



## Application of Vehicle Emission Remote Sensing in Hong Kong

What are cars really emitting in our cities?

The Real Urban Emissions Initiative (TRUE)

Mr. YS Yam, Senior Environmental Protection Officer

Environmental Protection Department, Hong Kong SARG, China

15 Nov 2018

# Overview

---

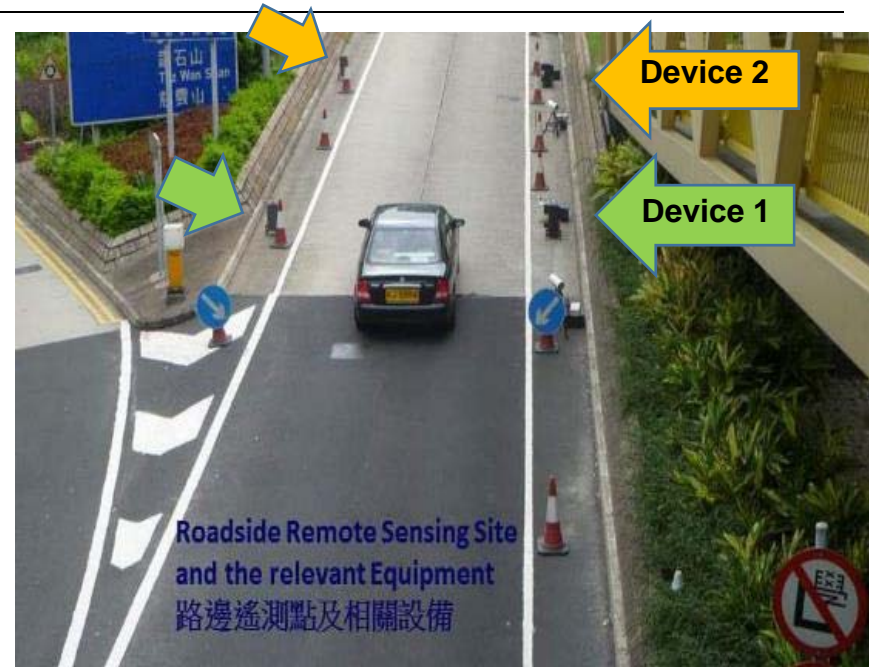
- I. Hong Kong remote sensing programme and data
- II. Are new vehicles cleaner? - vehicle emission trends
- III. Need to enhance emission monitoring and formulate reduction solutions

