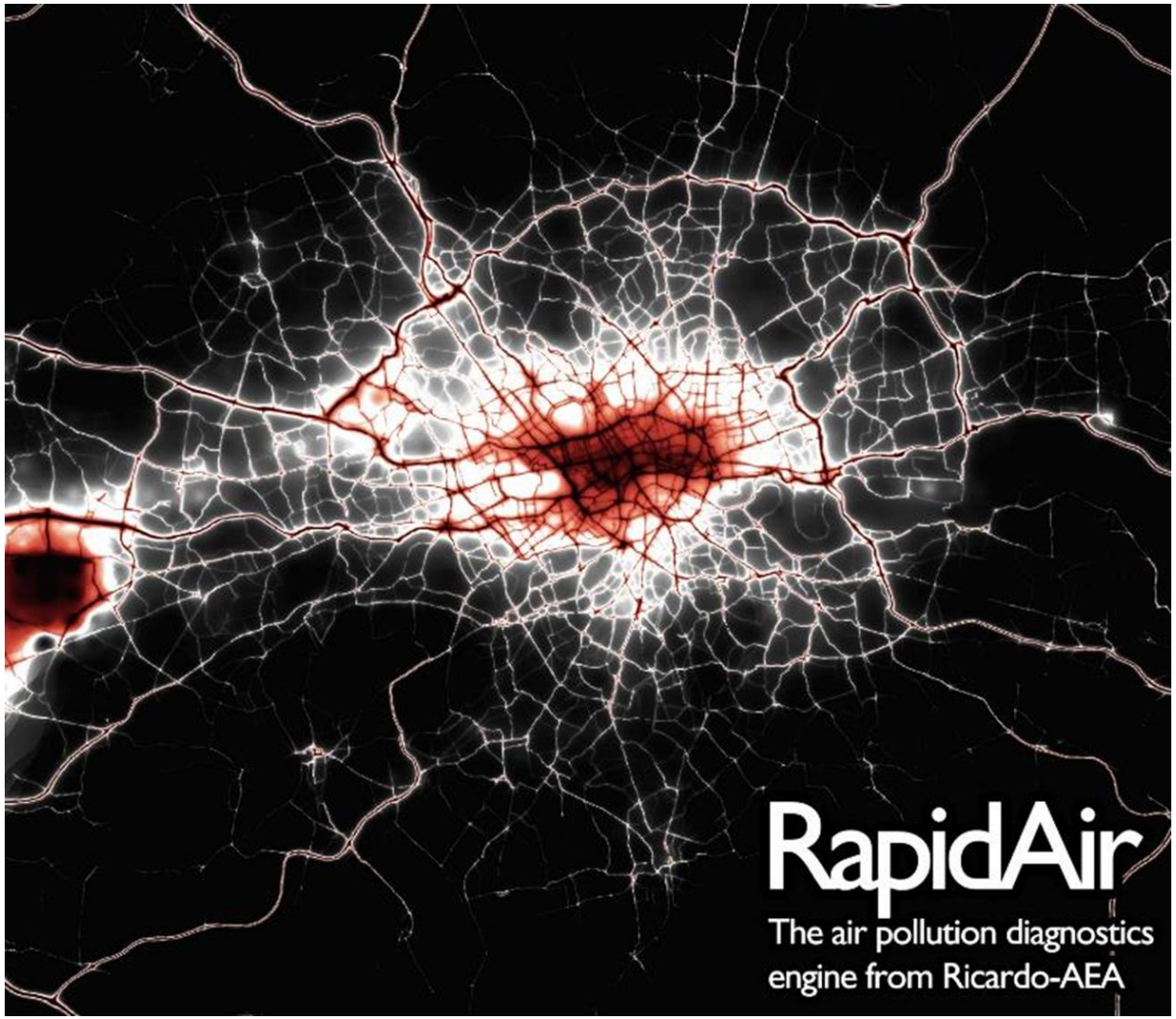
- What vehicles are causing the problem?
  - Source apportionment
- What is the likely size of impact needed to solve the problem?
- What impacts will you have on businesses and residents?
  - How to keep these to a minimum?



