Monitoring air quality impacts in Auckland's proposed zero emission area

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Auckland City Centre Advisory Board

27 February 2019

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Overview

- Identify transport as the major polluter in Auckland City Centre
- The rationale for change
- Monitoring the impacts of land use and design changes
- What will be achieved with air quality monitoring

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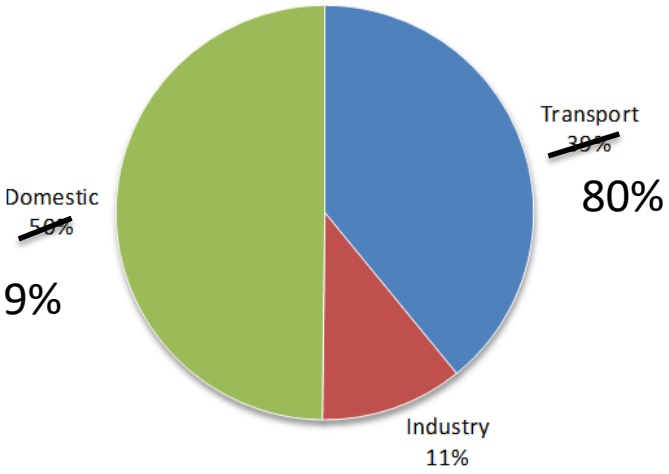
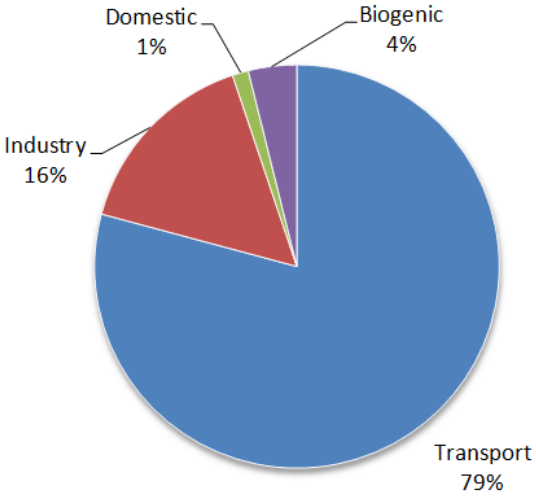
Transport is the major anthropogenic emission source across Auckland

…..however, within the City Centre

$PM_{2.5}$ (total = 3,000 t/yr)