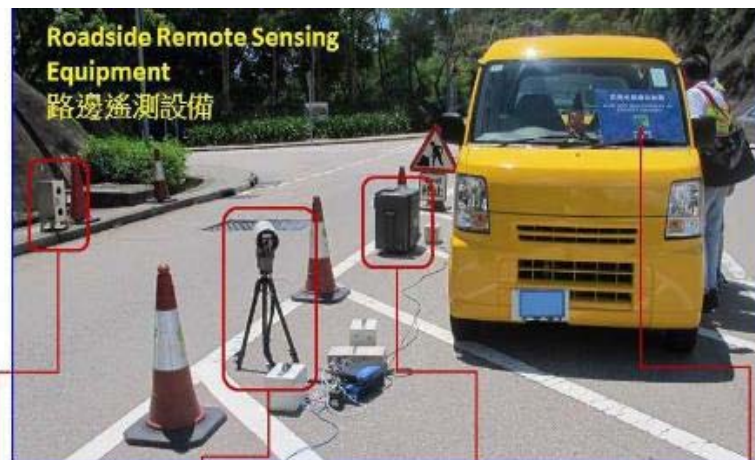
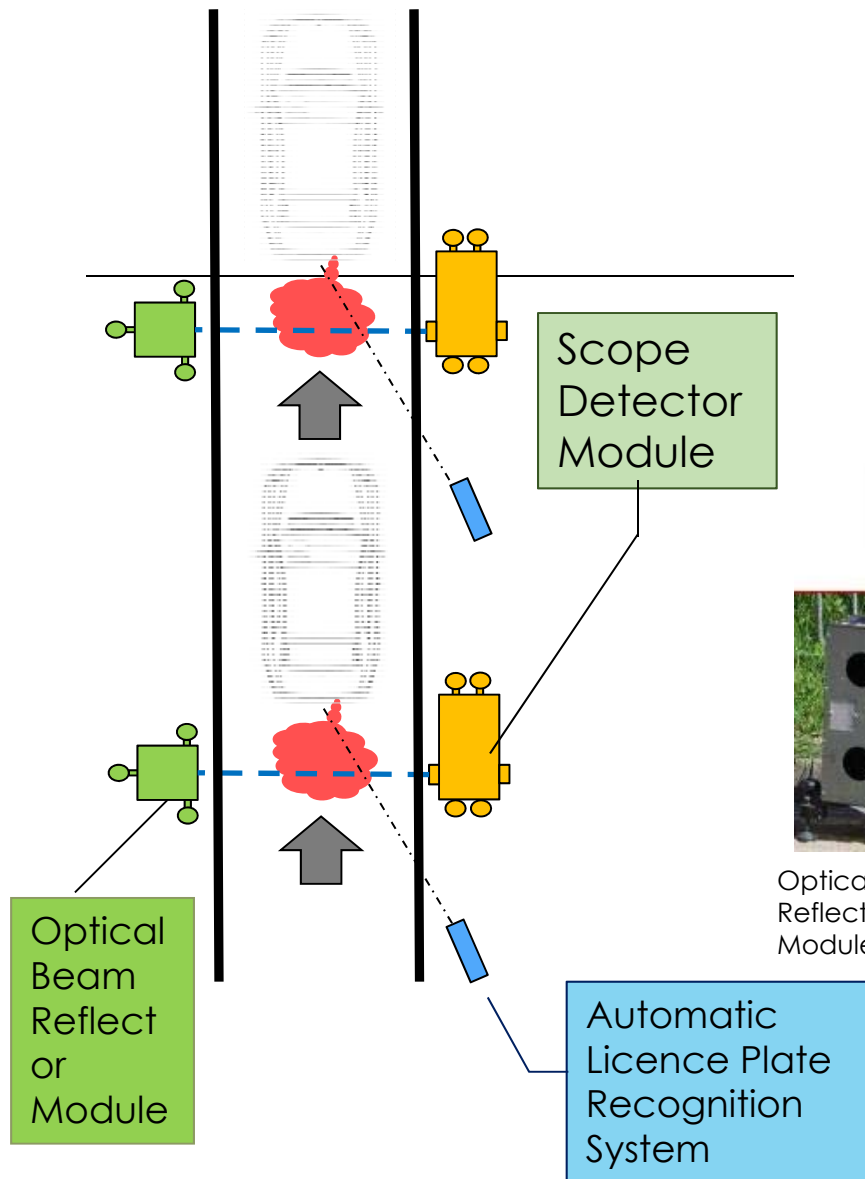
## **Disclaimer**

The views expressed in this presentation are those of the presenter, and do not necessarily reflect the views of the conference organizers. The organizers do not guarantee the accuracy of the data included in this presentation and does not accept responsibility for consequence of their use.

# Strengthened Emission Control of In-use Petrol/LPG Vehicles (Hong Kong Remote Sensing Programme)

- Commenced September 2014
- Portable roadside remote sensing equipment to screen out gross emitters in the petrol and LPG vehicle fleet
- Emission Testing Notices (ETNs) sent to owners of gross emitting vehicles
- As at end of October 2018
  - 2.7 million vehicle counts screened
  - 15 000 ETNs issued
  - 500 vehicles failing to repair and pass follow up dynamometer tests were scrapped