Consider and assess range of options



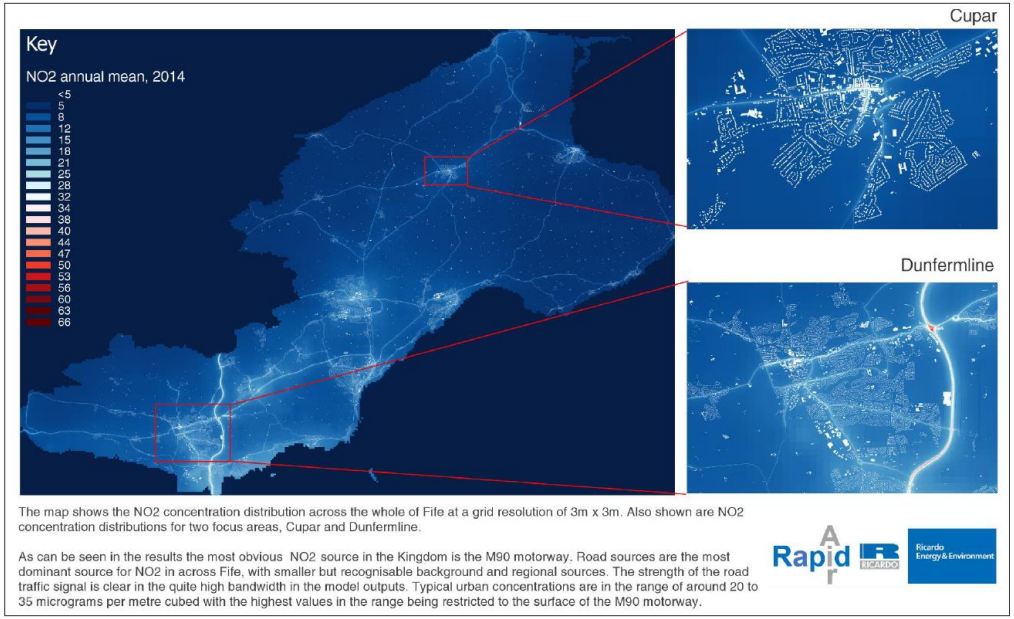
Ricardo's RapidAir model



400 million prediction points, 1.2 trillion dispersion calculations

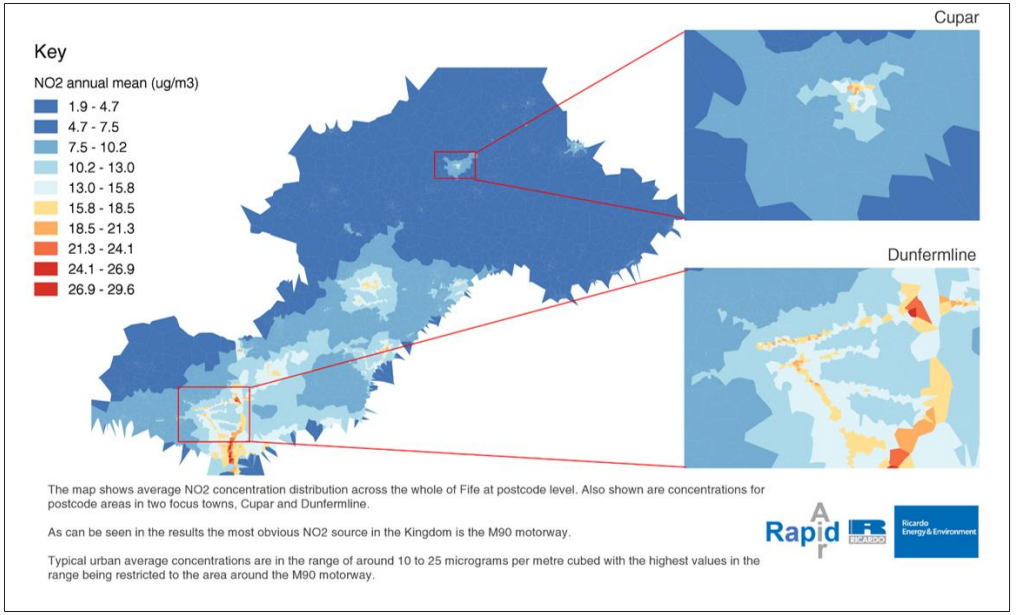
- Applying *modern scientific computing methods* to create highly resolved air pollution fields in large urban areas.
- *Modular / semi automated* approach to what is normally a very labour intensive set of processes
- *Automatic handling* of key parts of the analysis chain
  - Meteorology
  - Emissions
  - Background conditions
- *Reproducible analysis* is made easier- a key benefit
- *No proprietary products* used in the development stack

RapidAir



The map shows the NO2 concentration distribution across the whole of Fife at a grid resolution of 3m x 3m. Also shown are NO2 concentration distributions for two focus areas, Cupar and Dunfermline.

