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Adapting driver behaviour
for lower emissions

Introduction to the Project

Andrew Winder

MODALES Project Coordinator

ERTICO – ITS Europe

Mid-term results on the road to low emissions: 28 May 2021

MODALES at a glance

Project vision:

To reduce air pollution from all types of on-road vehicles (but especially older vehicles) by encouraging adoption of low-emission driving behaviour and proper maintenance choice

MODALES is working to reduce air pollution from all types of road vehicles by encouraging the adoption of low-emission driving behaviour and appropriate maintenance.

The project focuses on emissions from the following three sources:

- Powertrain exhaust
- Break wear
- Tyre/road wear

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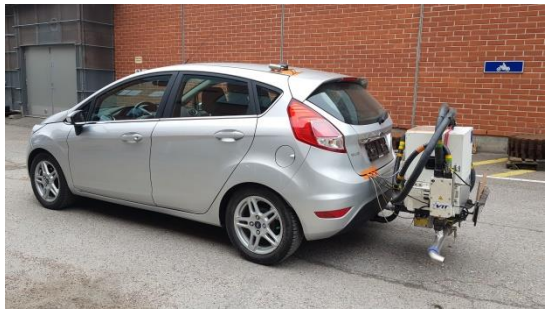
Expected impacts of MODALES

Contribute to reduction of emissions from the existing combustion-engine car fleet



Contribute to reduction of unnecessary driver-induced emissions though a better awareness by the public of their role in controlling polluting emissions through a driver assistance app and an awareness campaign

Provide technical evidence to assess gaps in current regulation of vehicles

International cooperation

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Low-emission driving versus eco-driving

- Eco-driving targets a reduction in CO_2 emissions and fuel consumption by encouraging green driving behaviour.
- CO_2 strongly correlates with certain air pollutants from vehicle, e.g. Carbon Monoxide (CO)
- But there is a substantial discrepancy between CO and CO_2 due to factors including air-fuel ratio
- MODALES focuses on other air pollutants much more loosely correlated with CO_2, e.g.:
  - NOx – Nitrogen oxides
  - O3 – Ground-level ozone
  - PM – Particle matter
  - PN – Ultrafine particles
- Also, particle emission from brake and tyre wear (especially for heavier vehicles, including EVs and other newer models)

Project innovation areas

Driver
1. Low-emission driving style & training
2. Guidelines for regular maintenance
3. Use of adaptive cruise control & navigation to avoid congestion
4. Increased awareness of emissions
5. Real time indication of emission (app)

Retrofits
6. Diesel-saving technologies for cars & vans
7. NOxBUSTER for buses and trucks
8. Diesel particulate filter servicing

On-Board Diagnostics
9. More robust & durable emission control systems
10. Enhanced OBD functionality as an anti-tampering measure

Periodic inspections
11. Enhanced inspection procedure to trap tampering
12. Roadside emissions testing

Exhaust emission
CO_2, CO, HC, NO_X, PM, PN

Brake and tyre/road wear
Fine and ultrafine particles (PM, PN)

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MODALES project data, partners and media

Project figures:

- Project runs from September 2019 to August 2022
- European Commission Horizon 2020 call MG-1.1: Reduction of transport impact on air quality, Topic: “Low-emission oriented driving, management and assistance, exploring the impact of the user on emission production”
- €4.72 million budget
- 16 EU-funded partners from 10 countries (BE, CH, ES, FI, FR, GR, IT, LU, TR, UK)
- 2 self-funded International Partners in China

Project partners:

Associations

ERTICO

IRU

FIA

RACC Mobility Club

Universities

ITS UNIVERSITY OF LEEDS

İSTANBUL OKAN ÜNİVERSİTESİ

SOUTHEAST UNIVERSITY 東南大學

Research institutes

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

VTT

Cerema CLIMATE & REGIONS, THE FUTURE

CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

Industry/Services

brembo

BRIDGESTONE

MICHELIN

PROVENTIA

Spark Legal network

DYNNOTEQ

SAMPLE

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LinkedIn MODALES project

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Agenda for this morning

- Session 1: Introduction and driving behaviour aspects

09:20 to 10:35, chaired by Andrew Winder (ERTICO)

---------- *Break* ----------

- Session 2: OBD, Retrofits, Tampering and Inspection

10:50 to 11:50, chaired by Dimitris Margaritis (CERTH)

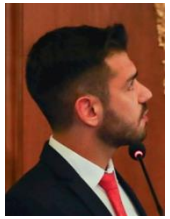
- Session 3: Questions/Discussion

11:50 to 12:30, moderated by Jean-Charles Pandazis (ERTICO)

Session 1 speakers:

Impact of user behaviour
Juhani Laurikko (VTT)

Low emission driving guidance and training
Ted Zotos (IRU)



Low-emission driving app and demonstration
Sébastien Faye and Ramiro Camino (LIST)

On-road trials with real users
Joan Domingo (RACC Mobility Club)

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Thank you

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Adapting driver behaviour
for lower emissions

Impact of user behaviours

on exhaust emissions, brake and tyre wear

Mid-term results - “On the Road to Low Emissions” - 28 May 2021

Juhani LAURIKKO – VTT

with the assistance of

Matteo FREDERICI – BREMBO (Brakes)

Mauro PATELLI – BRIDGESTONE (Tyres)

General Overview

- **OBJECTIVE**
  - **Assess the impact of user behaviour and driving style to various emissions**
- **LOTS OF GROUNDBREAKING EXPERIMENTAL WORK!**
  - Powertrain **exhaust emissions**
  - Emissions from **brakes** (wear)
  - Emissions from **tyres** (wear)
  - **Lack of maintenance** to exhaust emissions
- **SEPARATE TASK FOR PROCESSING ALL DATA**
  - All data used **in determining low emissions driving style for all emissions**
- **TEAM**
  - **VTT, BREMBO, BRIDGESTONE, LEEDS, OKAN, CERTH, LIST, MICHELIN**

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Adapting driver behaviour
for lower emissions

Powertrain exhaust emissions

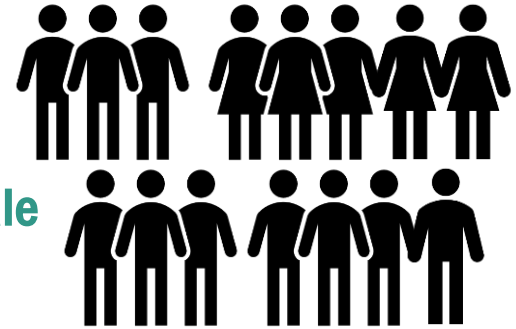
- methodology and measurements

Mid-term results - “On the Road to Low Emissions” - 28 May 2021

Juhani Laurikko – VTT

Test Set-up for Driving Style Experiments

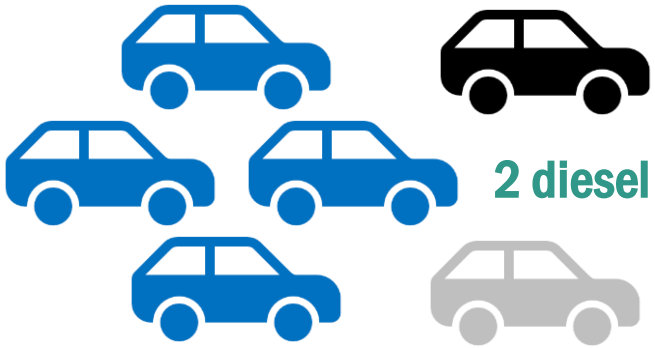
5 Female



10 Male

15 Drivers

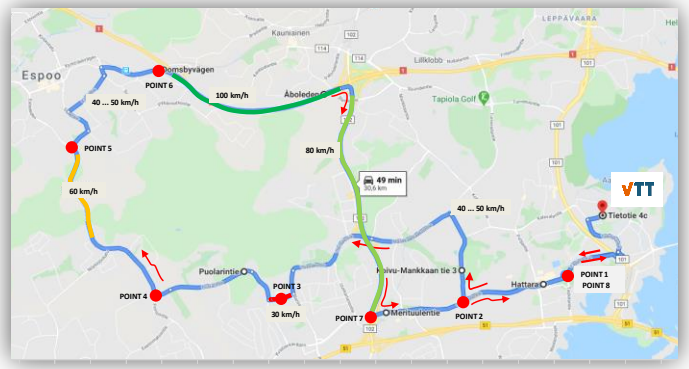
4 petrol



2 diesel

6 Cars

Streets – Rural Roads - Highway



1 Route

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Driver selection

	class	age	driving exp.	class	age	driving exp.
	male, young	30	12			
	male, young	30	12			
	male, middle	35	17	female, middle	39	21
	male, middle	43	25	female, middle	40	22
	male, middle	48	30	female, middle	40	22
	male, middle	57	39	female, middle	49	31
	male, senior	60	42	female, middle	56	38
	male, senior	60	42			
	male, senior	62	44			
	male, senior	62	44			
	total	**10**		**total**	**5**	