Optical Beam Reflector Module



Automatic Licence Plate Recognition System

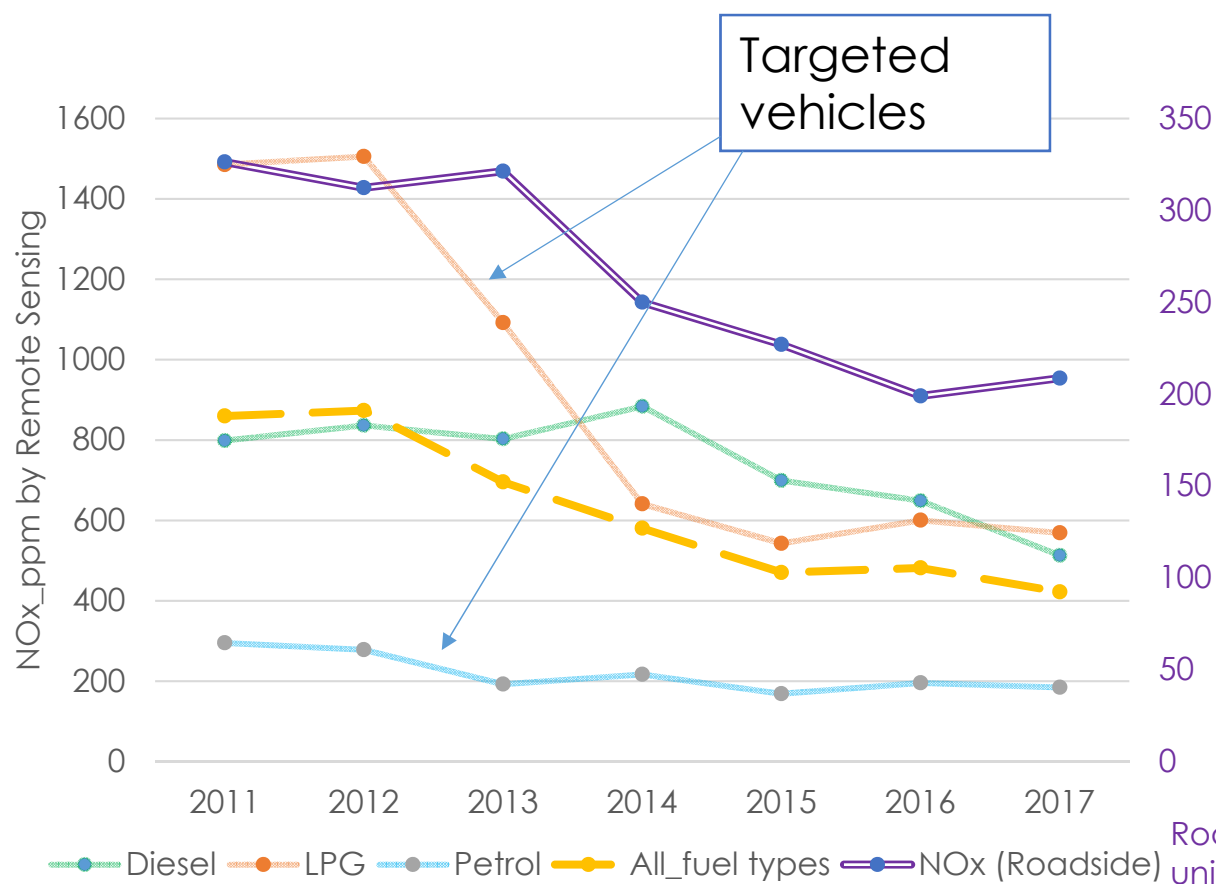


Scope Detector Module



Central Control Console Module

# Remote Sensing vs Roadside NOx Trend



- Both tailpipe and roadside NOx concentrations show a downward trend
- From 2012 to 2017,
  - LPG vehicles - 63%↓
  - Overall fleet - 52%↓
  - Roadside - 33%↓



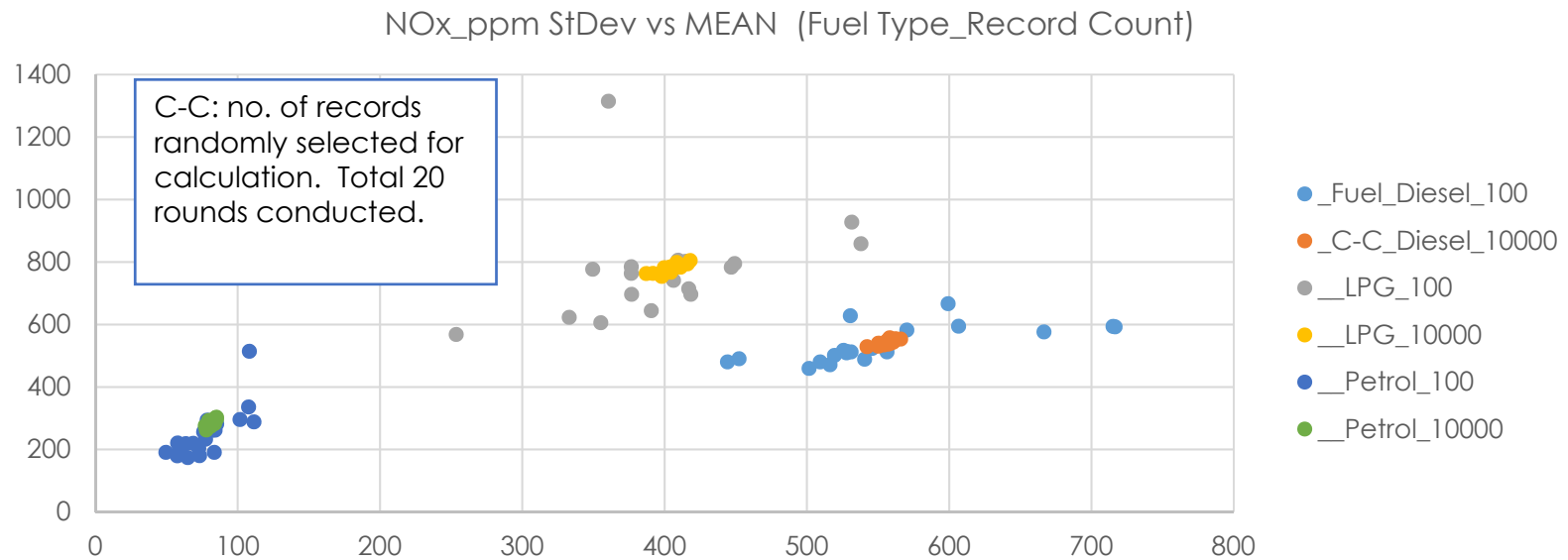
# 2018 RS NOx Data (1)

