EVALUATING TRAFFIC MANAGEMENT INTERVENTIONS IN CITIES: A TIERED APPROACH FOR EFFICACY TESTING AND SOURCE IDENTIFICATION

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Background

- Pedestrians are at greater risk of exposure to air pollution
- Transport related air pollution kills 400,000 people every year
- Low/Zero emissions zones (LEZ) are an important intervention
- Evidence base quantifying the effects of implementing such interventions is lacking
  - Lack of monitoring data
  - Uncertainties in models and emissions inventories



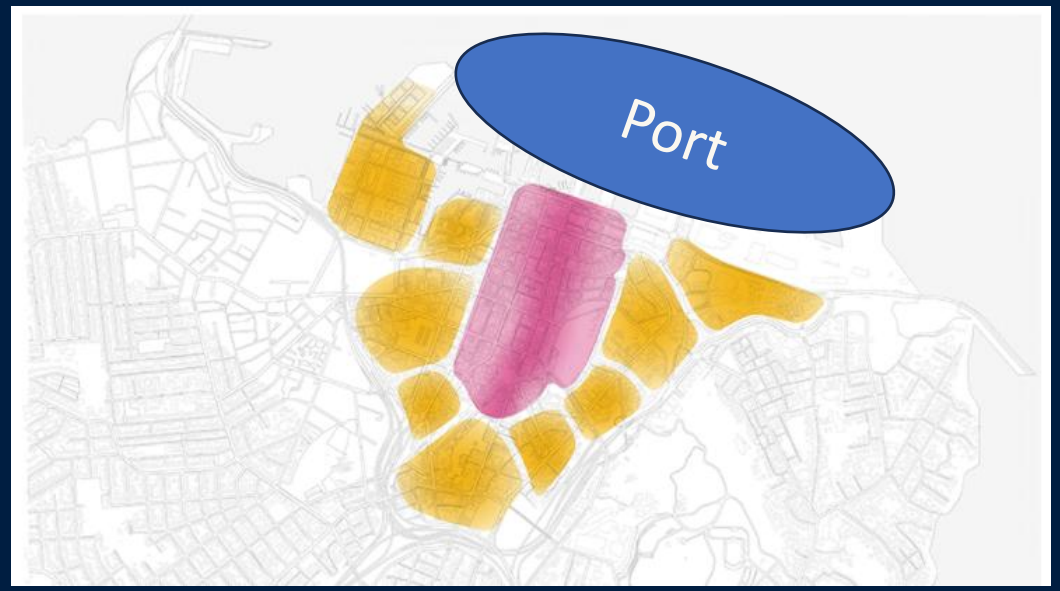


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Background

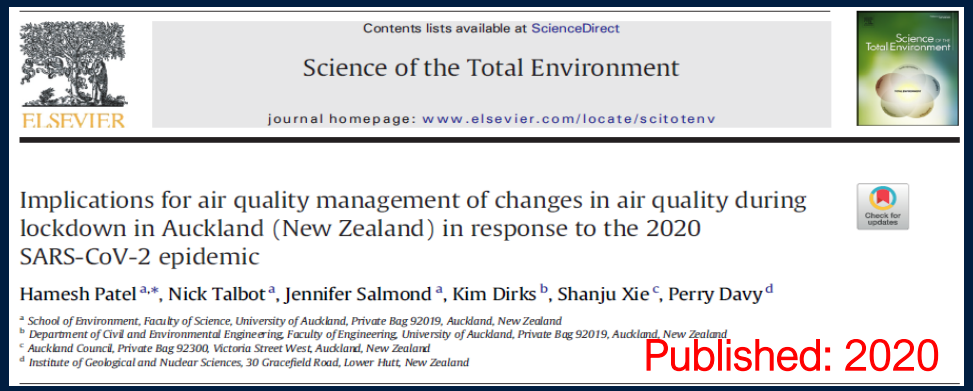
- C40 cities are collaborating to tackle the climate crisis
- Access for everyone (A4E) is part of Auckland commitment to C40
- Implementation of a zero-emission area by 2030
- Phased introduction (started 2020)
- Multiple issues already noted
  - Aging car fleet
  - Goods and service vehicles exempt
  - Increase in coarse PM
  - Largest industry is exempt





Questions to answer

- If we remove vehicles what are the:
  - **Regional** impacts on air quality (phase 1)
  - **Local** scale impacts and variability and hotspots (Phase 2)
  - **Sources** of air pollution (Phase 3)

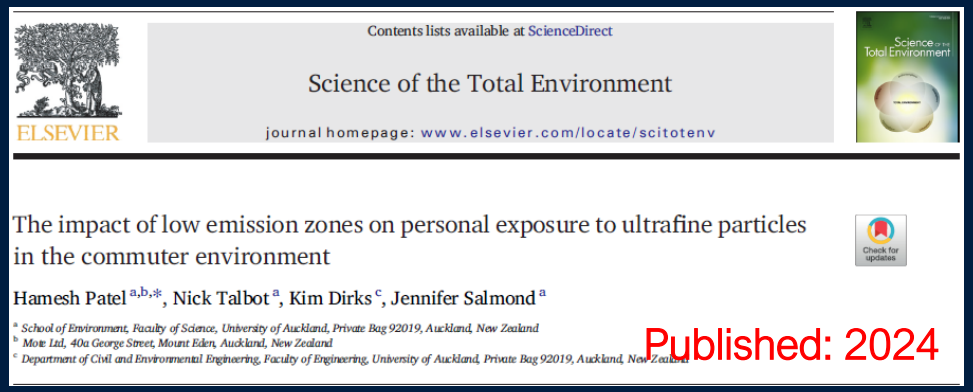

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Implications for air quality management of changes in air quality during lockdown in Auckland (New Zealand) in response to the 2020 SARS-CoV-2 epidemic

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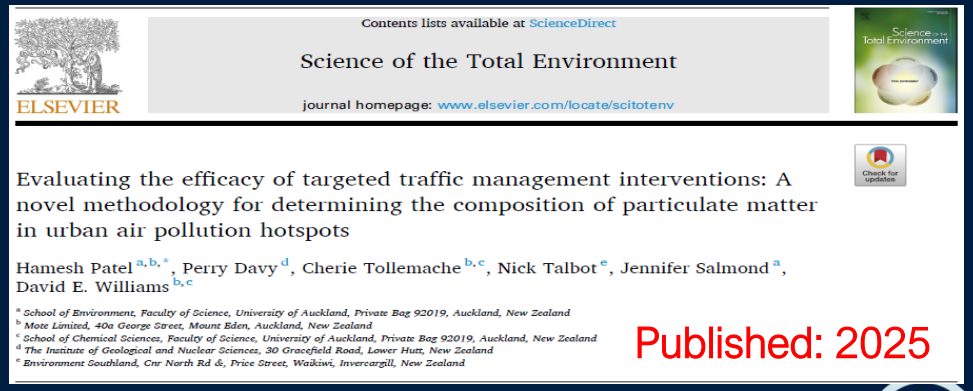

