ASSESSING THE IMPACT OF GROSS EMITTING VEHICLES

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1. INTRODUCTION

Roadside vehicle emission monitoring using a remote sensing device (RSD), as shown in figure 1, is a useful and cost-effective method of collecting large amounts of real-world vehicle emission data.

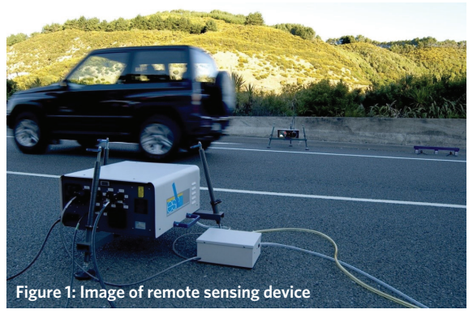

Figure 1: Image of remote sensing device

There have been five RSD monitoring campaigns in New Zealand between 2003 and 2015, mainly in Auckland, providing over 120,000 valid light duty vehicle emission measurements. The RSD campaigns identified that a small number of high gross emitting vehicles (GEVs) have a disproportionate impact on total fleet emissions.

Integrating the information extracted from the RSD database on GEVs with the data contained in the Motor Vehicle Registry (including vehicle age, mileage, engine size, and emissions control), provides a powerful investigative tool. Aligning these two sources of data allows us to advance our understanding of the impact of GEVs.

Waka Kotahi NZ Transport Agency has funded a project which aims to better understand the impact of GEVs and evaluate potential interventions (eg scrappage schemes, in-service vehicle testing) to reduce the impact of emissions from gross emitters. This project considers harmful pollutants carbon monoxide (CO), hydrocarbons (HC), nitrogen monoxide (NO) and uvSmoke (a proxy for particulate emissions) using the 2015 RSD data set. This paper describes the method used to assess the impacts of GEVs and initial results. In this paper, CO is used as an example.

2. DEFINING GEVs

Using cumulative distribution curves, GEVs have been defined as those vehicles that have emissions above the 97th percentile value. Below the 97th percentile value, the rate at which the % total emissions accumulate begins to slow. Vehicles that have emissions below the 97th percentile value are classified as typical emitting vehicles (TEVs). The 2015 RSD data set shows that 50% of the total CO emissions monitored came from these GEVs (top 3%). Figure 2 compares CO emissions from GEVs and TEVs.

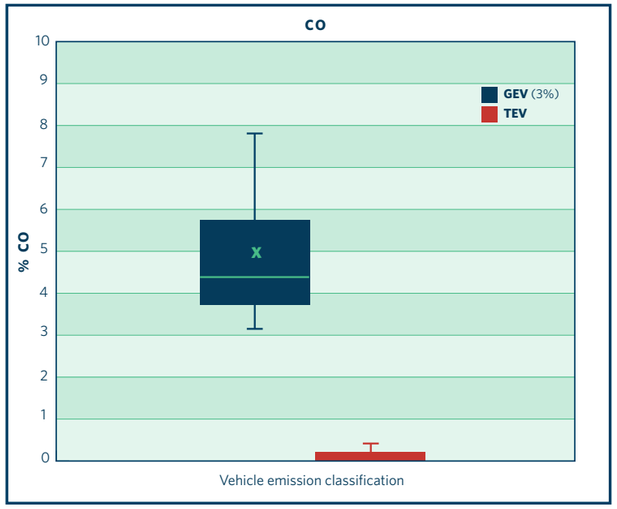

Figure 2. Box and whisker plot of CO emissions from GEVs and TEVs

3. METHOD FOR ASSESSING THE IMPACT OF GEVs

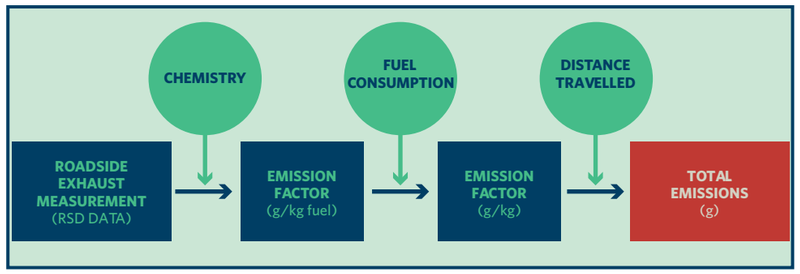

Figure 3. Flow chart - RSD measurement to total GEV/TEV emissions

To quantify the impacts of CO emitted by GEVs and TEVs, we undertook the following steps:

1. Obtained CO concentration measurement from the 2015 RSD data.
2. Converted the measurement to a g/kg fuel emission factor.
3. Converted the CO g/kg emission factor into a g/km emission factor by applying the relevant fuel consumption rate.
4. Calculated the total amount of CO discharged by multiplying the CO g/km emission factor by the distance travelled by the vehicle. A flow chart outlining the process is shown in Figure 3.

4. INITIAL RESULTS

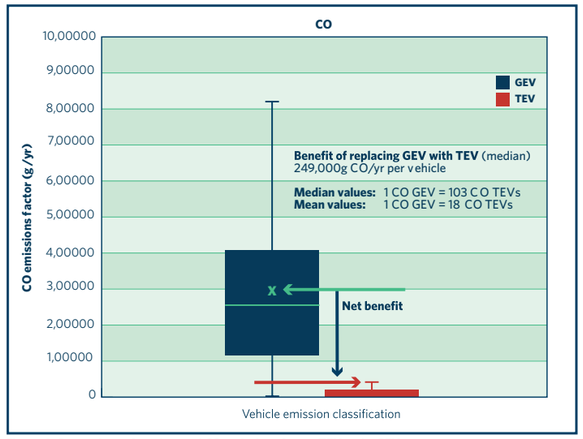

Figure 4. Comparison of total annual CO emissions from a TEV and a GEV

Figure 4 shows the benefit (reduction in CO emissions) of replacing a GEV with a TEV. This has been estimated by subtracting the median value total annual CO emissions of the TEVs from the median value total annual CO emissions of the GEVs. The results indicate that 1 CO GEV emits the equivalent of 103 CO TEVs (median value).

The initial analysis of 2015 RSD data indicates:

- GEVs (top 3%) have much higher emissions than TEVs, contributing about 50% of CO emissions
- the majority of GEVs have odometer readings >150,000 km and are 16 years or older
- GEVs retire earlier from the fleet than TEVs
- GEVs for CO (mainly petrol vehicles) travel less distance (Note: GEVs for uvSmoke (mainly diesel vehicles) have been found to travel more).

5. NEXT STEPS

The next stage of the project will use the information and method described in this paper to define GEVs and expand results to the National fleet to investigate the potential wider impacts of GEVs.

The outcomes of this investigation will be published early 2020 on **nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/air-quality-climate/research-and-information/research-reports/**

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WAKA KOTAHI NZ TRANSPORT AGENCY

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