---

- I. Over 860,000 records so far with vehicle coverage of 30%, 80% and 27% for diesel, LPG and petrol vehicles respectively
- II. About 3,400 fuel-engine size-manufacture year combinations;  
i.e. averaged 250 records per combination
- III. Variations in emission will hinder analysis if record size is too small  
(see next slide)

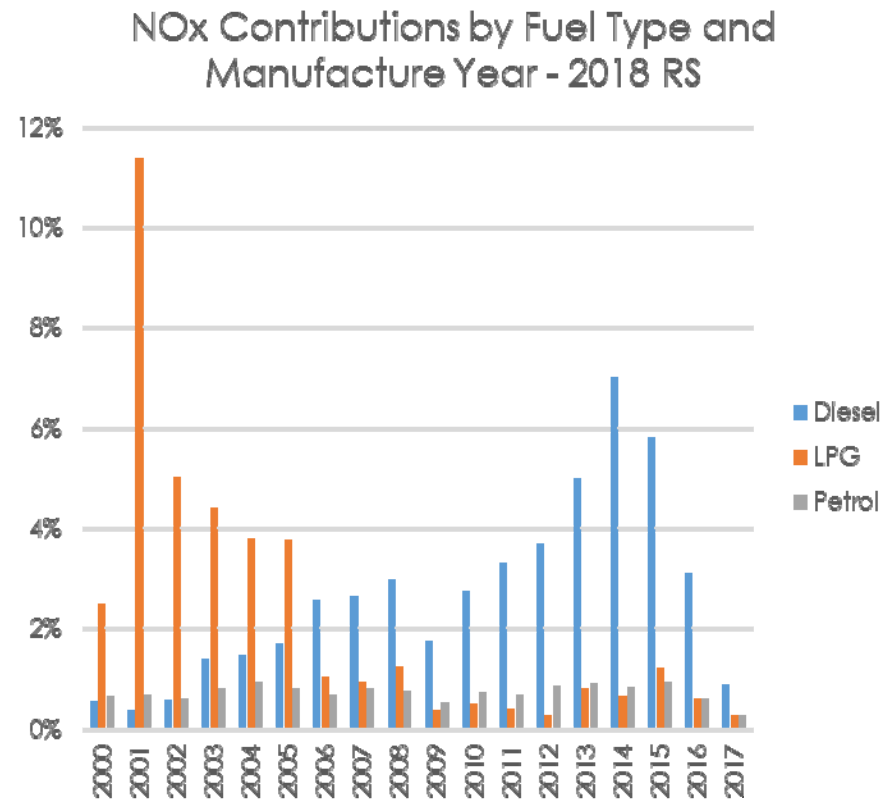
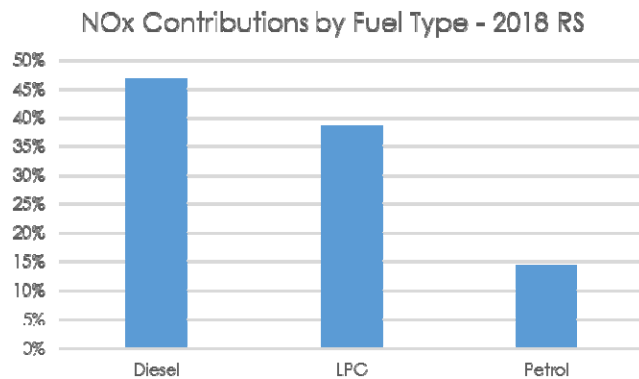
# 2018 RS NOx Data (2)

- I. Mean and deviation of NOx is higher for small sample size (100 vs 10,000 records)