As can be seen in the results the most obvious NO2 source in the Kingdom is the M90 motorway. Road sources are the most dominant source for NO2 in across Fife, with smaller but recognisable background and regional sources. The strength of the road traffic signal is clear in the quite high bandwidth in the model outputs. Typical urban concentrations are in the range of around 20 to 35 micrograms per metre cubed with the highest values in the range being restricted to the surface of the M90 motorway.

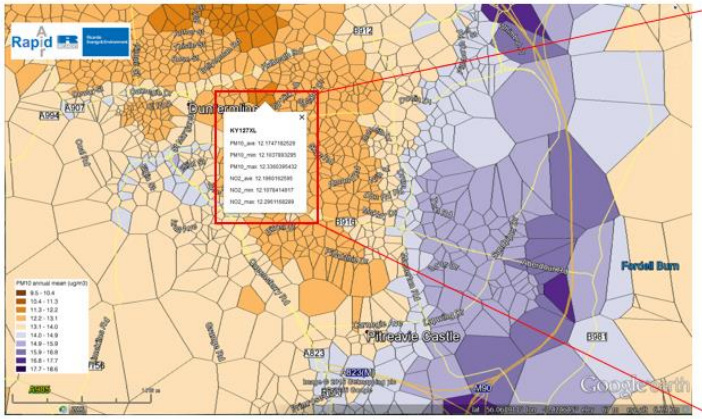


The map shows average NO2 concentration distribution across the whole of Fife at postcode level. Also shown are concentrations for postcode areas in two focus towns, Cupar and Dunfermline.

As can be seen in the results the most obvious NO2 source in the Kingdom is the M90 motorway.

Typical urban average concentrations are in the range of around 10 to 25 micrograms per metre cubed with the highest values in the range being restricted to the area around the M90 motorway.

PM_{10} average by postcode



Concentrations for a single postcode

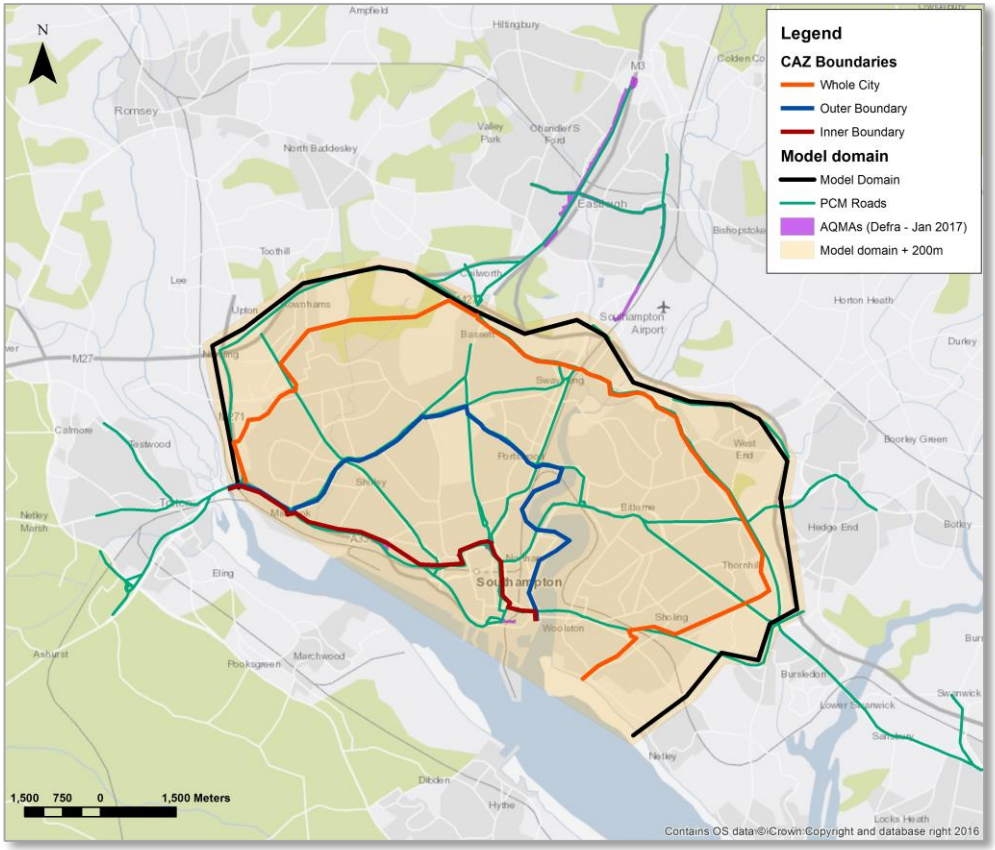
Every postcode in Fife has annual mean modelled concentrations of NO_2 and PM_{10}. Maximum, minimum and mean values within each postcode area are provided.