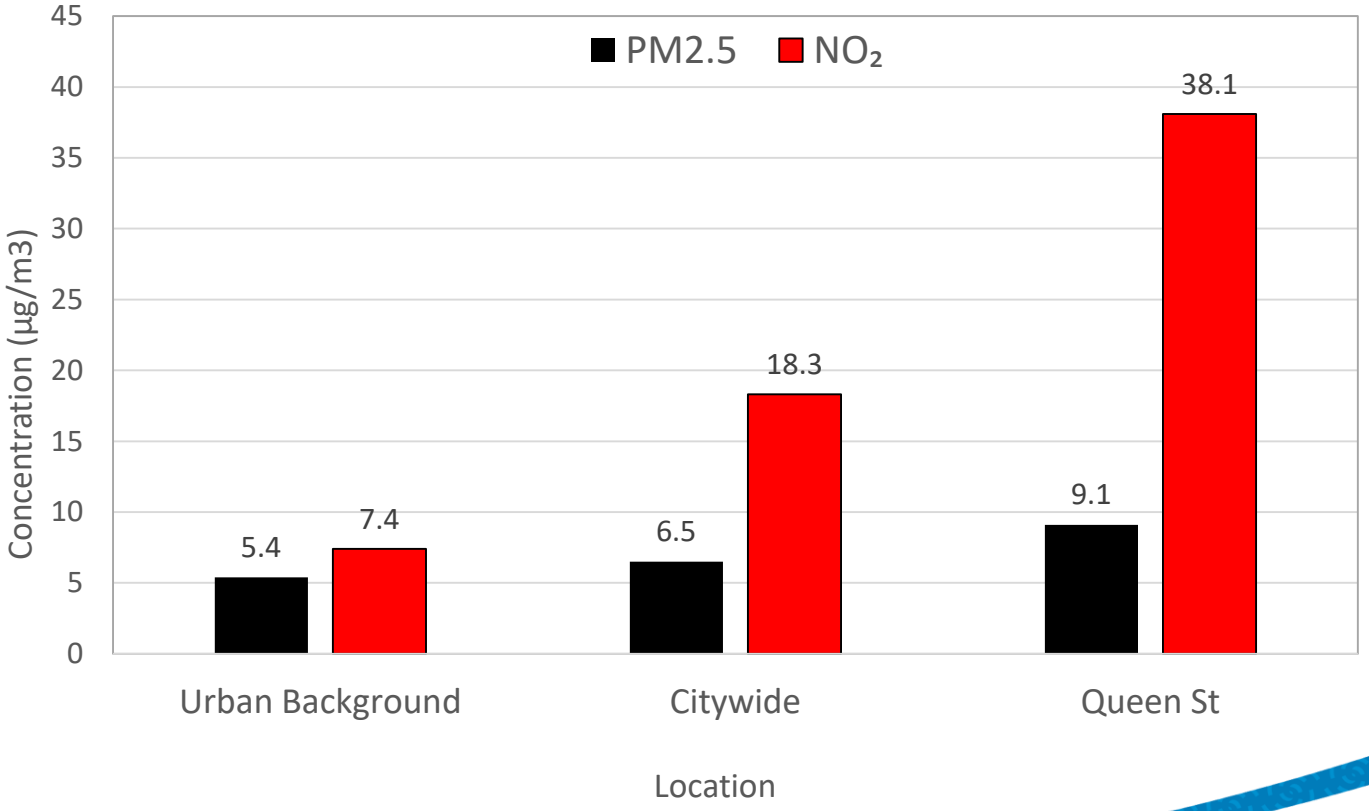


NOx (total = 20,800 t/yr)



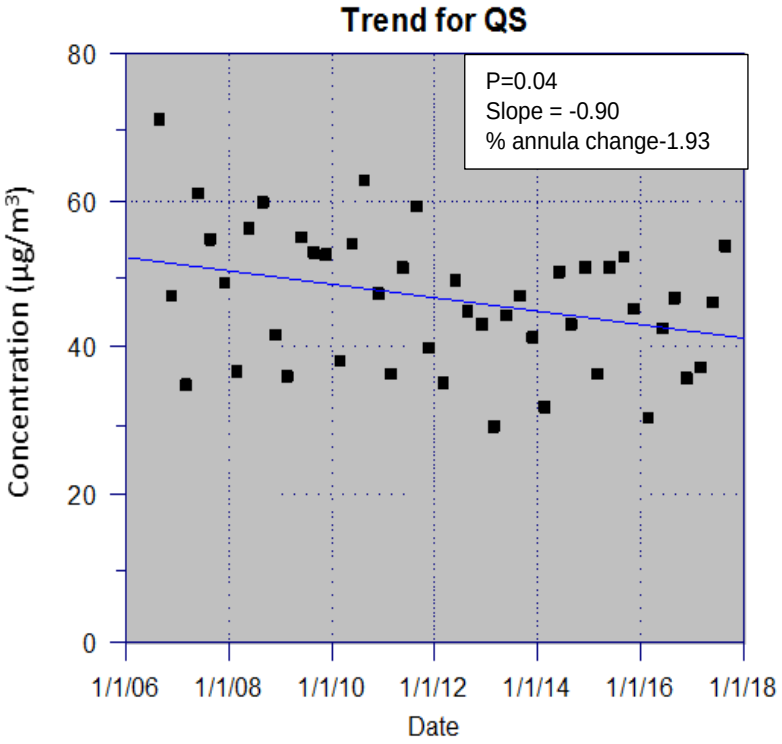
The need for change

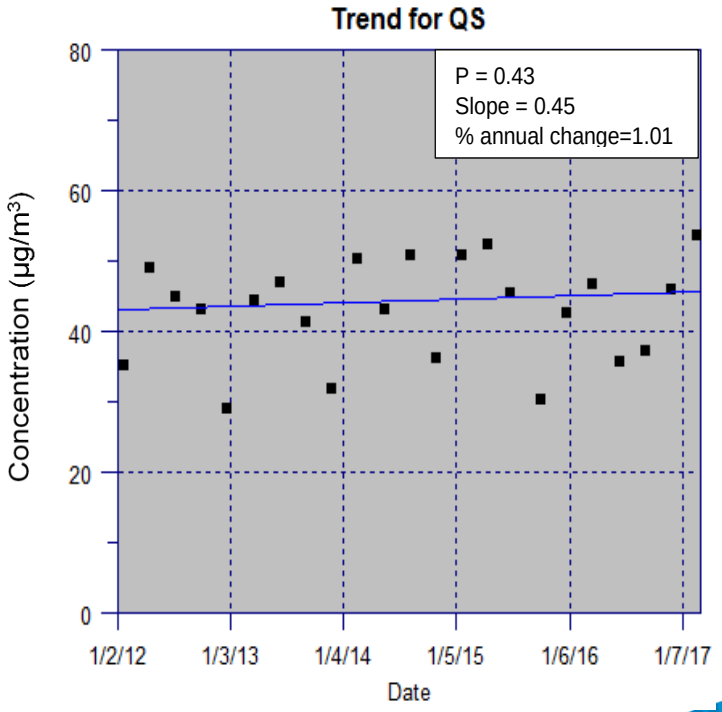
- Downtown Auckland has the highest air pollution measurements across the Auckland network.