Test Car Specifications

Car #	R1	R2	R3	R4	R5	R6
Model Year	2015	2017	2019	2019	2021	
Size Category	B	C	C	JS	B	JM
Fuel	petrol	petrol	diesel	petrol	petrol	diesel
Engine displ. (dm^3)	0.998	1.498	1.598	1.119	1.119	
Power (kW)	73.5	110	85	81	77	
Transmission	Man (5)	Man (6)	Auto (7)	Auto (6)	Manual (5)	Manual
Mass (kg)	1130	1470	1556	1278	1055	
Euro Class	Euro 6a	Euro 6c	Euro6d$_{temp}$	Euro 6d$_{temp}$	Euro6d$_{ISC_FCM}$	
Emissions Aftertreatment	TWC	TWC	EGR, SCR, DOC, DPF	TWC, GPF	TWC, GPF	

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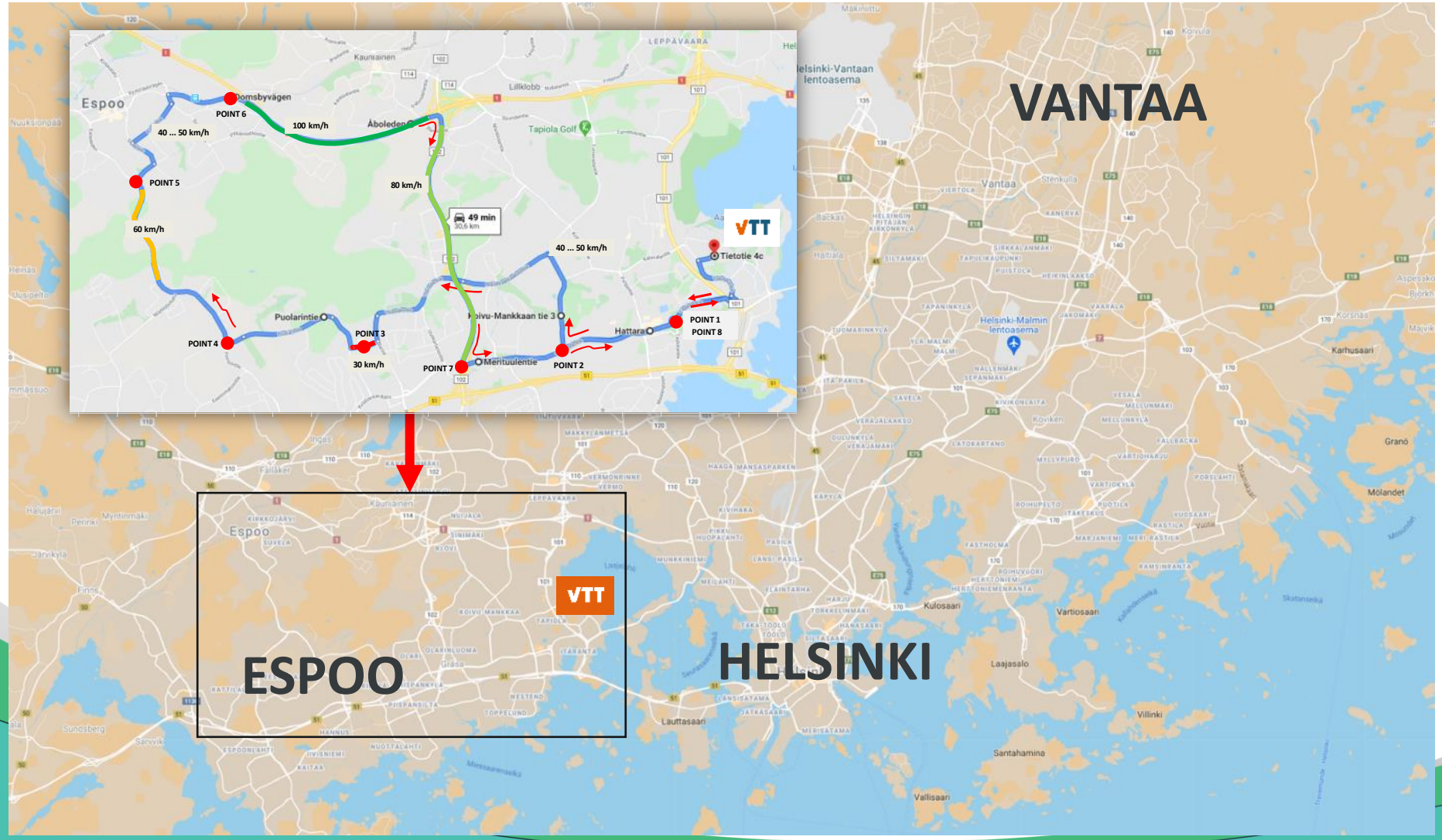
Route for emissions vs. driving style experiments

Route for emissions vs. driving style experiments



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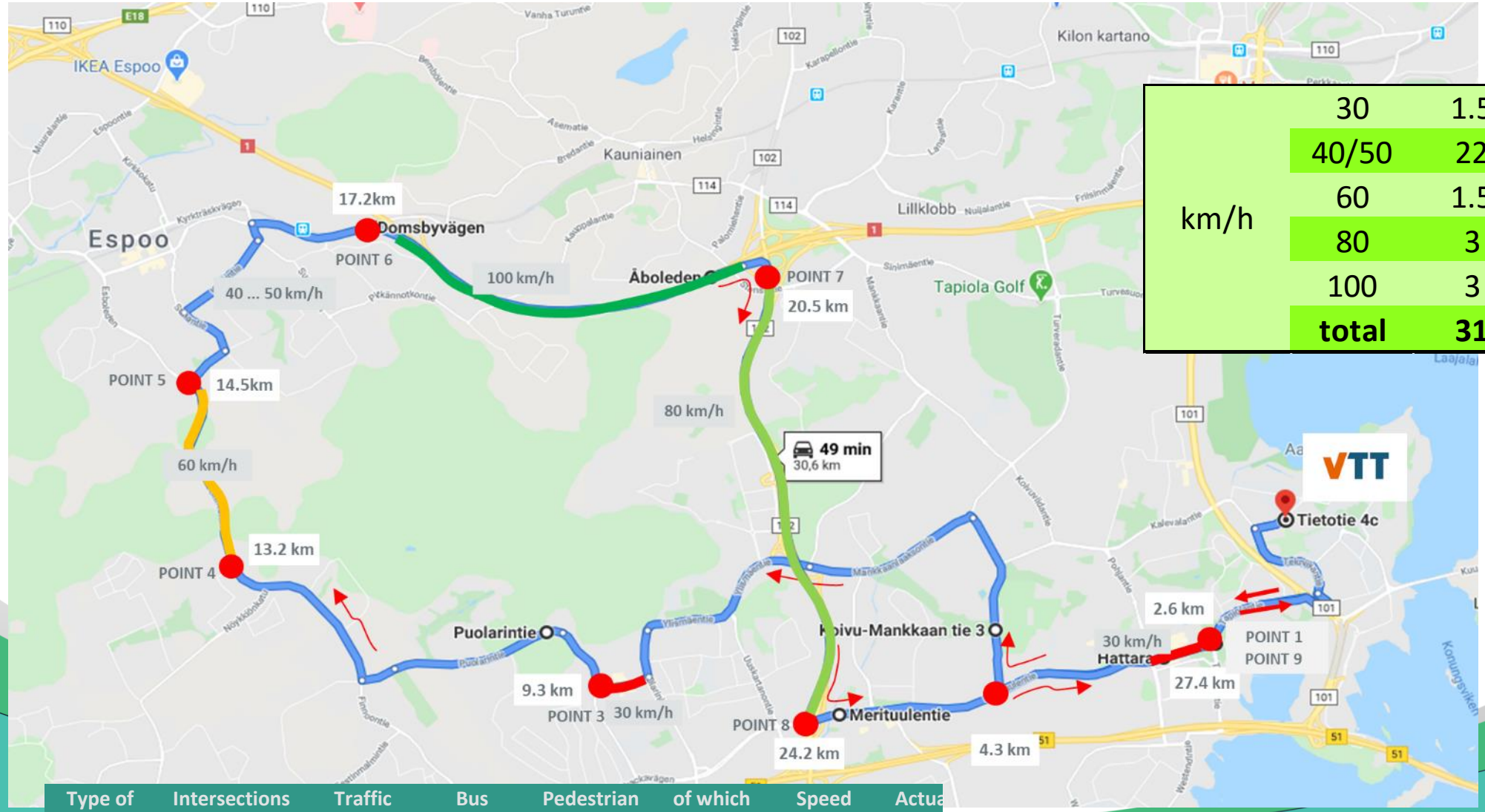
Route for emissions vs. driving style experiments



km/h			
	30	1.5	km
	40/50	22	km
	60	1.5	km
	80	3	km
	100	3	km
	total	**31**	**km**