These values will be useful to health professionals who use postcode level metrics in their analyses.

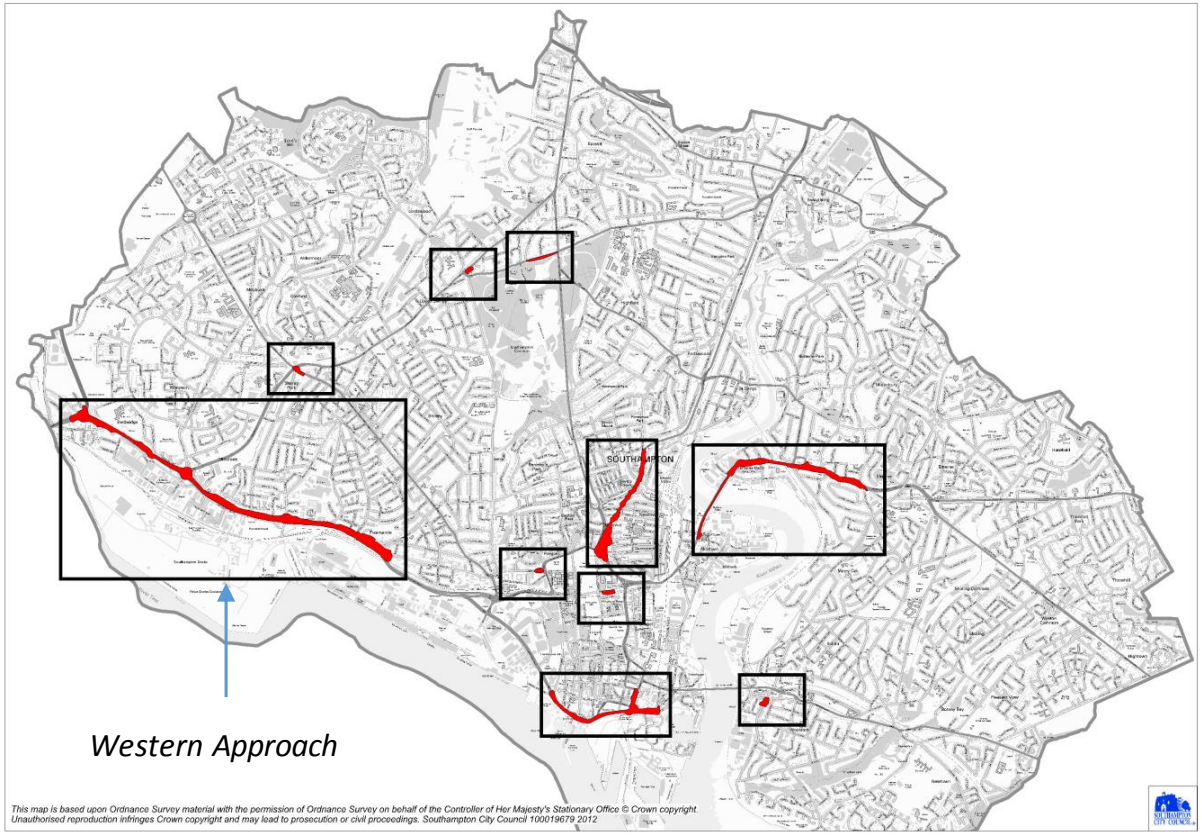
The model has a resolution of 3m (>300million prediction points) and covers the whole Local Authority areas Data products include common GIS formats, Google Earth layers, interactive report including OpenAir.