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The impact of low emission zones on personal exposure to ultrafine particles in the commuter environment

Hamesh Patel [a,b,*], Nick Talbot [a], Kim Dirks [c], Jennifer Salmond [a]

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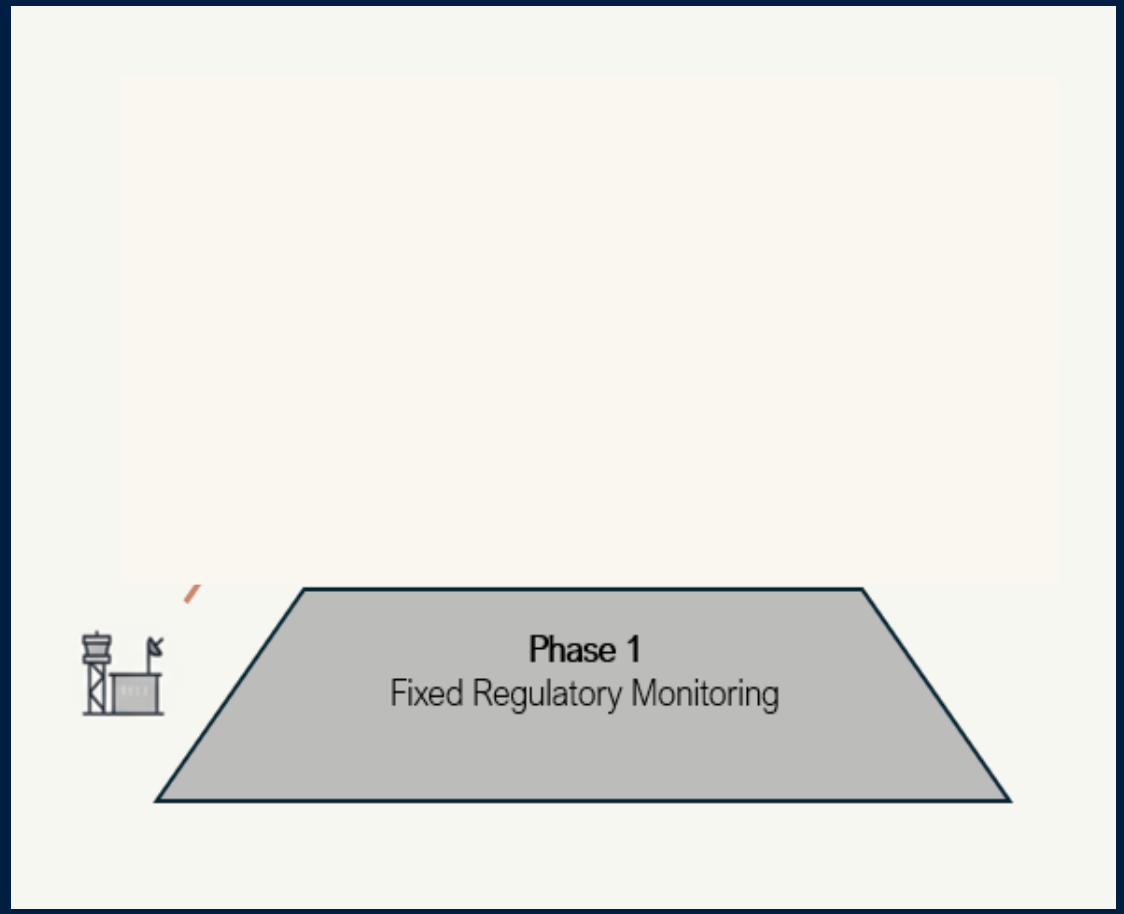
Evaluating the efficacy of targeted traffic management interventions: A novel methodology for determining the composition of particulate matter in urban air pollution hotspots

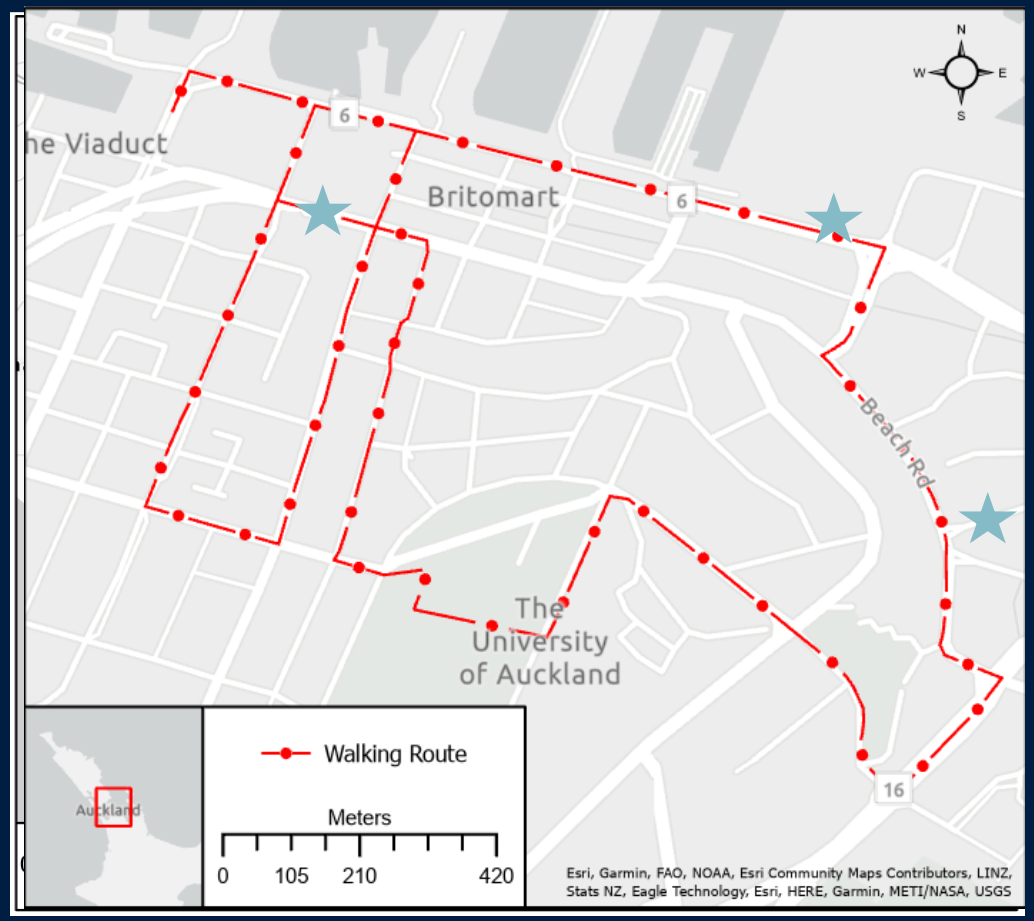
Hamesh Patel [a,b,*], Perry Davy [d], Cherie Tollemache [b,c], Nick Talbot [e], Jennifer Salmond [a], David E. Williams [b,c]