Type of feature	Intersections or similar	Traffic Lights	Bus Stops	Pedestrian Crossings	of which Raised	Speed Bumps	Actua Stops
total	47	38	39	10	5	9	19

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PEMS set-up for emissions measurements

PEMS set-up for emissions measurements

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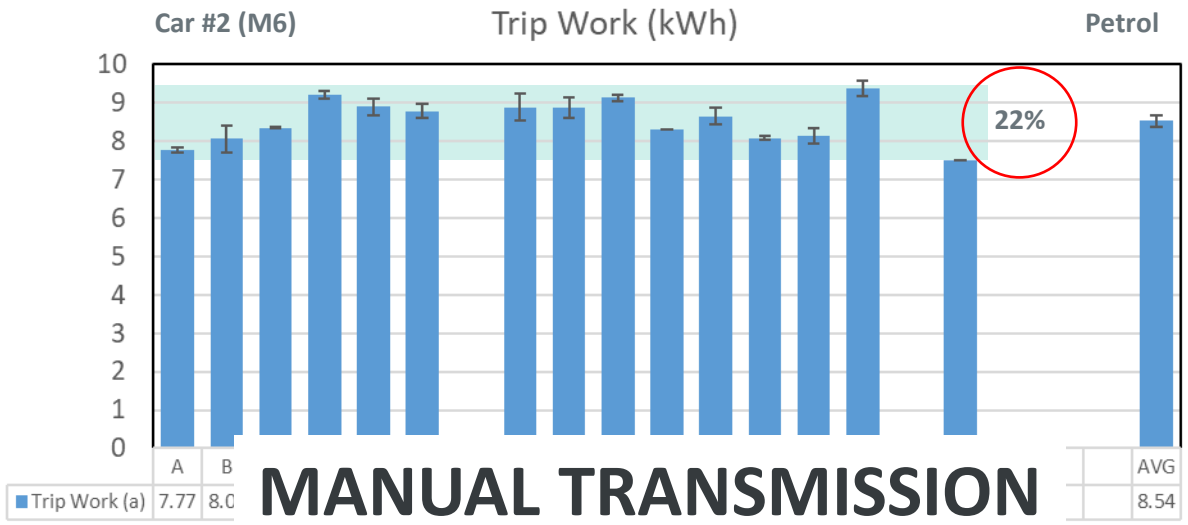
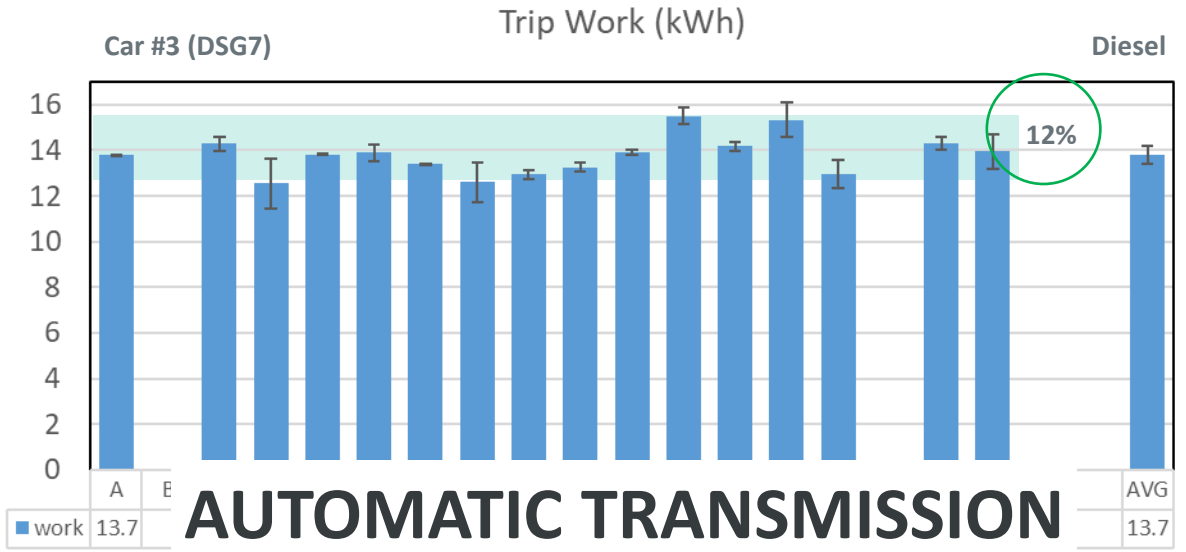
Examples of parameters

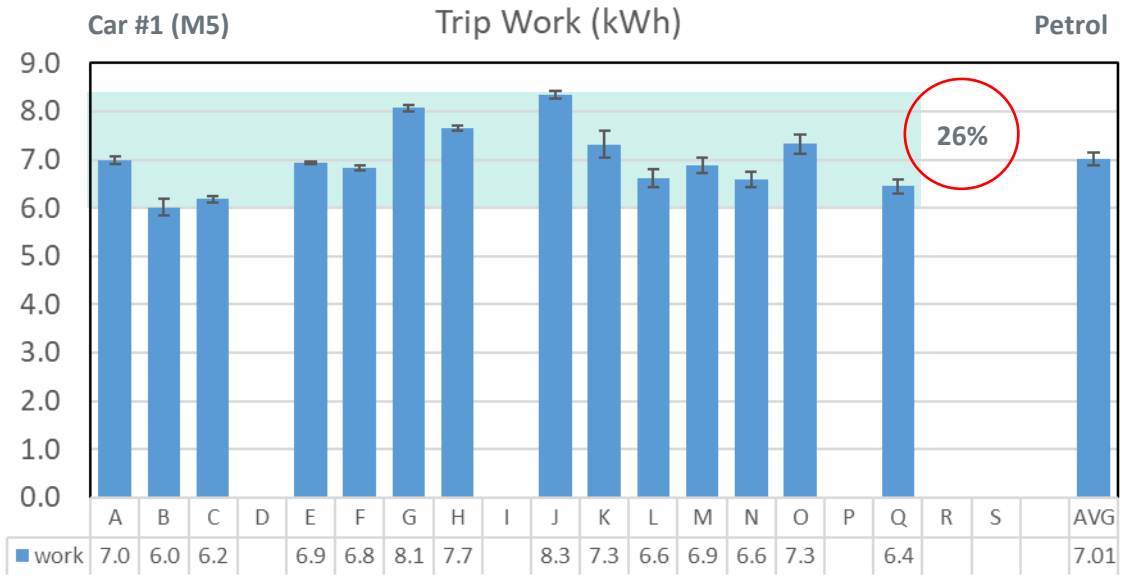
Several parameters collected during driving

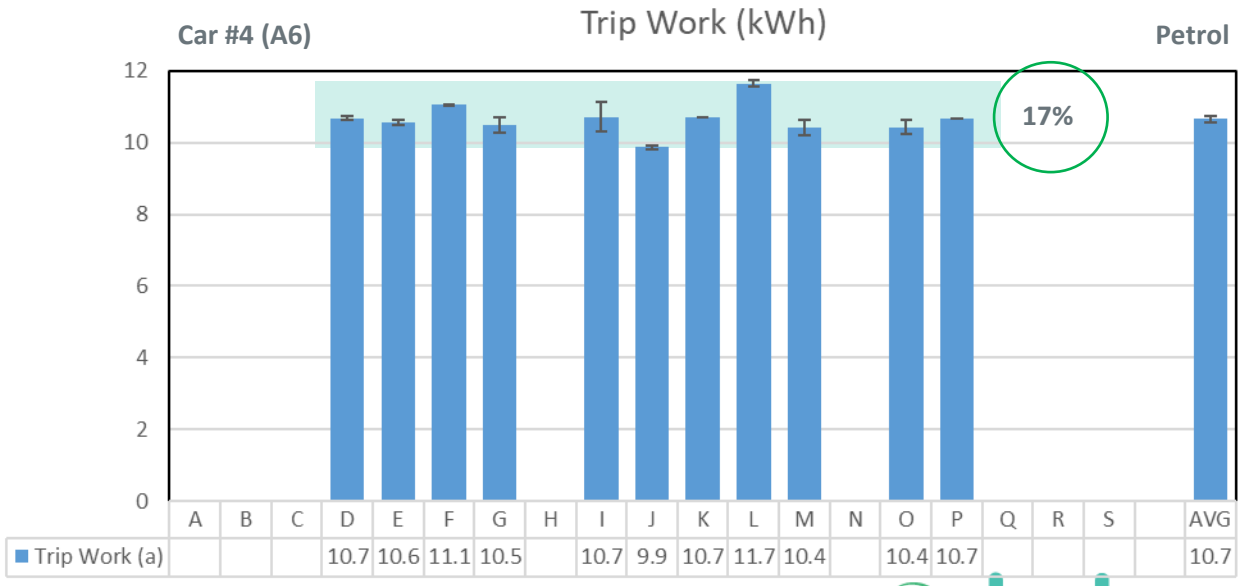
- GPS position, distance travelled (km), road gradient (%)
- Driving speed (km/h)
- Engine power (kW), speed (rpm), throttle position (%)
- Exhaust emissions: CO, **CO_2**, NO, NO_2, **NOx**, **PN** (ppm, g/s)