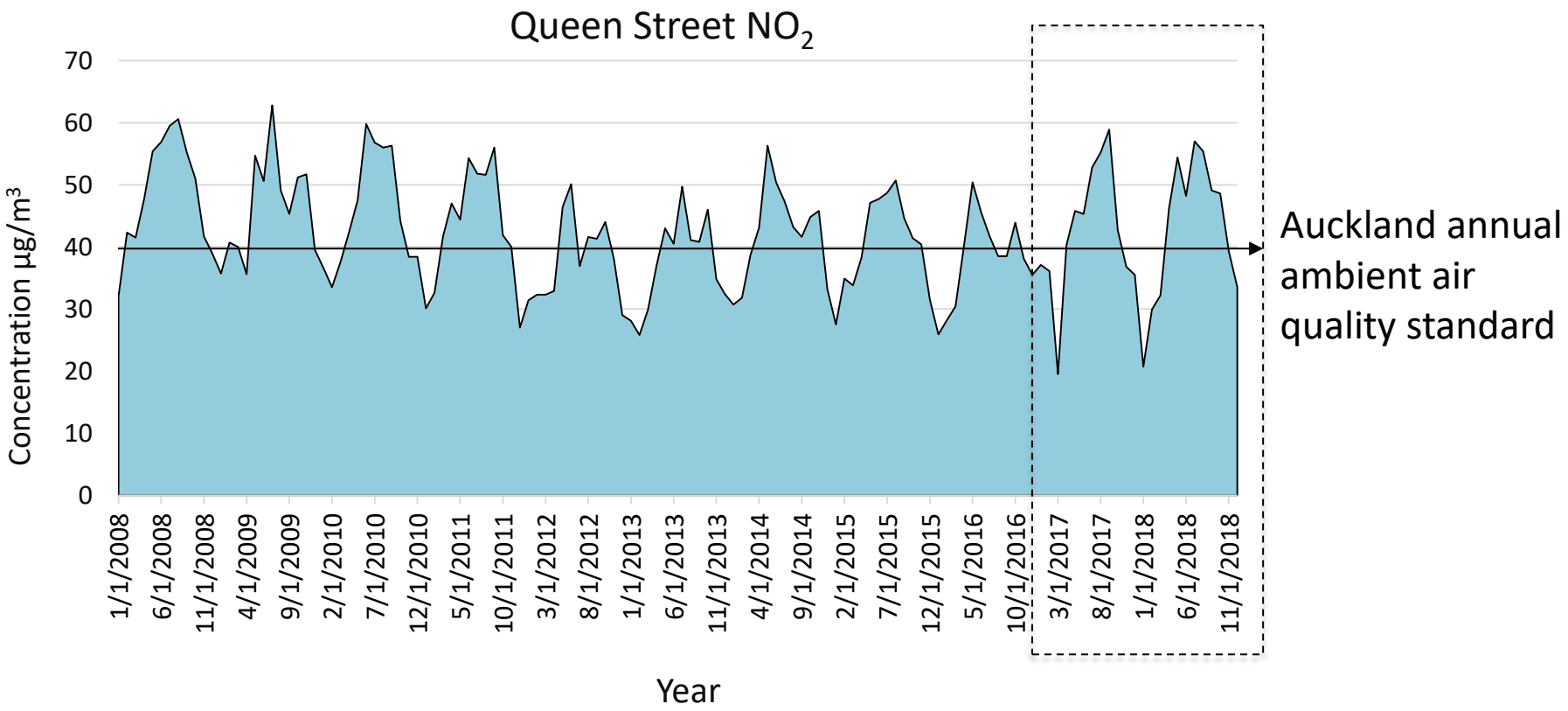
Nitrogen Dioxide (NO_2) trends

- **Decreased significantly since 2006**
- **Now increasing slightly: The question is WHY?**