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[d] The Institute of Geological and Nuclear Sciences, 30 Gracefield Road, Lower Hutt, New Zealand
[e] Environment Southland, Cnr North Rd &, Price Street, Waikiwi, Invercargill, New Zealand

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Methodology





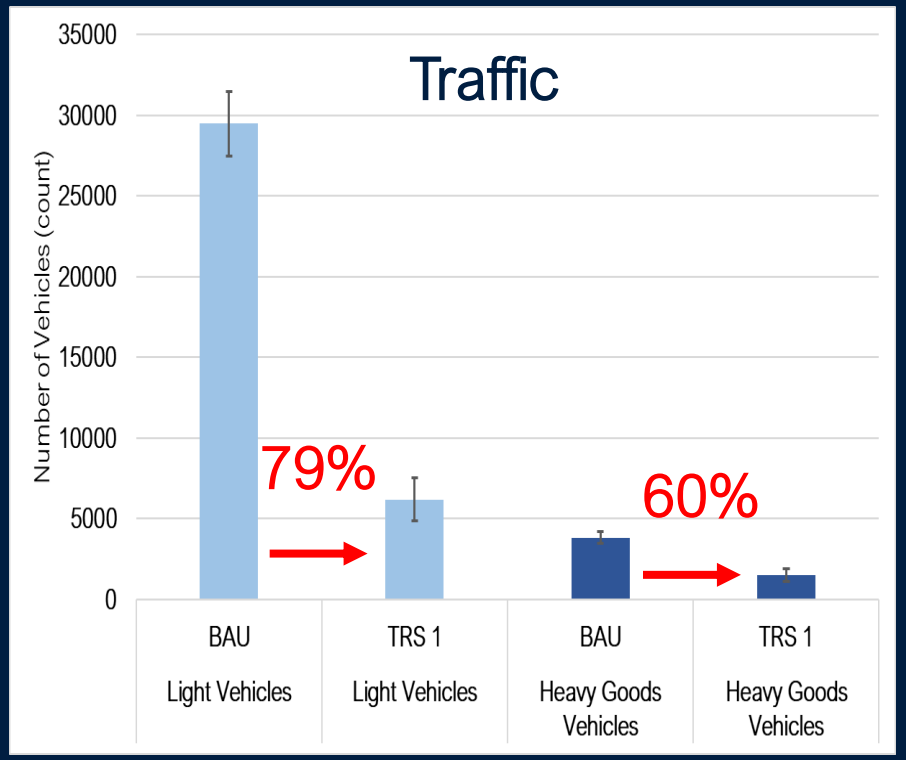
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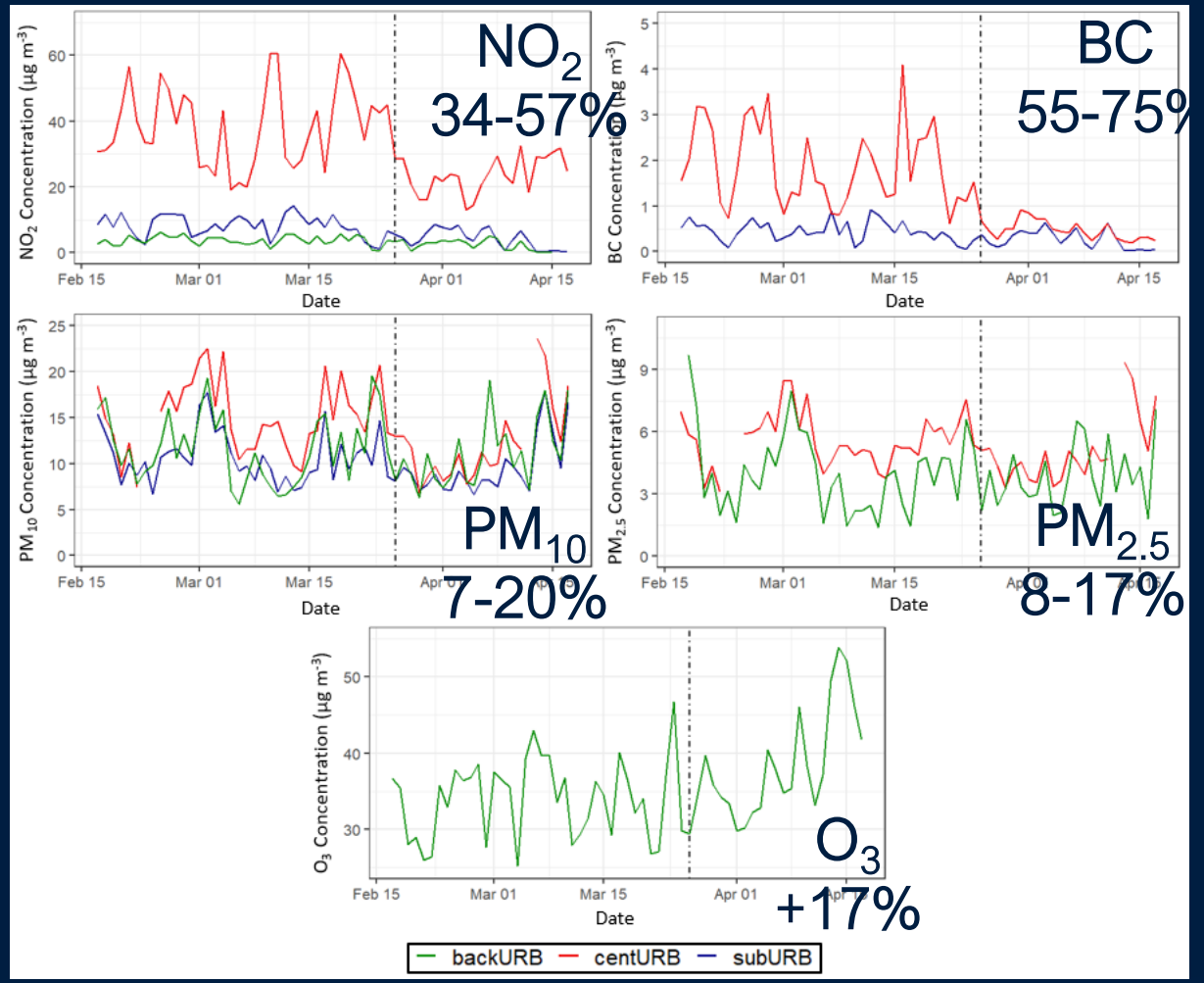
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Traffic Reduction Scenarios

Traffic Reduction Scenario (TRS)	Restrictions	Stringency Index (SI)	Regional Traffic Reduction (%)
BAU, 2020	No restrictions	22.22	NA