Aggregated results over the trip for different drivers









Drivers A to S, and average for all

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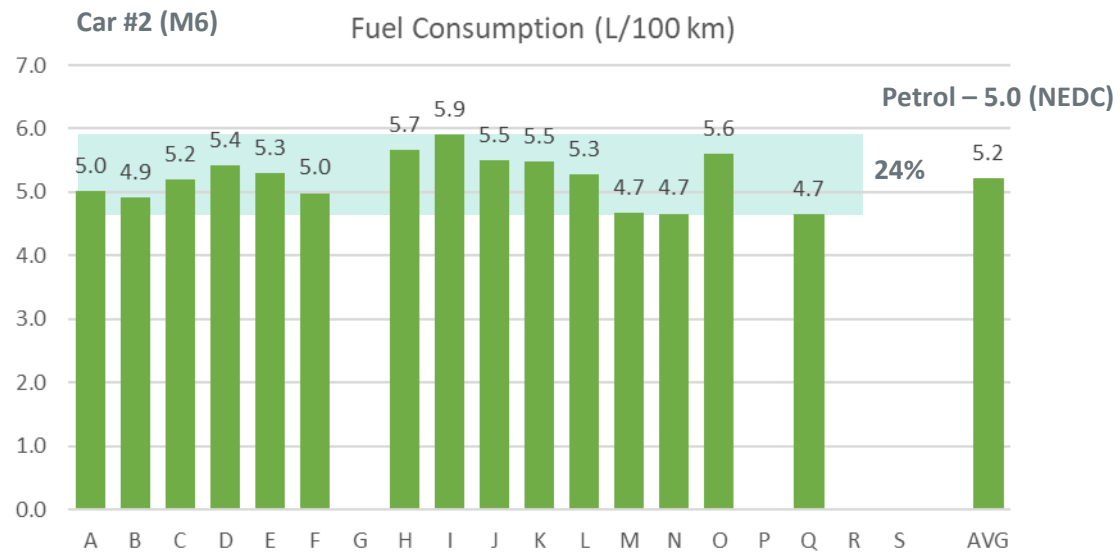
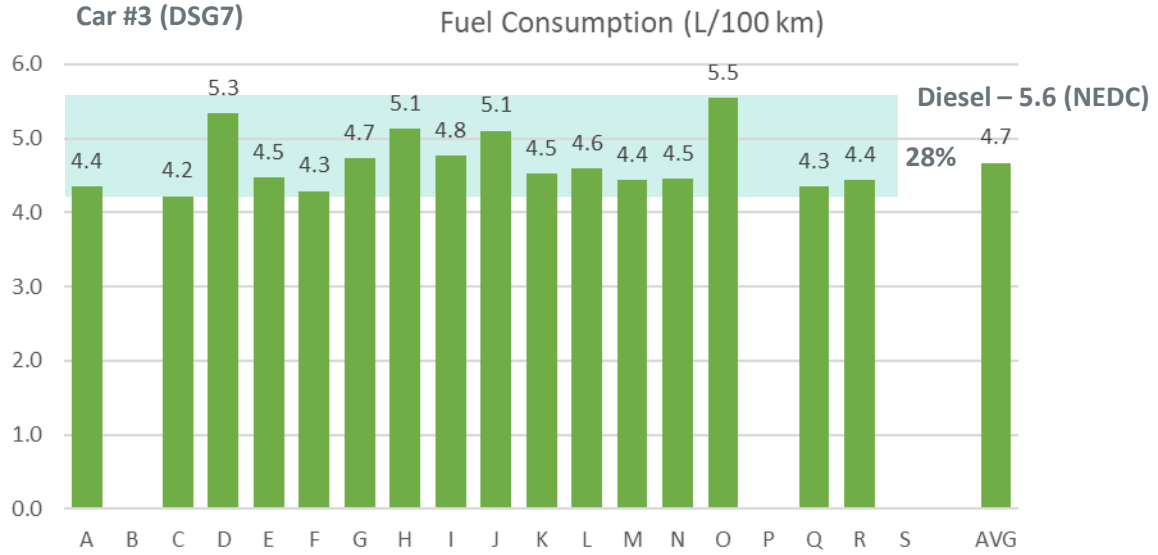
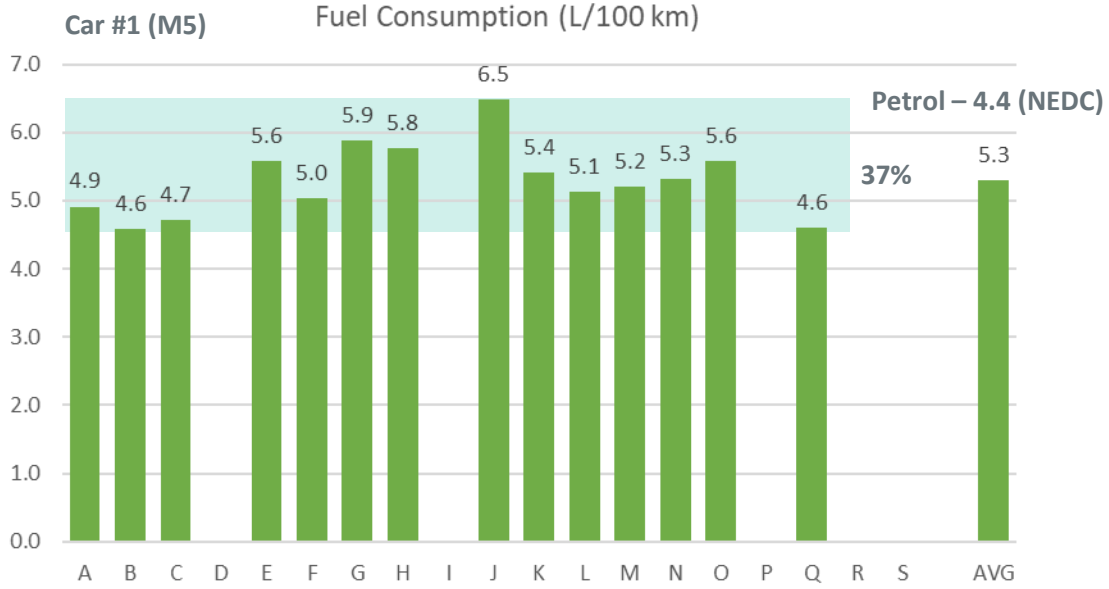
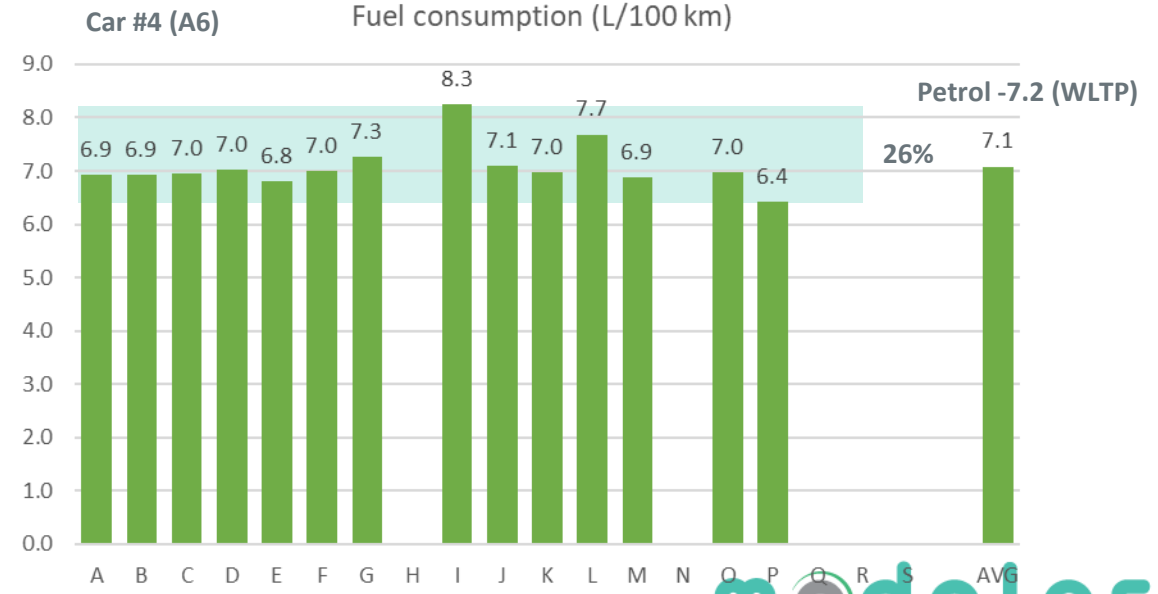
Aggregated results over the trip for different drivers