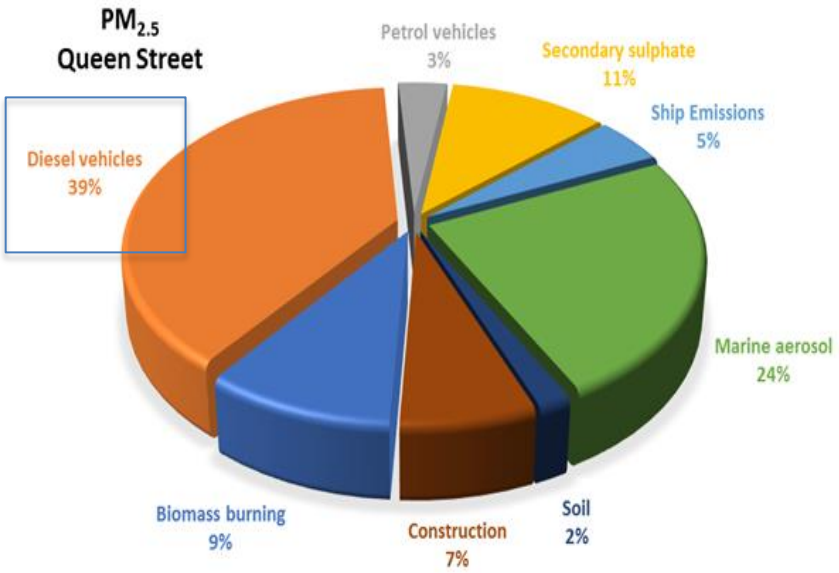
Nitrogen Dioxide (NO_2) 2017 and 2018



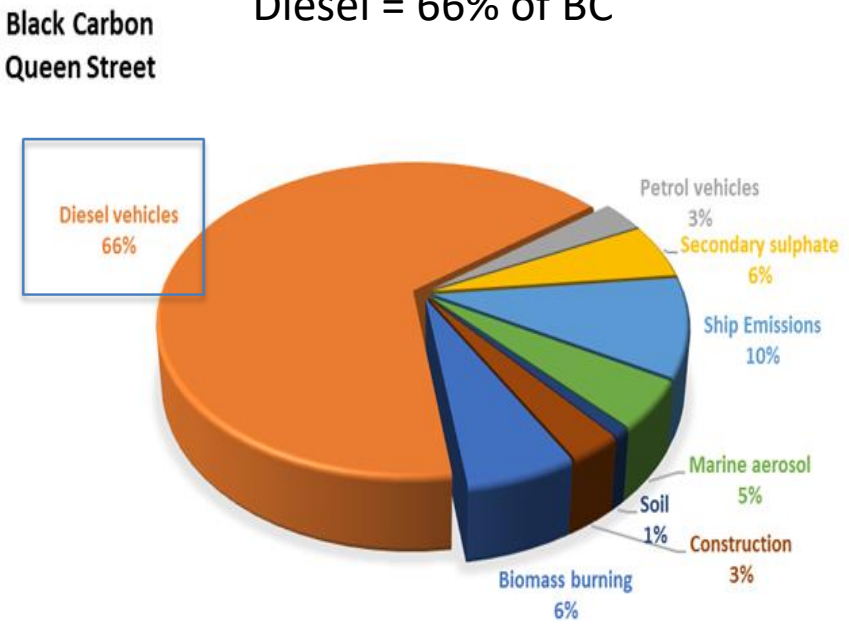
Recent increases MAY reflect bus / trucks and building work going on through the City Centre area.