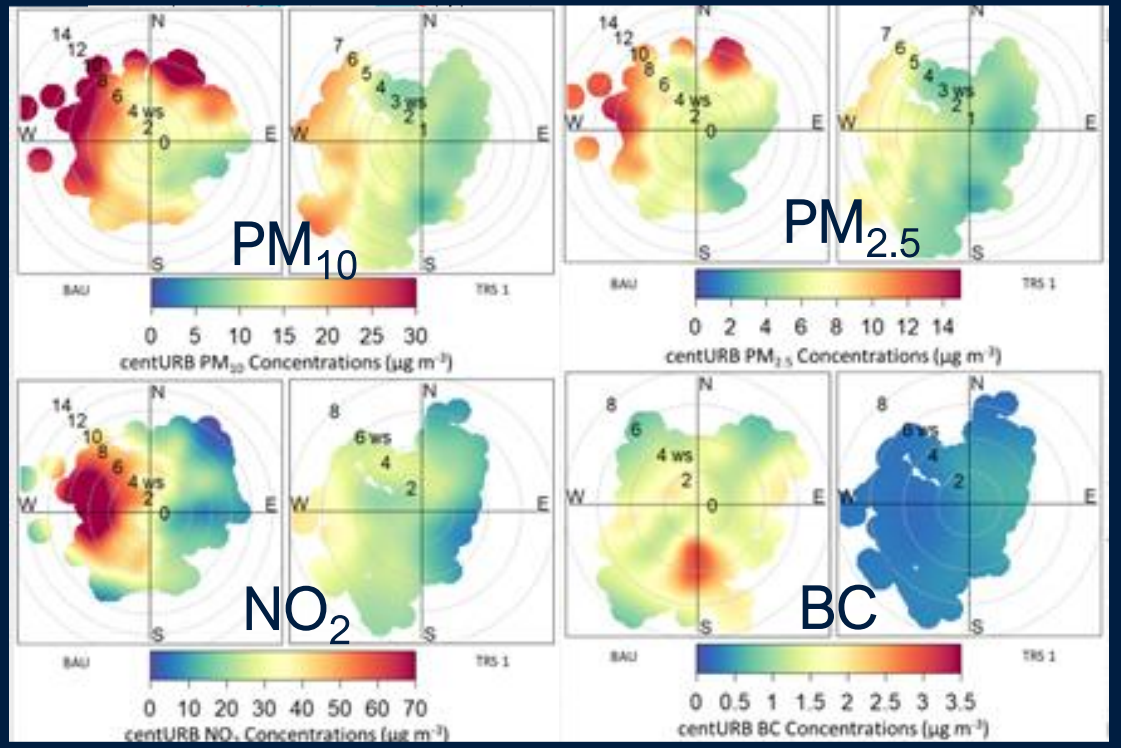
Phase 1 Results





Phase 1 Results

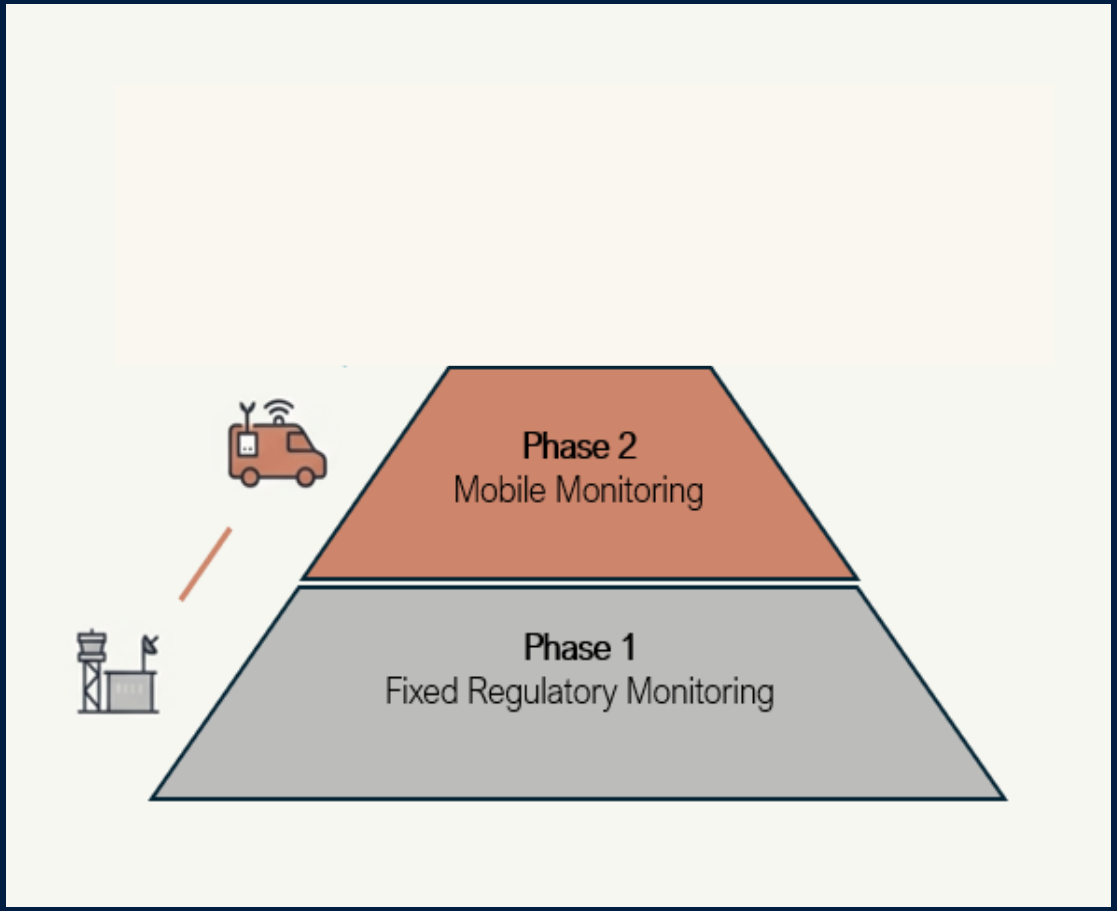
- Similar temporal pattern, reduced magnitude
- The misaligned reduction in NO_2 (34%) & BC (75%) at the city site raised further questions
- Potentially explained by:
  - Regional differences in traffic flow
  - Unknown Ports contributions
  - Differences in meteorology
  - Operation of diesel vehicles
  - NO being oxidised to NO_2