Impact of CAZ on society locally

- Ricardo working with the leading CAZ cities:
  - Southampton, Leeds, Nottingham, Derby and London
- Considerations include:
  - Charging of vehicles to enter zone
  - Placement of boundary
  - Air quality and health benefits
  - **Social and economic impacts**
  - **Impacts on business and displacement**



AQMAs in Southampton

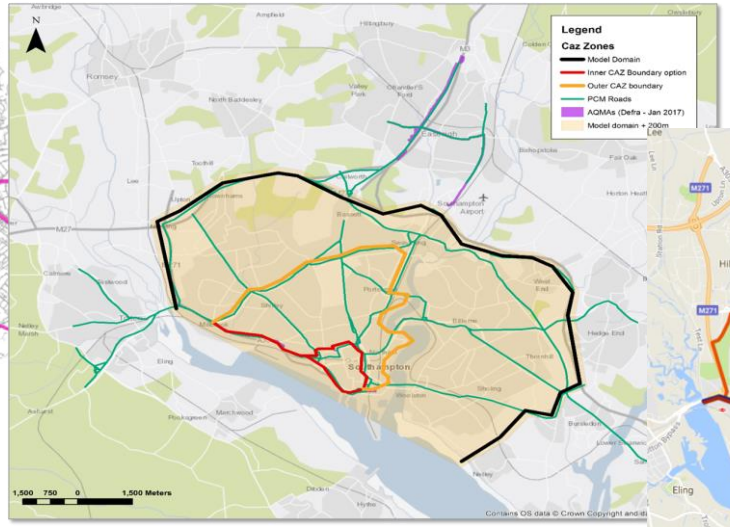


Evolving the scheme options

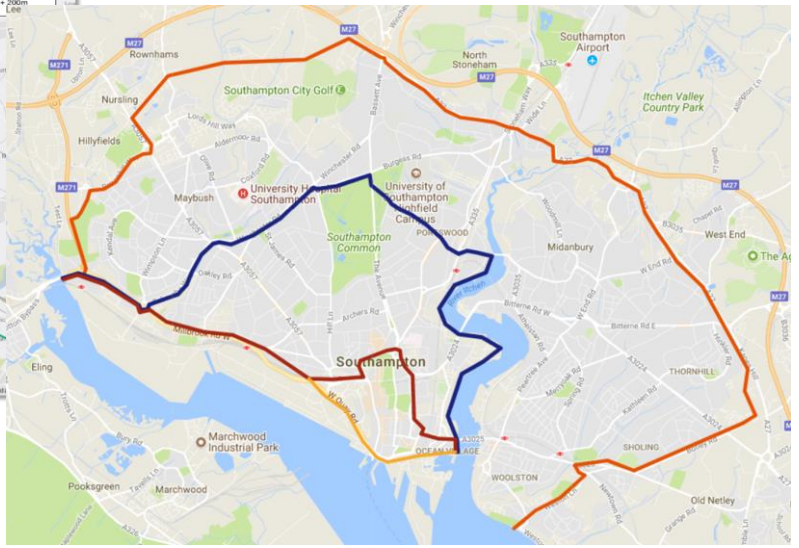
Training and Technical Guidance from the Experts