Black Carbon on Queen Street

Diesel = 39% $PM_{2.5}$

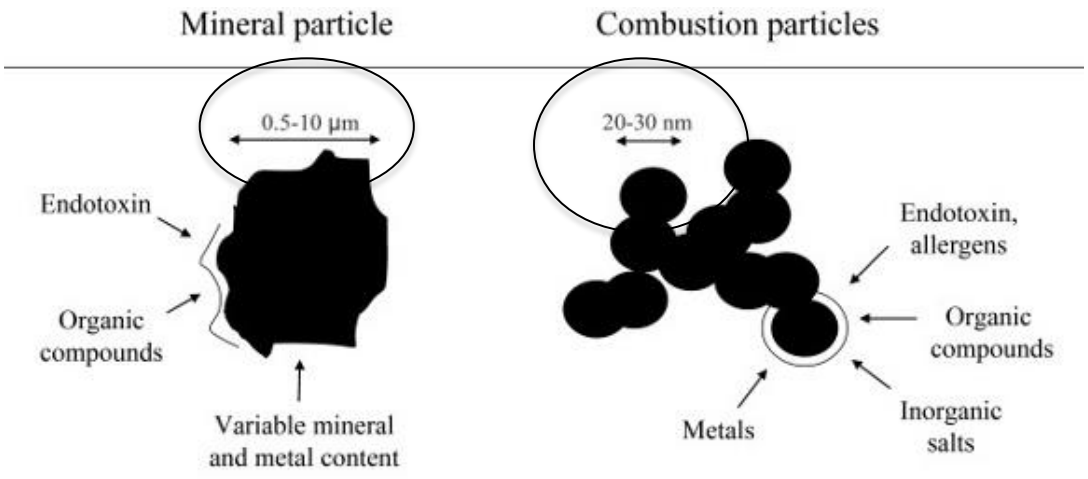


Diesel = 66% of BC

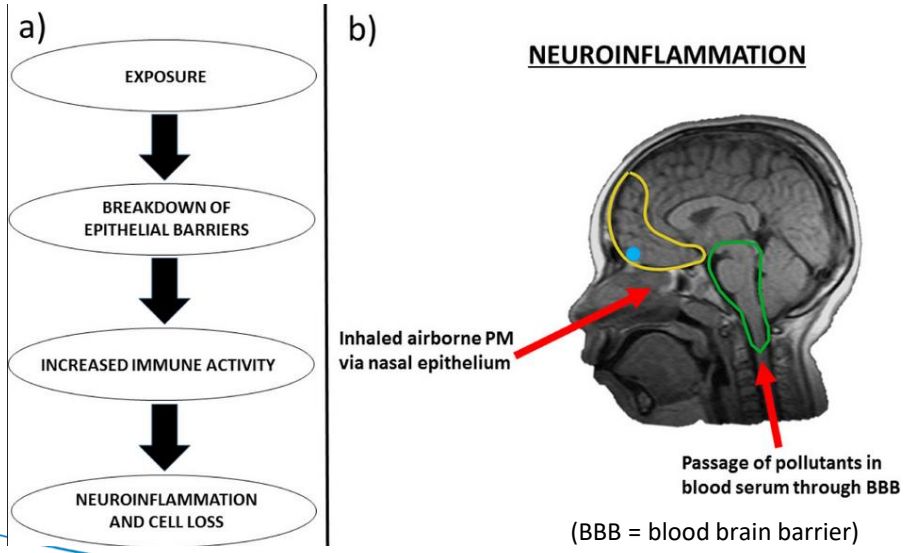


Source apportionment data from filter measurements on Queen Street that identified $PM_{2.5}$ (Left) and Black Carbon (Right) (Davy and Trompetter 2017).

What's the issue with Black Carbon?



The surface area of BC combustion is large allowing for more nasties to condense on:
Including 12 poly-aromatic hydrocarbons (PAH's) – All are carcinogenic (1)



(BBB = blood brain barrier)

Adults: Access brain via bloodstream through alveoli air exchange in lungs.

Children: Epithelium under developed allows direct access via nasal passage (2)

Resulting in impaired cognitive function and increase the risk of developing dementia and Alzheimer's disease

[1] Schwarze PE et al. Importance of sources and components of particulate air pollution for cardio-pulmonary inflammatory responses: 2010: www.intechopen.com.
[2] Brockmeyer and D'Angiulli; 2016; **How air pollution alters brain development: the role of neuroinflammation** https://doi.org/10.1515/tnsci-2016-0005

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Black Carbon international comparison

Region	Network	Year	Black Carbon µg/m³	
			Urban	Rural
Queen Street: Auckland	***Auckland Council***	***2006-2016***	***2.2 – 5.3***	
United States			5 (~200 sites)	0.1 – 0.6 (~150 sites
Canada			.8 (12 sites)	0.4 – 0.8 (4 sites)
Europe			.8 (4 sites)	0.2 – 1.8 (12 sites)
UK			.9 (19 sites)	
China			4.2 (5 sites)	0.3 – 5.3 (13 sites)