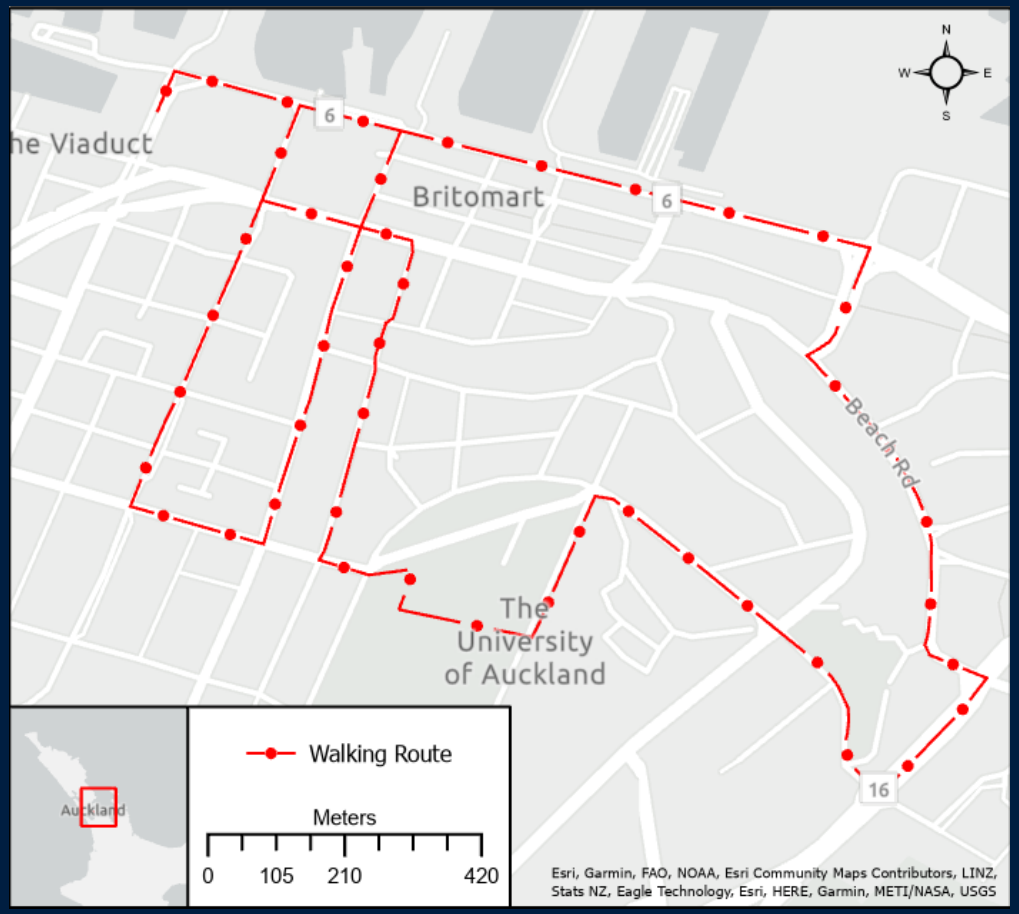


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Phase 2

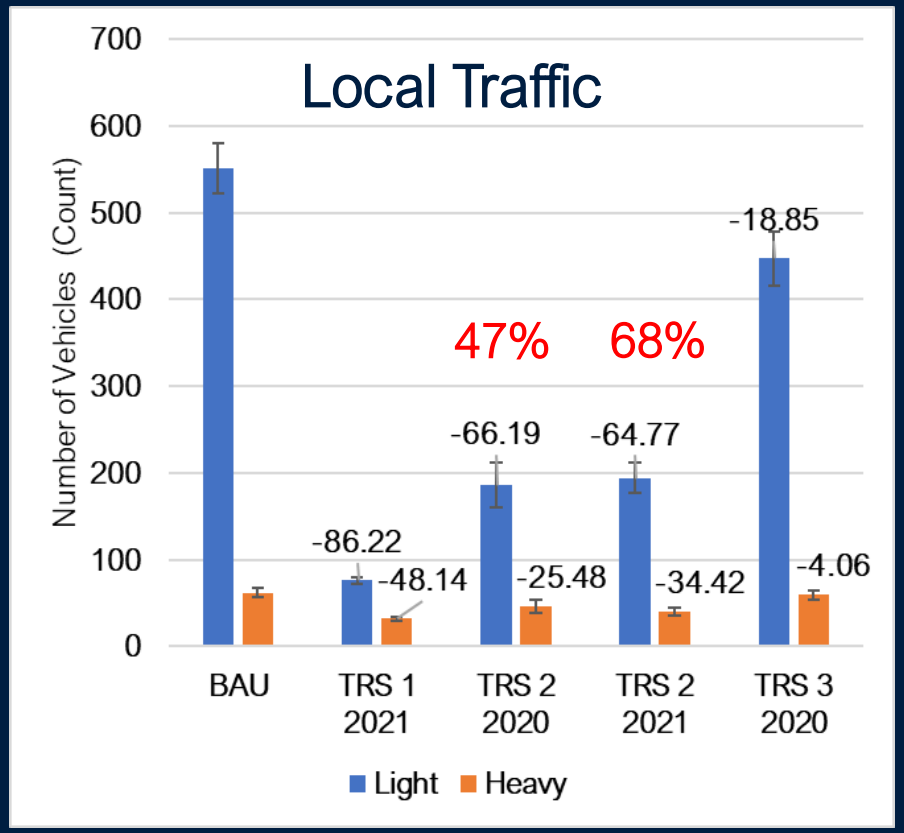


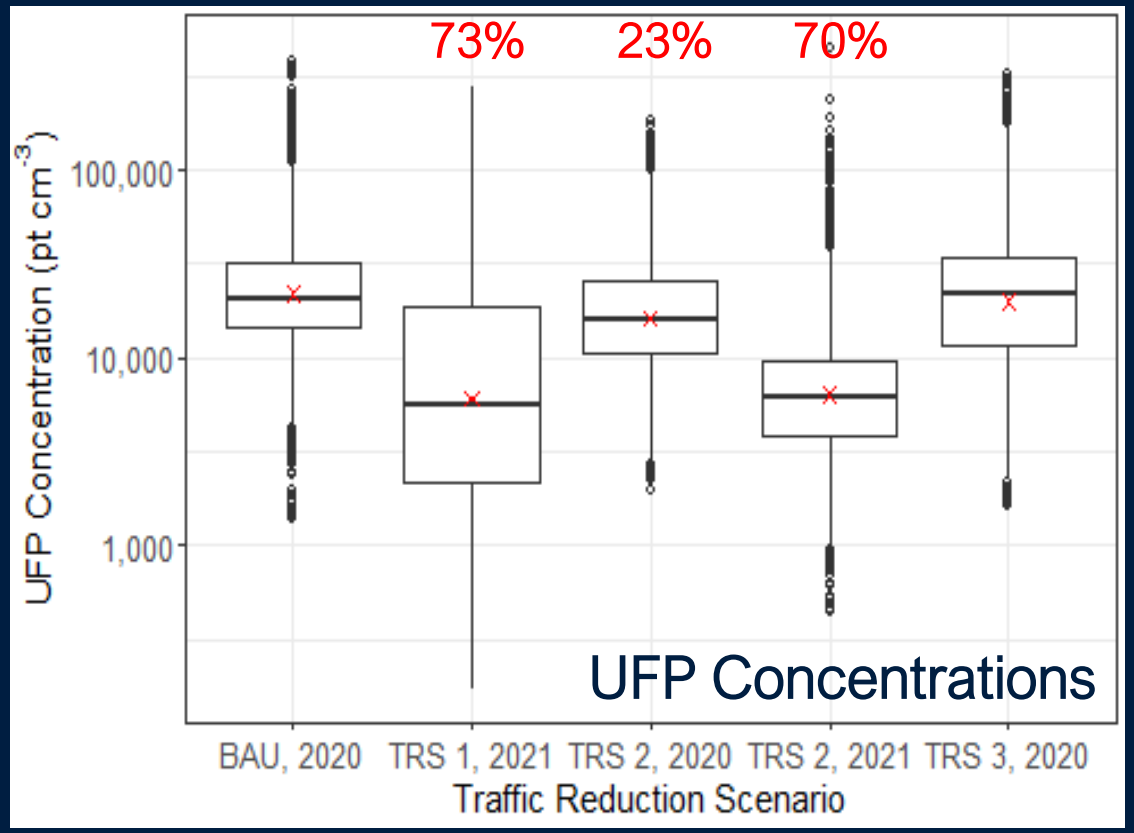