Class B covering AQMAs

Class B or D and two boundaries

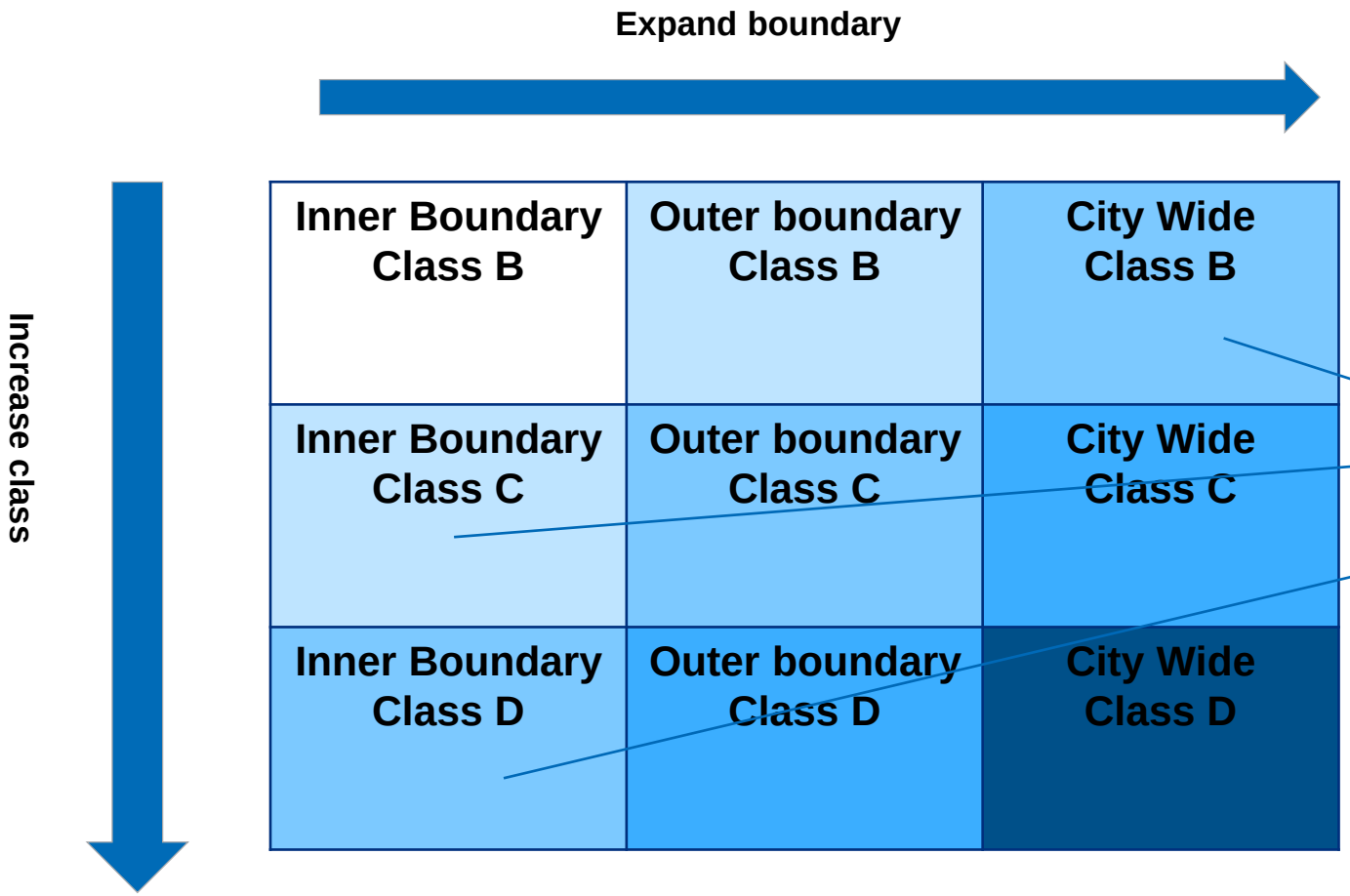


3 boundaries and 3 classes



A matrix of options

Training and Technical Guidance from the Experts



Possible Doughnut options

- City wide B plus inner Class C
- City wide B plus inner Class D

A longlist

Training and Technical Guidance from the Experts

	Scenario	Red	Blue	Brown WA+CC	Brown WA+CC	Brown CC	Brown CC
		Citywide	Outer RR	inc Inner RR	exc Inner RR	inc Inner RR	exc Inner RR
0	DM (not incl. CAZ response)						
1	Citywide B	B					
2	Citywide C	C					
3	Citywide D	D					
4	OuterRR B		B				
5	OuterRR C		C				
6	OuterRR D		D				
7	Inner WA+CC (Inc InnerRR) B			B			
8	Inner WA+CC (Inc InnerRR) C			C			
9	Inner WA+CC (Inc InnerRR) D			D			
10	Inner WA+CC (Exc InnerRR) B				B		
11	Inner WA+CC (Exc InnerRR) C				C		
12	Inner WA+CC (Exc InnerRR) D				D		
13	Citywide Doughnut BD	B				D	
14	Citywide Doughnut BC	B				C	
15	Citywide Doughnut CD	C				D	
16	Citywide Doughnut BD	B					
17	Citywide Doughnut BC	B					
18	Citywide Doughnut CD	C					
19	OuterRR Doughnut BD		B			D	
20	OuterRR Doughnut BC		B			C	
21	OuterRR Doughnut CD		C			D	
22	OuterRR Doughnut BD		B				
23	OuterRR Doughnut BC		B				
24	OuterRR Doughnut CD		C				
25	Double Doughnut BCD	B	C			D	
26	Double Doughnut BCD	B	C				D