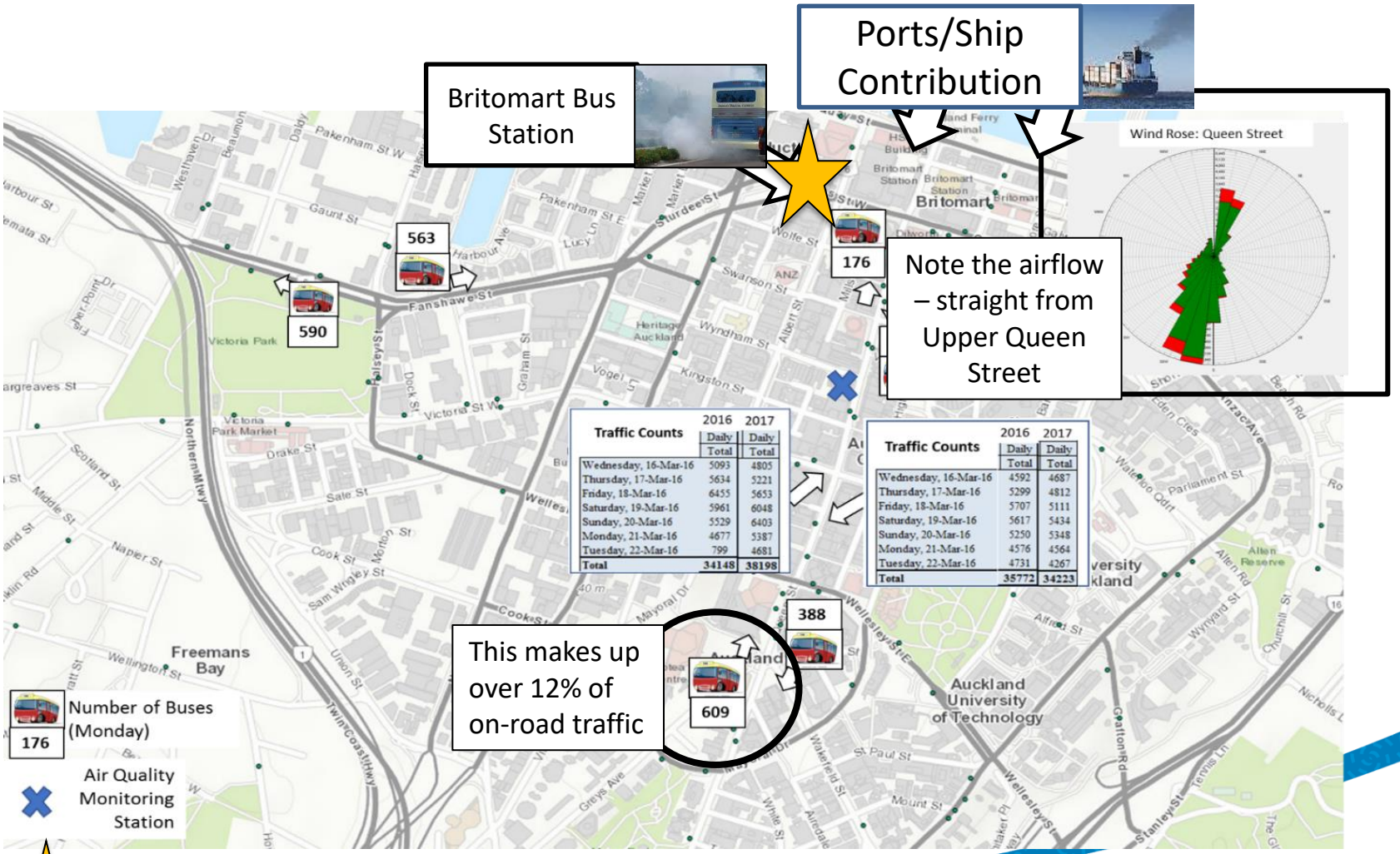
Rising levels of 'black carbon' in Queen St heighten health risk for Aucklanders

7 Nov, 2018 11:00am

3 minutes to read

Soot or 'black carbon' is something to be aware of in Auckland's Queen St. It's emitted from diesel vehicles and is on the rise again. Photo / Brett Phibbs

Why are air pollution levels elevated downtown?