Drivers A to S, and average for all

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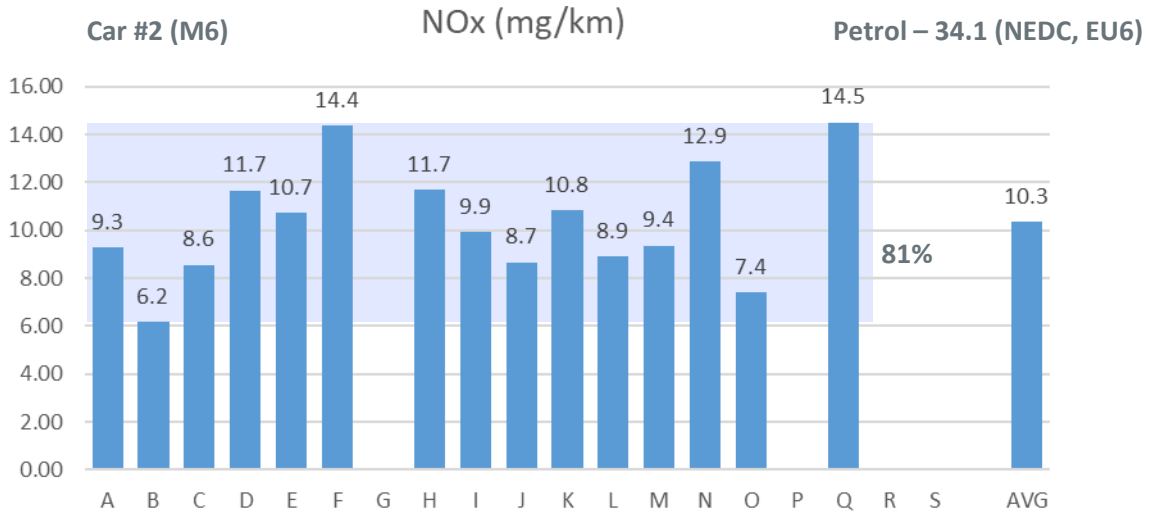