# 2018 RS NOx Data (3)

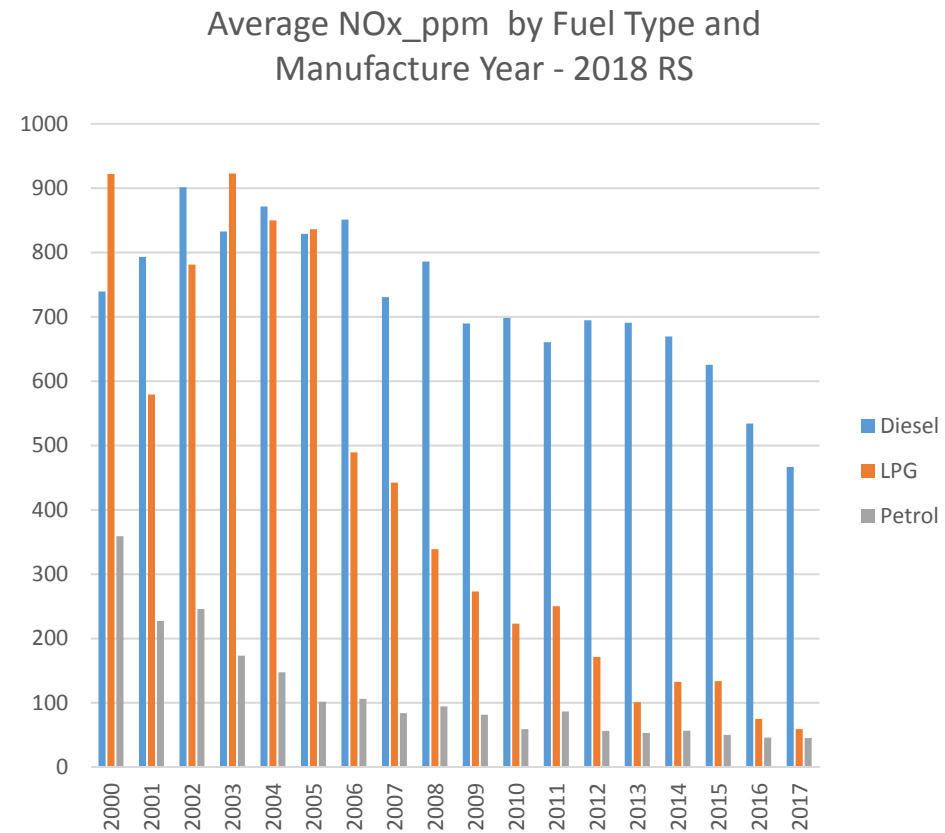
- I. Diesel vehicles contributed highest NOx of about 47% on fuel based basis directly from remote sensing records
- II. Older LPG and newer diesel vehicles contributed more NOx





# Newer Diesels NOx Emission is Too High

- I. NOx emission rate does not come down as significant as petrol and LPG
- II. Benefit of diesel vehicle replacement undermined





# Pass/Fail of 174 Diesel Van Dyno Tests in 2016-2017

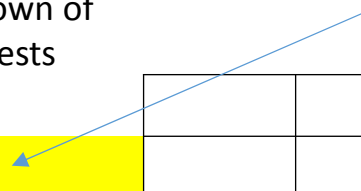
- Based on 2 times certification limits using TUV cycle

Brand	F	H	H	N	N	T	T	T	
Euro type	E5	E4	E5	E4	E5	E3	E4	E5	
# of Vehs	1	4	7	7	2	8	76	62	167
# of Tests	1	4	7	7	2	11	78	64	174
Passed Tests			1	5		8	14	52	80
Failed Tests	1	4	6	2	2	3	64	12	94
%_Failed	100%	100%	86%	29%	100%	27%	82%	19%	54%

## Breakdown of Failed Tests

NOX		4	6	1	2	3	43	1	60
CO							5	11	16
Both	1			1			16		18

Could be design problem of injectors and/or combustion control.



# Remote Sensing vs Dynamometer Data on Diesel Vans

---

- I. Good agreement in failures in E4 and E5 vehicles
- II. Design or maintenance problem? - Need to verify but more likely the former due to general failure of one E5 model
- III. General failure of newer E5 vehicles is a concern – current certification standard failed to address real world diesel emissions



# Remote Sensing and other Real World Monitoring for Diesel Vehicles

---

- I. Should develop dirty screen to tackle high real world contribution
- II. Current engine technology and emission standard cannot address emission reduction need – a long term burden for I&M and emission planning
- III. Need to strengthen diesel RS monitoring and repair studies to formula quick solutions against the high emitters





Thank You !