New Air Quality monitoring site: Real-time BC data

Proposed design, transport and infrastructure changes in Auckland's City Centre

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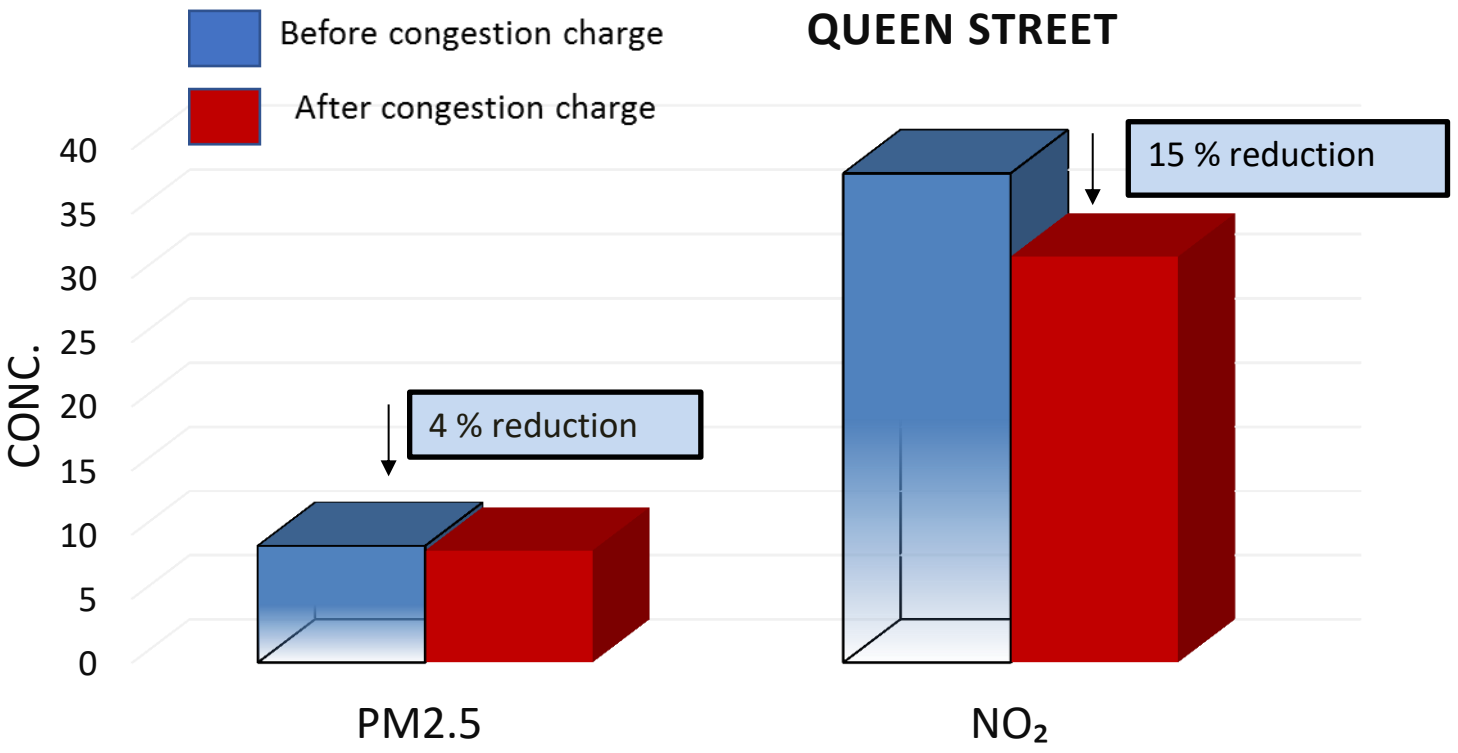
Modeling the impacts of a congestion charge

With C40 healthy cities initiative, We modelled what would happen if we removed 11000 private vehicles from the City Centre



With congestion pricing we are not removing the major emitters
Buses/ trucks / delivery vans etc. Small decreases prove this!

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New Transport Investment for Central Auckland

SOCIAL IMPACT

Number of deaths averted annually across the total population:

0 **days per person**

Life expectancy across the total population increased by:

0 **days per person**

ECONOMIC IMPACT

Approximate costs avoided due to reduced premature mortality from change in PM2.5 levels:

NZ $40,291.15 Per Year

SOCIAL IMPACT

Number of deaths averted annually across the total population:

6

Life expectancy across the total population increased by:

31 **days per person**

ECONOMIC IMPACT

Approximate costs avoided due to reduced premature mortality from change in NO2 levels:

NZ $1,051,099.51 **year**

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The impacts of Auckland City Centre changes

The A4E programme helps resolve air quality issues from the city centre.

Current investment in CRL and light rail will also help reduce vehicle numbers.

Most importantly: is an <u>urgent need</u> to electrify the bus fleet as per the fossil fuel free streets agreement.