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Phase 2 Results





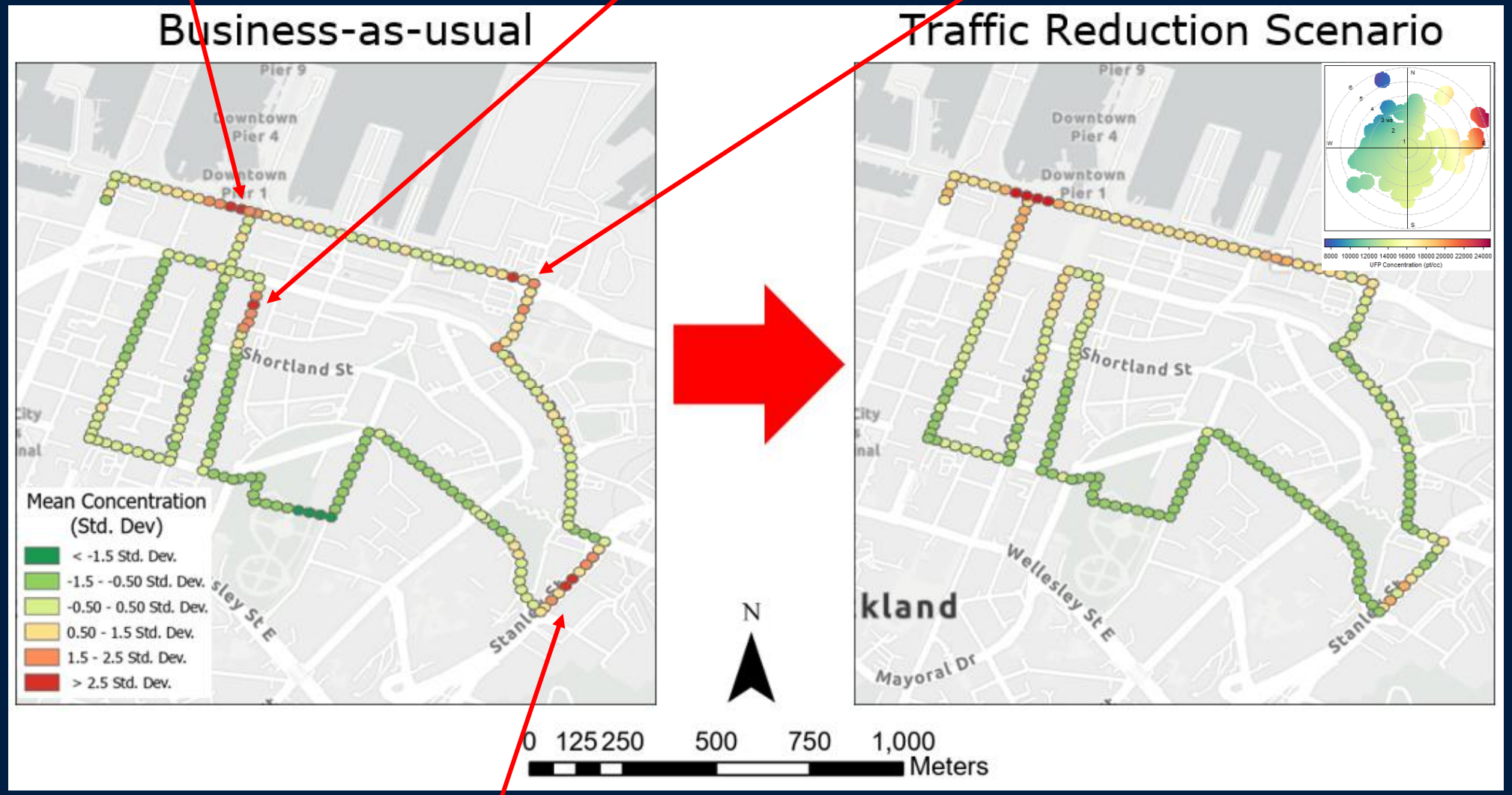
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Construction/Ferry Terminal