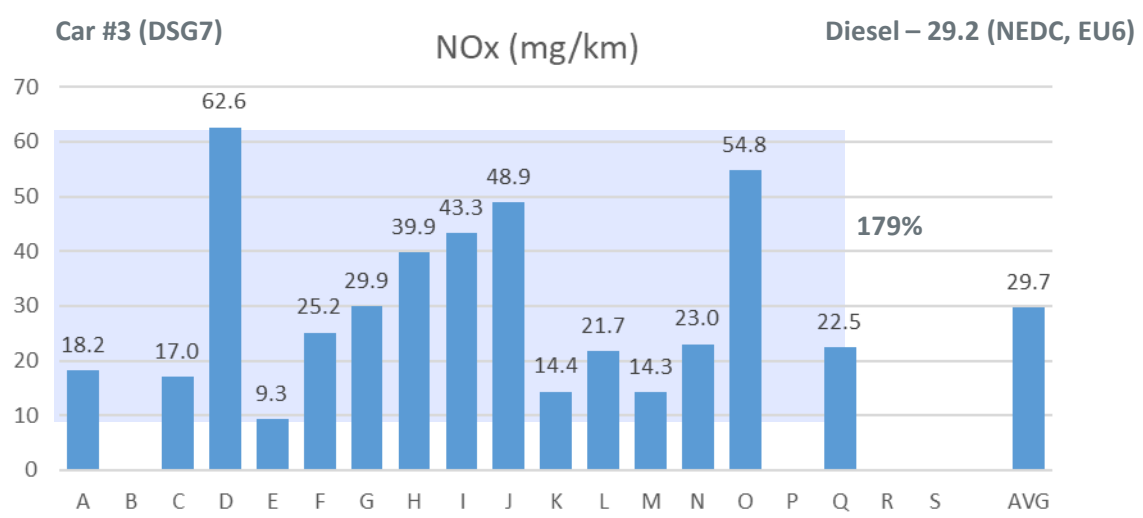

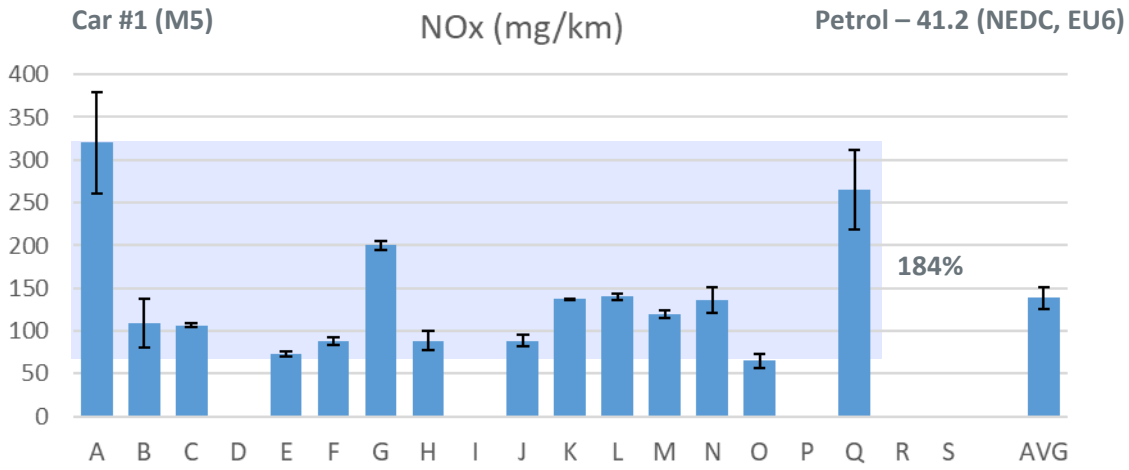

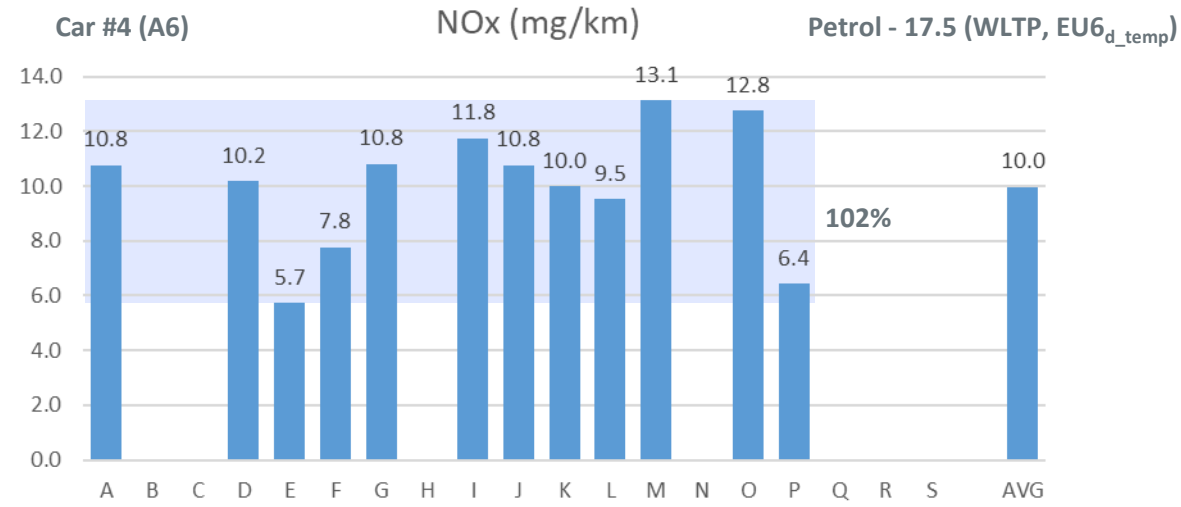

Drivers A to S, and average for all

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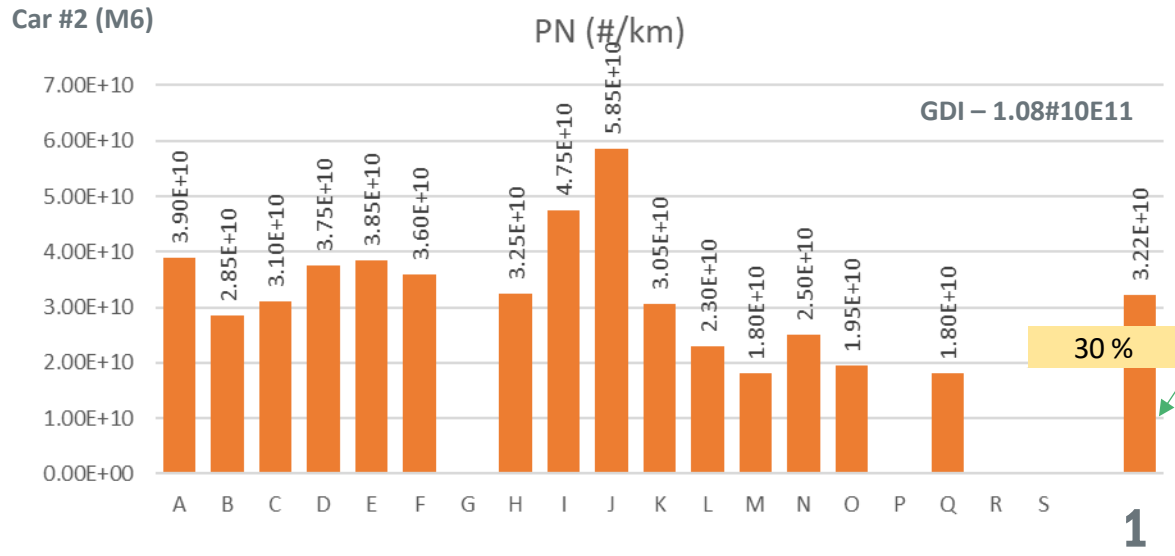
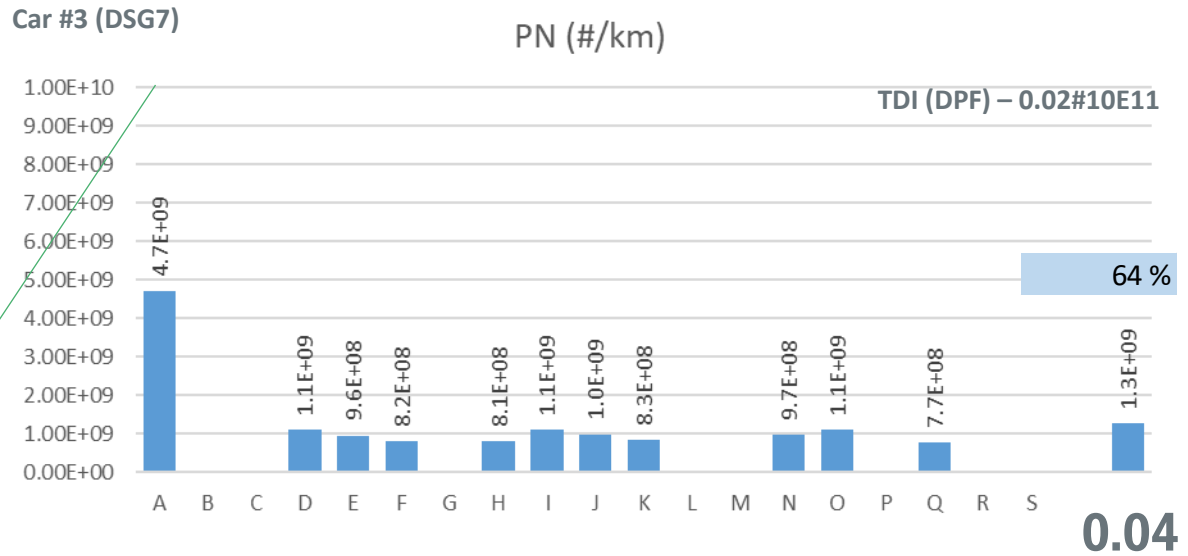
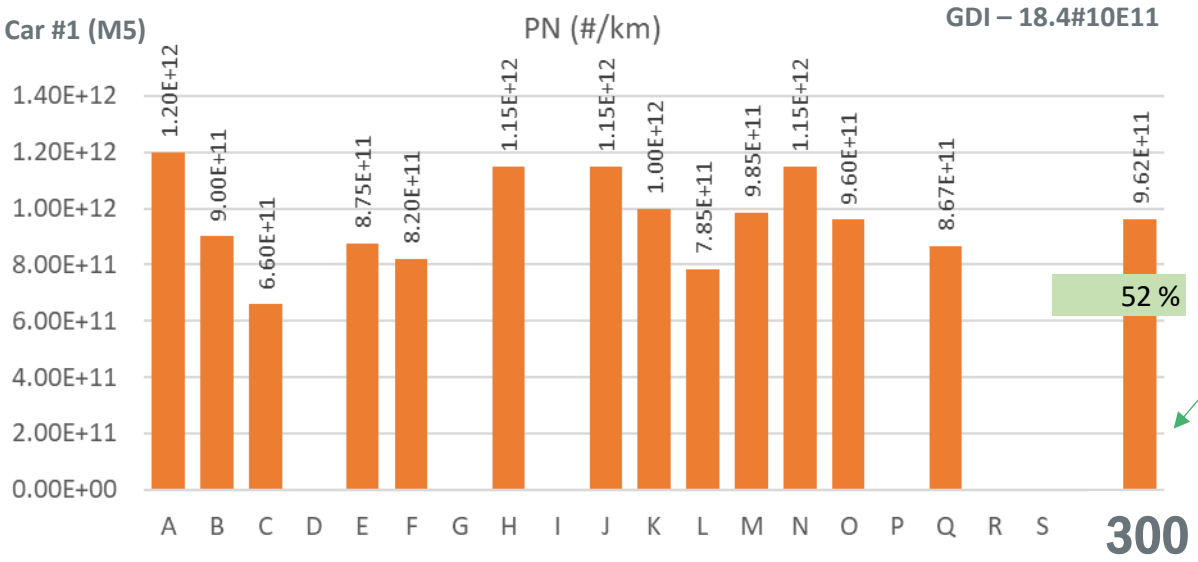
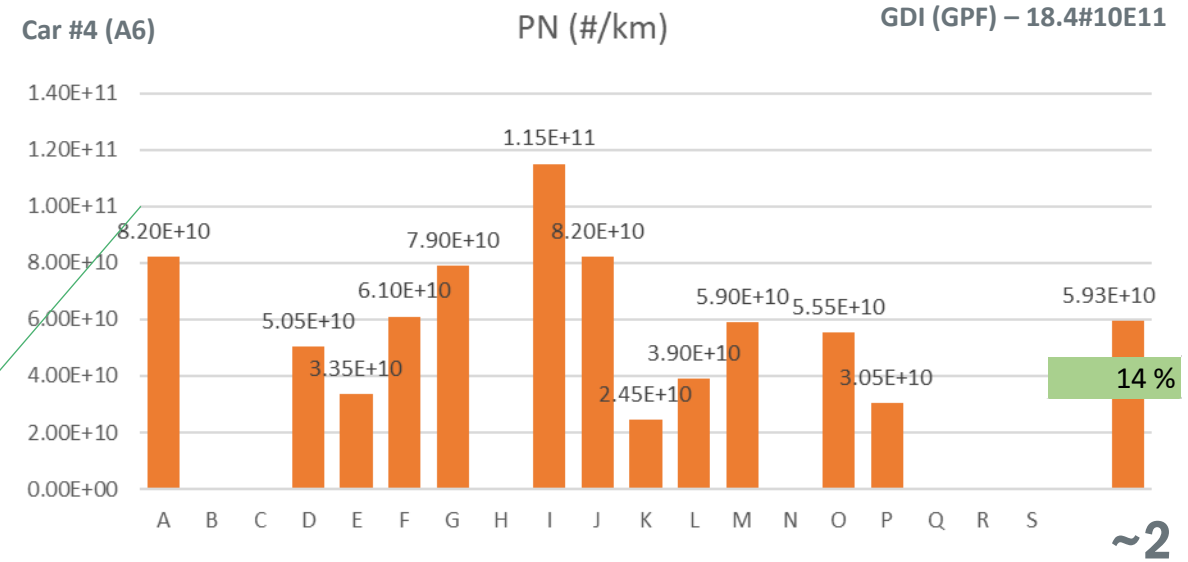
Aggregated results over the trip for different drivers