Reduced list for sifting

	Scenario	Red	Blue	Brown WA+CC	Brown WA+CC	Brown CC	Brown CC
		Citywide	Outer RR	inc Inner RR	exc Inner RR	inc Inner RR	exc Inner RR
1	Citywide B	B					
2	Citywide C	C					
3	Citywide D	D					
4	OuterRR B		B				
5	OuterRR C		C				
6	OuterRR D		D				
7	Inner WA+CC (Inc InnerRR) B			B			
8	Inner WA+CC (Inc InnerRR) C			C			
9	Inner WA+CC (Inc InnerRR) D			D			
10	Inner WA+CC (Exc InnerRR) B				B		
11	Inner WA+CC (Exc InnerRR) C				C		
12	Inner WA+CC (Exc InnerRR) D				D		
13	Citywide Doughnut BD	B				D	
14	Citywide Doughnut BC	B				C	

Example sifting results

Training and Technical Guidance from the Experts

Scenario	Air Quality Management Areas – Emissions Weighted Vehicles % change: A3024 Northam Bridge	A33 Milbrook Road West	A33 Redbridge Road	A33 Town Quay	A335 Onslow Road	A35 Burgess Road	A35 Hill Lane	Commercia Road	New Road	Victoria Road	Windmere Ave - Redbridge Hill	Pass / Fail Criteria: A3024 Northam Bridge	A33 Milbrook Road West	A33 Redbridge Road	A33 Town Quay	A335 Onslow Road	A35 Burgess Road	A35 Hill Lane	Commercia Road	New Road	Victoria Road	Windmere Ave - Redbridge Hill	Minimum (Pass / Fail)	Minimum (Pass / Fail)
1	-10%	-11%	-11%	-7%	-11%	-6%	-5%	-9%	-22%	-6%	-6%	4	4	4	4	4	4	4	4	4	4	4	4	O
4	-8%	-6%	-4%	-3%	-2%	6%	4%	-2%	-17%	0%	-2%	4	4	4	4	4	1	1	4	4	4	4	1	×××
7	-9%	-9%	-4%	-3%	2%	1%	1%	-11%	-23%	0%	-1%	4	4	4	4	1	1	1	4	4	4	4	1	×××
10	-7%	-10%	-5%	-3%	-2%	1%	1%	3%	-23%	0%	-1%	4	4	4	4	4	1	1	1	4	4	4	1	×××
3	-26%	-24%	-25%	-21%	-24%	-21%	-21%	-23%	-31%	-15%	-21%	4	4	4	4	4	4	4	4	4	4	4	4	O
6	-27%	-26%	-20%	-23%	-24%	-1%	-5%	-25%	-35%	-2%	-7%	4	4	4	4	4	4	4	4	4	4	4	4	O
9	-23%	-31%	-16%	-21%	-2%	2%	-2%	-36%	-38%	-1%	-5%	4	4	4	4	4	1	4	4	4	4	4	1	×××
12	-18%	-31%	-16%	-23%	-12%	0%	-2%	-16%	-38%	-1%	-5%	4	4	4	4	4	4	4	4	4	4	4	4	O
13	-25%	-22%	-18%	-25%	-14%	-7%	-8%	-35%	-37%	-6%	-8%	4	4	4	4	4	4	4	4	4	4	4	4	O
14	-13%	-12%	-12%	-8%	-10%	-7%	-6%	-13%	-25%	-6%	-7%	4	4	4	4	4	4	4	4	4	4	4	4	O

Key success criteria

Training and Technical Guidance from the Experts

Options should be assessed against the following criteria:

a) cause NO2 levels in the area to reach legal compliance within the shortest time possible;
   - Primary focus is compliance with the EU directive in relation to the Western Approach
   - Secondary focus is compliance with in all other AQMAs

b) minimise the effects and impacts on local residents and businesses, including disadvantaged groups, and have no unintended consequences;

c) demonstrate value for money.

Key conclusions

- A CAZ is essentially an environmental charging scheme, with support measures
- However, the Government is encouraging LA's to consider LES or non-charging measures as an alternative
- Developing LES or non-charging measures needs to be done as a cross authority process considering all policy levers
- Developing a formal CAZ requires consideration of both boundary and CAZ class
  - Key objective is to meet compliance with minimal impact on residents and businesses
- Highways authorities will be a key player in the development and implementation of a formal CAZ

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