Pedestrian/Shared Zone

Port Entrance

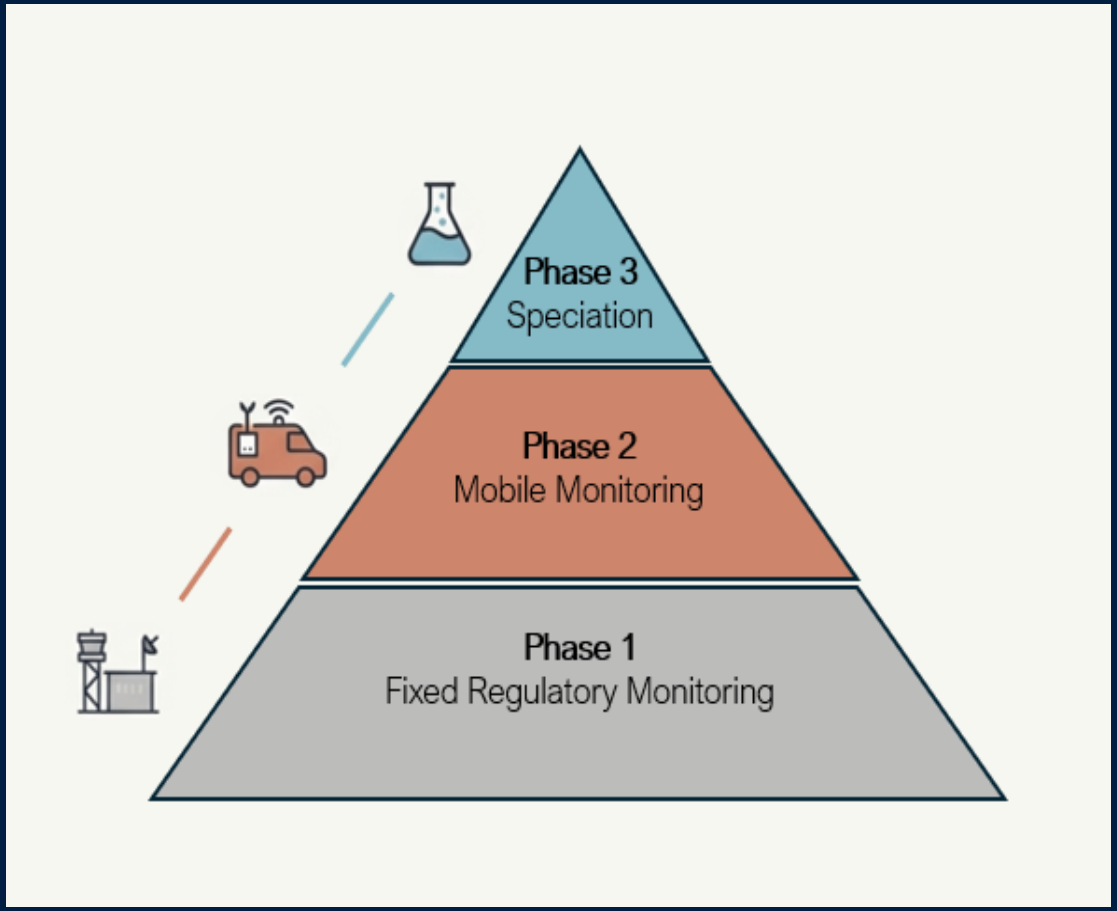


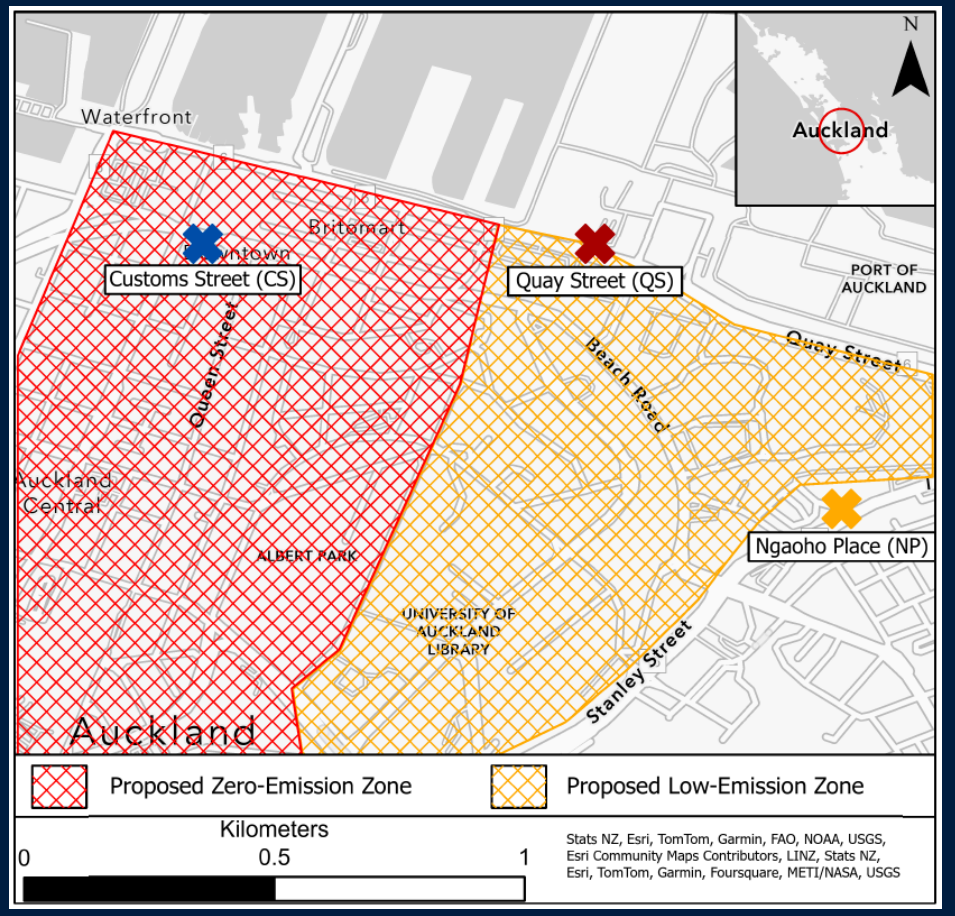
High Volume Road

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Phase 3



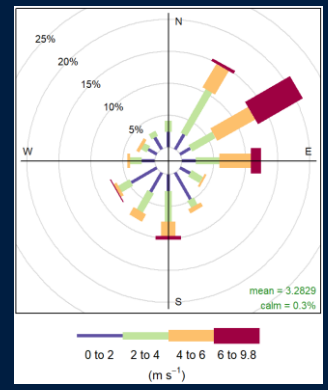


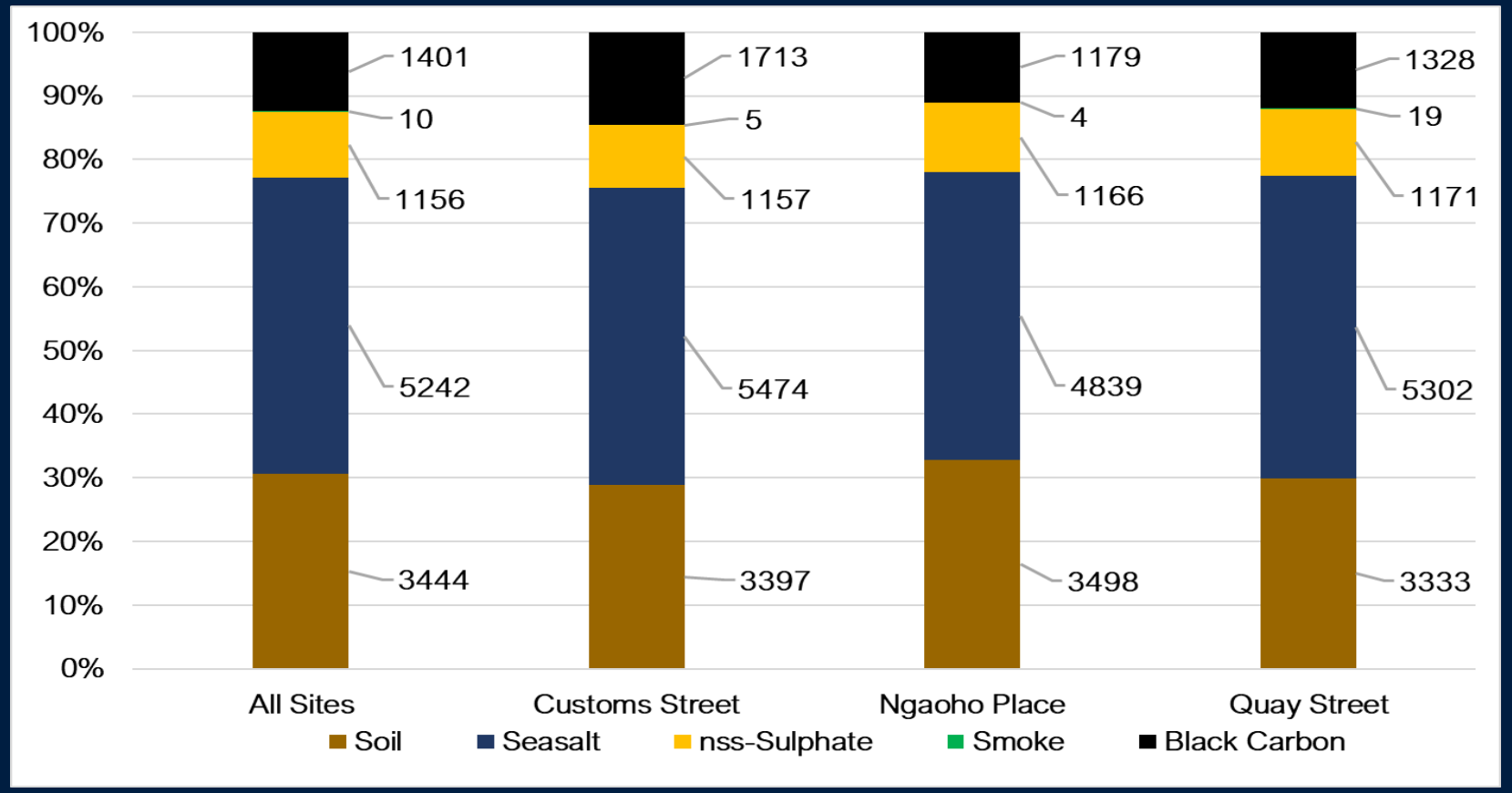
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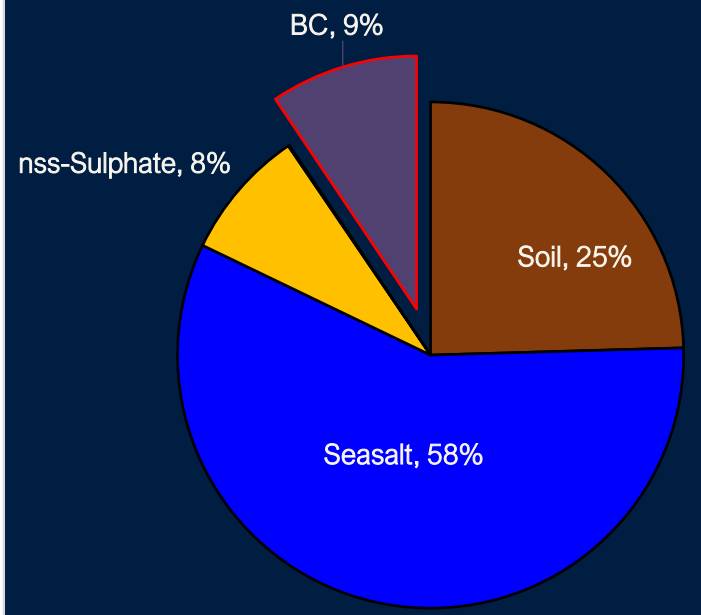
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Phase 3 Results





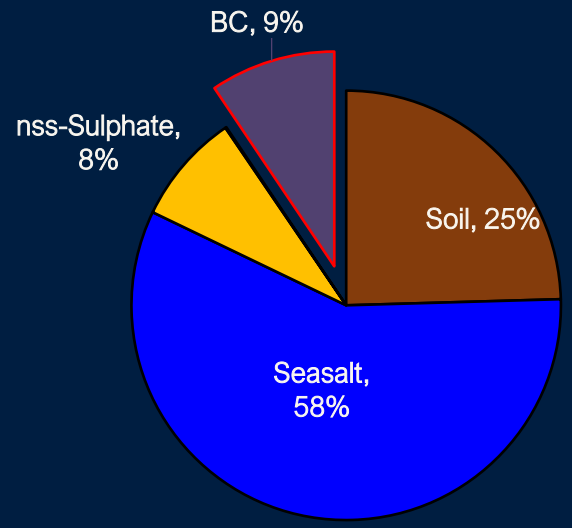


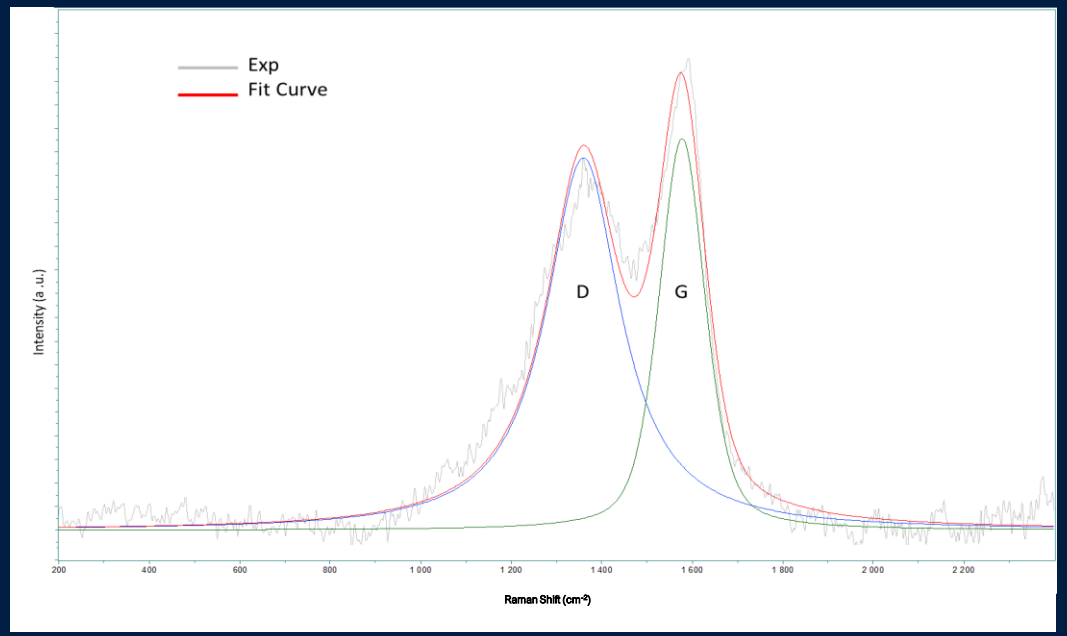


Average PM_{10} = 15.4 **µg m^{-3}**

Phase 3 Results

- Raman Spectroscopy – individual soot particles
- Exhibit spectra with peaks in the D and G band positions
- Similar across the three sites:
  - D = ~1350 cm^{-1}
  - G = ~1590 cm^{-1}
- Quay Street (Port Entrance)
  - Higher degree of graphitisation
  - Linked to higher combustion temperatures





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Conclusions

- Strict lockdowns provided a simulation for emission zones
- Clear disconnect between traffic and air pollutant concentrations – challenging to understand
- Removing cars alone is not enough.
- Emissions still exist from other sources, and if not managed correctly could impact the efficacy of interventions.
- The three-tiered approach provides a solution for policy makers to test the efficacy of interventions





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Questions?

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Questions?



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