Drivers A to S, and average for all

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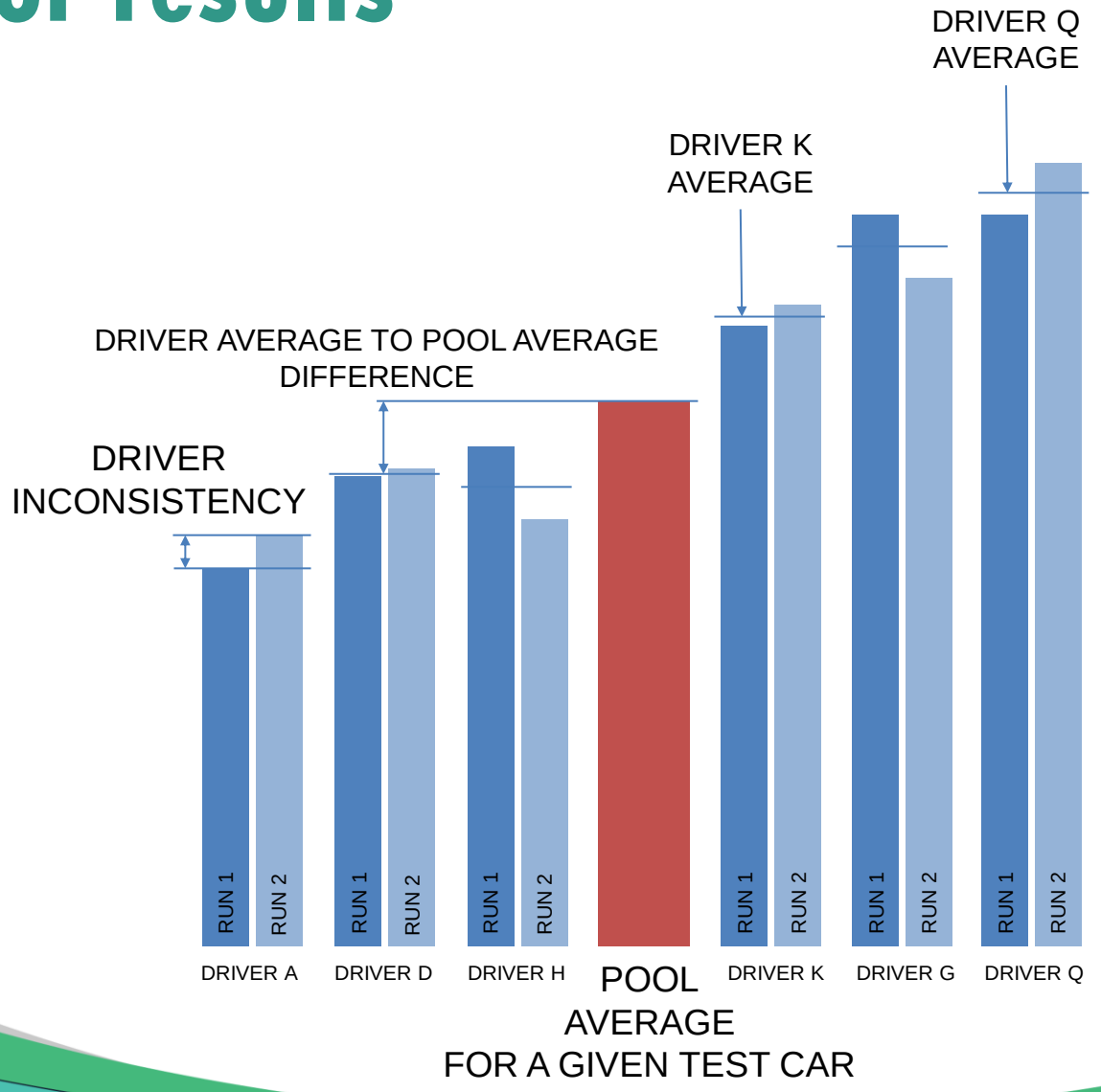
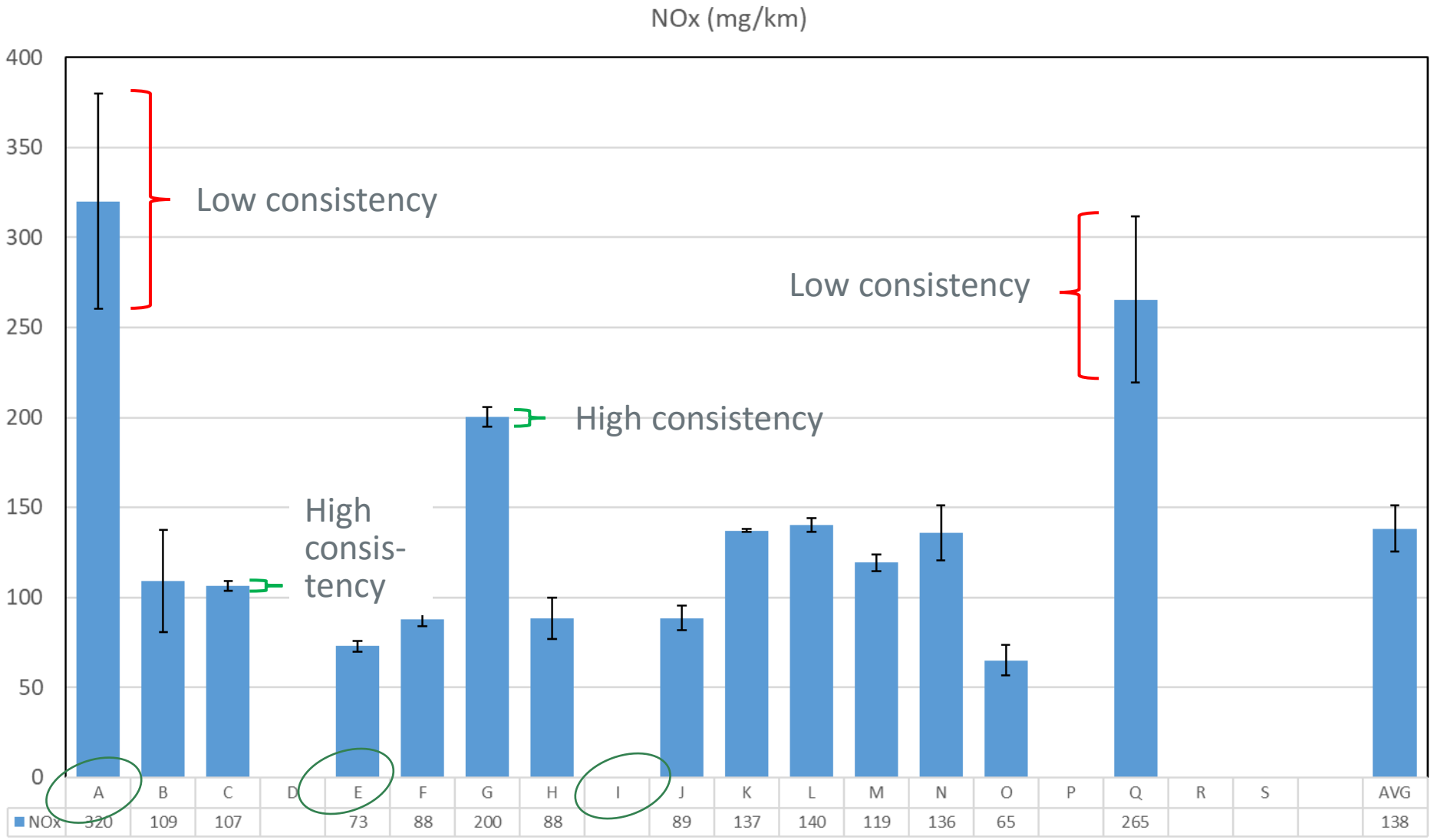
Analysis of results



Driver consistency data



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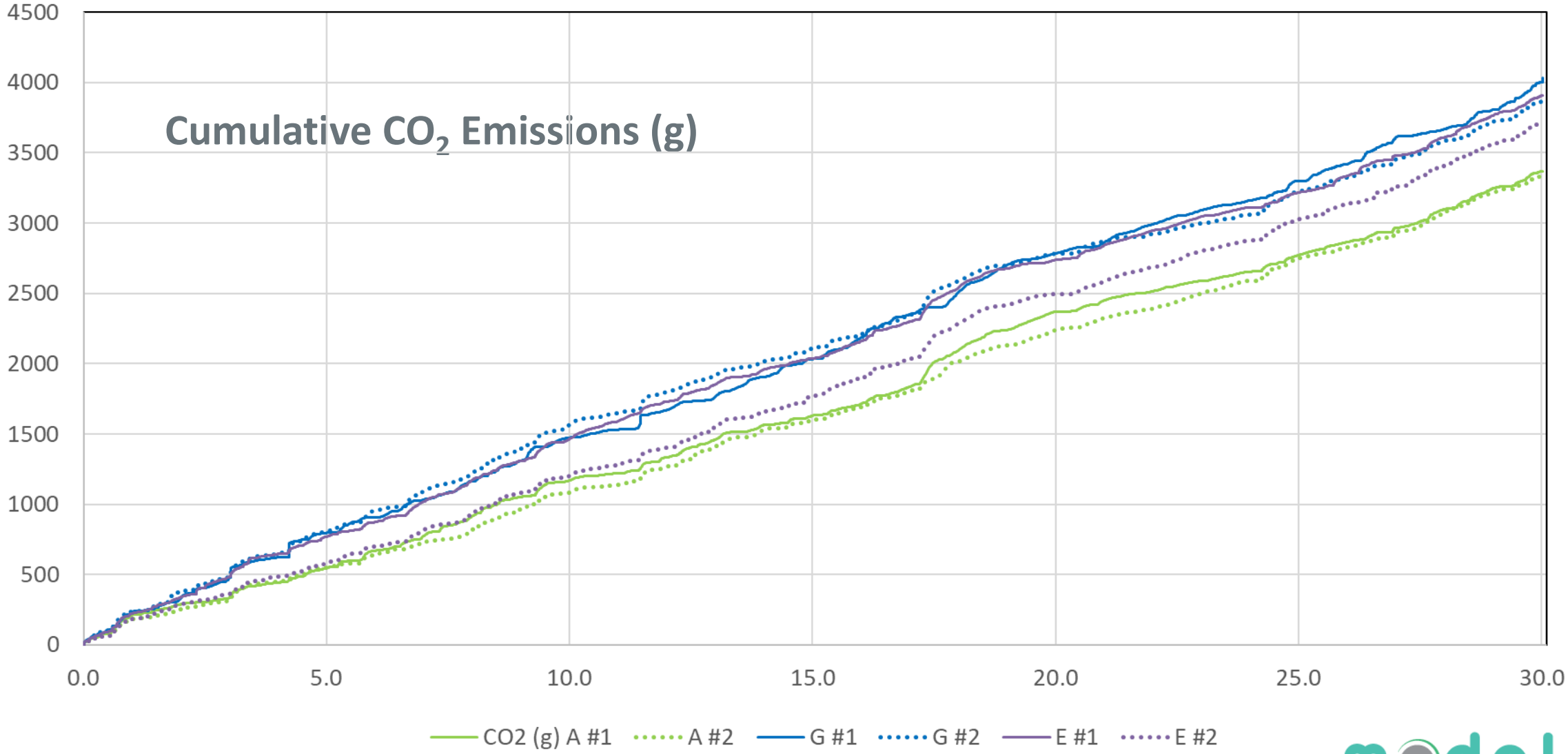
Examples of results