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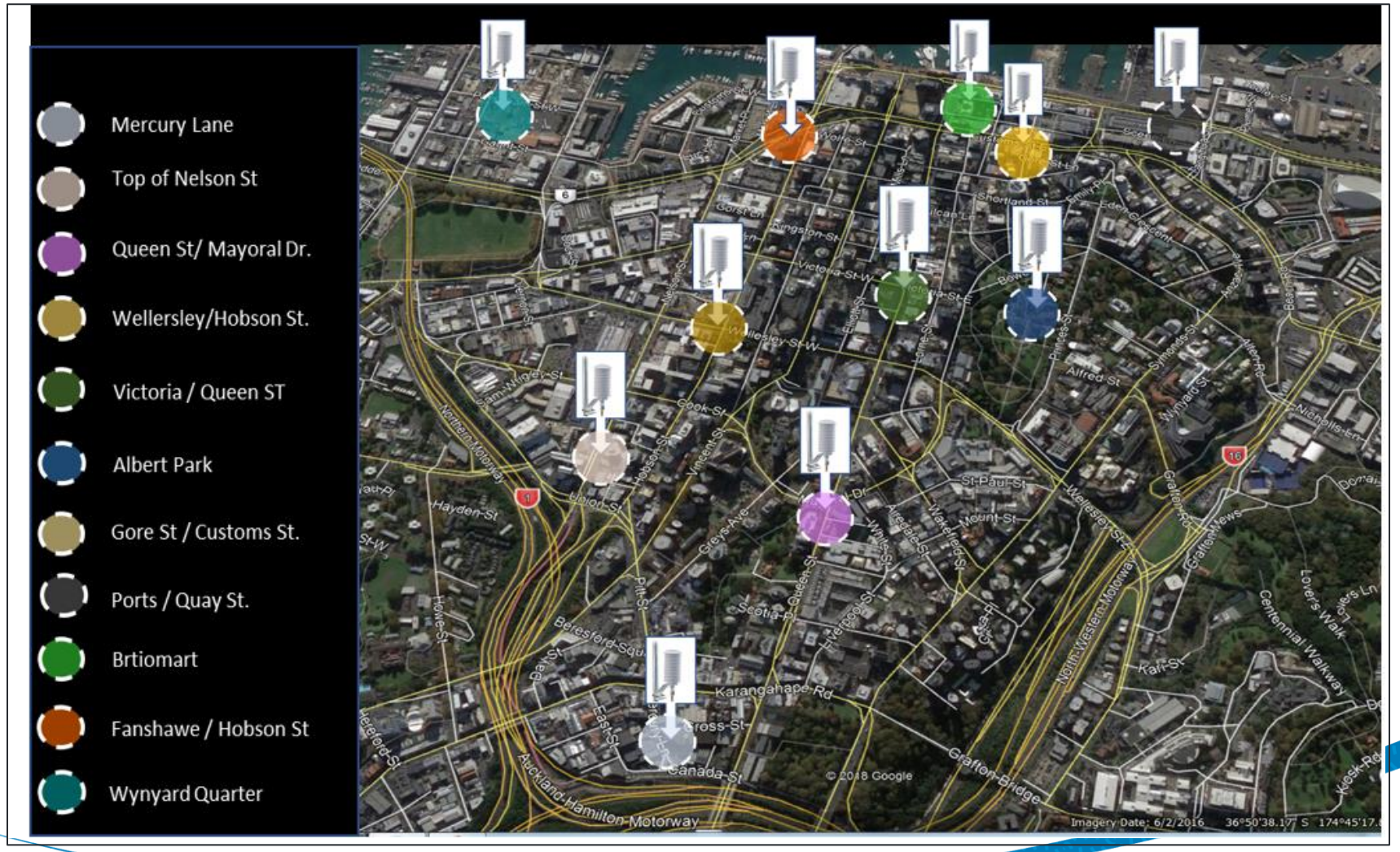
Establishing a smart sensor network



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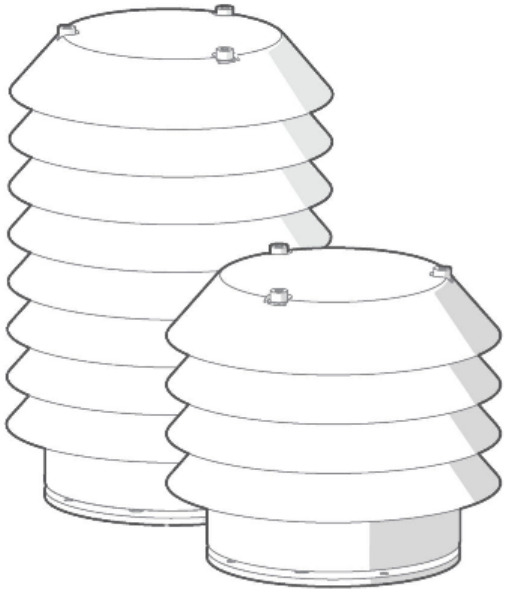
Example of parameters measured

- Air Pollution data …includes
  - PM_{10}
  - $PM_{2.5}$
  - NO_2
  - SO_2
  - CO
- Noise
- Pedestrian counts
- Traffic counts
- Social data – Foot fall number / crime/ accidents..

2. Vaisala Air Quality Transmitter AQT400 Series



Concluding Statement

"Policy decisions that promote safer streets, climate action, active and public transportation modes as well as congestion mitigation strategies have multiple and interdependent benefits.

This includes increased economic activity, vibrant social spaces and a cleaner, more sustainable environment, including cleaner air"

Questions?

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