Section: Total Route - Drivers A, G, E



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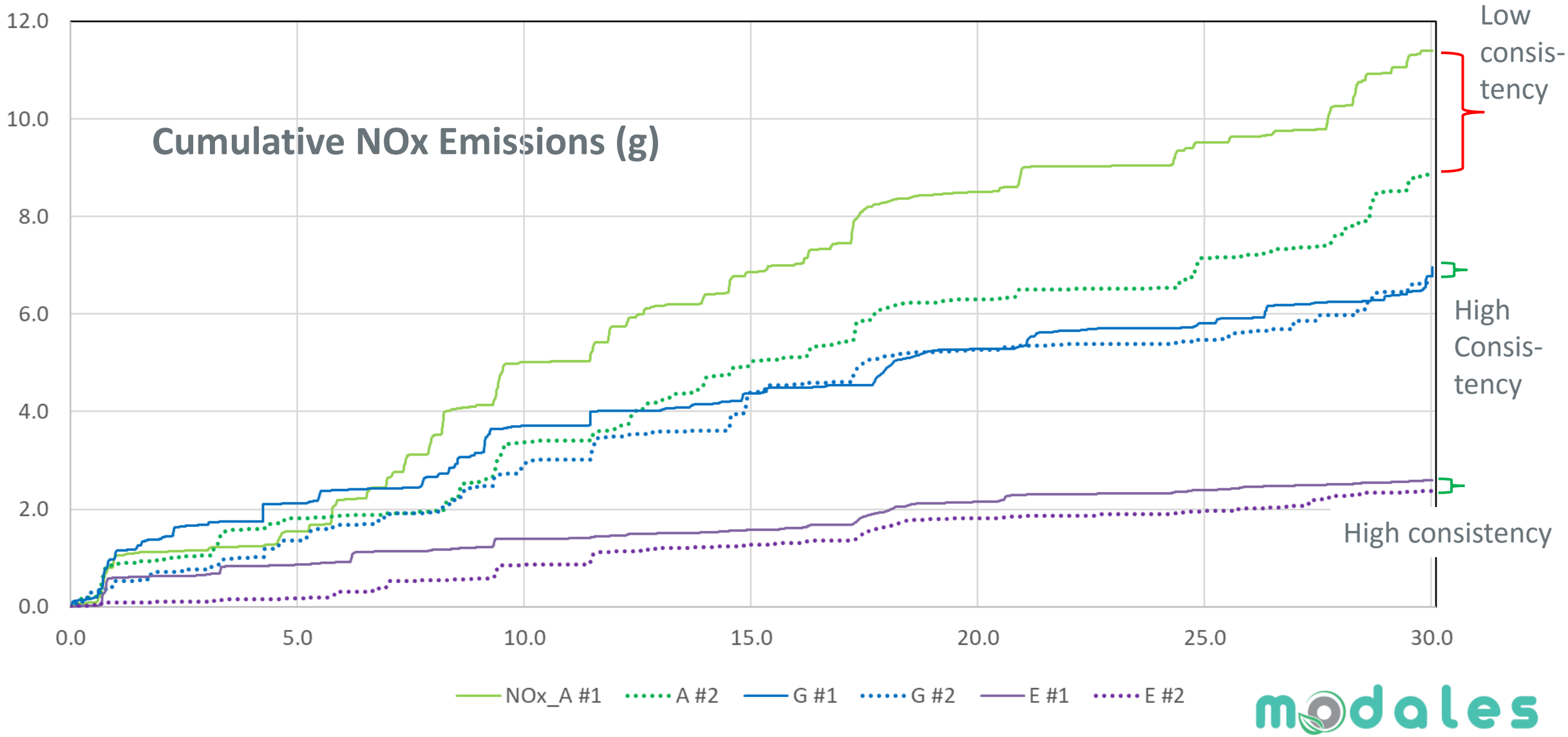
Examples of results

Section: Total Route - Drivers A, G, E



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Route description

Section: First 1 km

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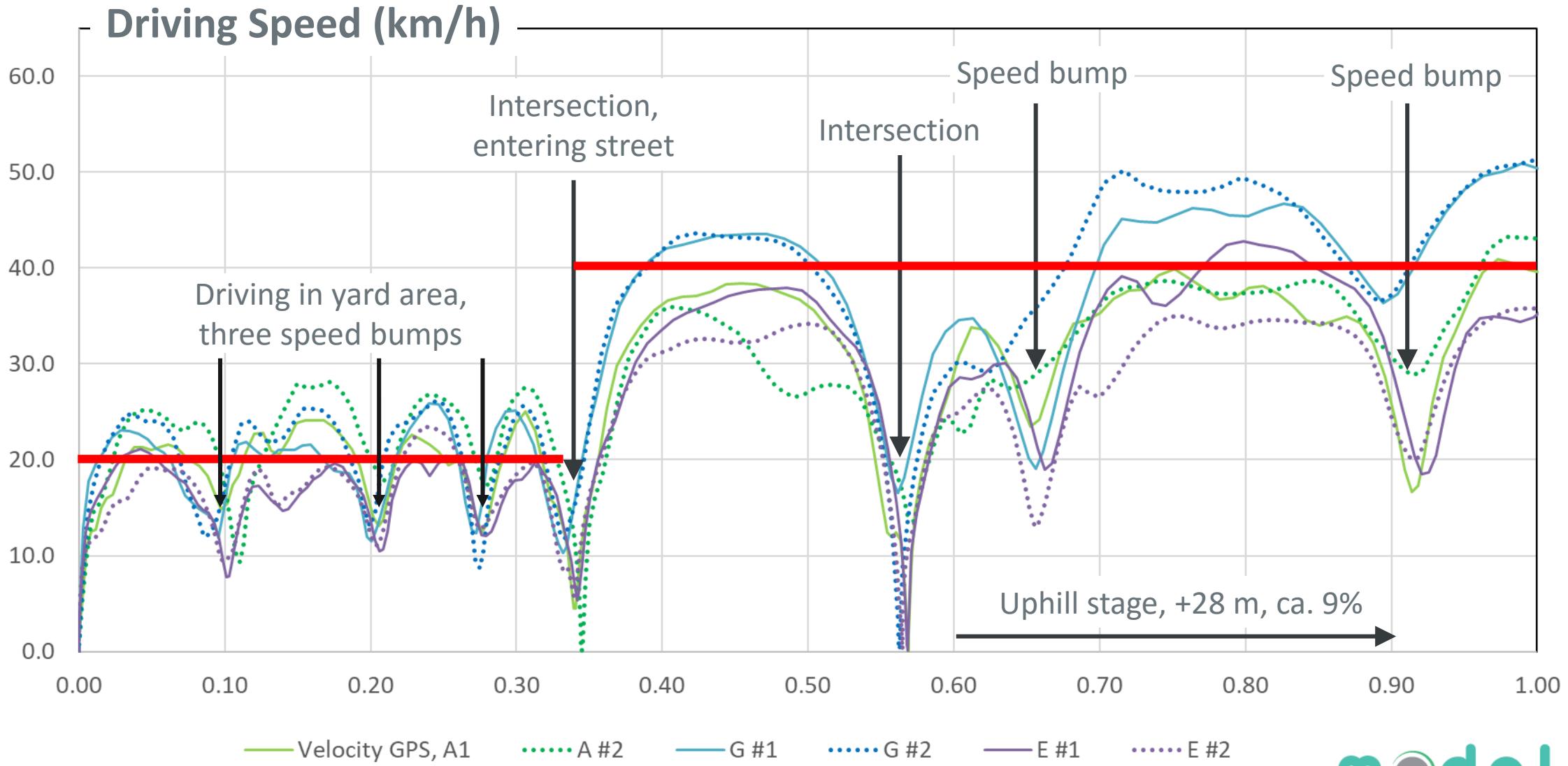
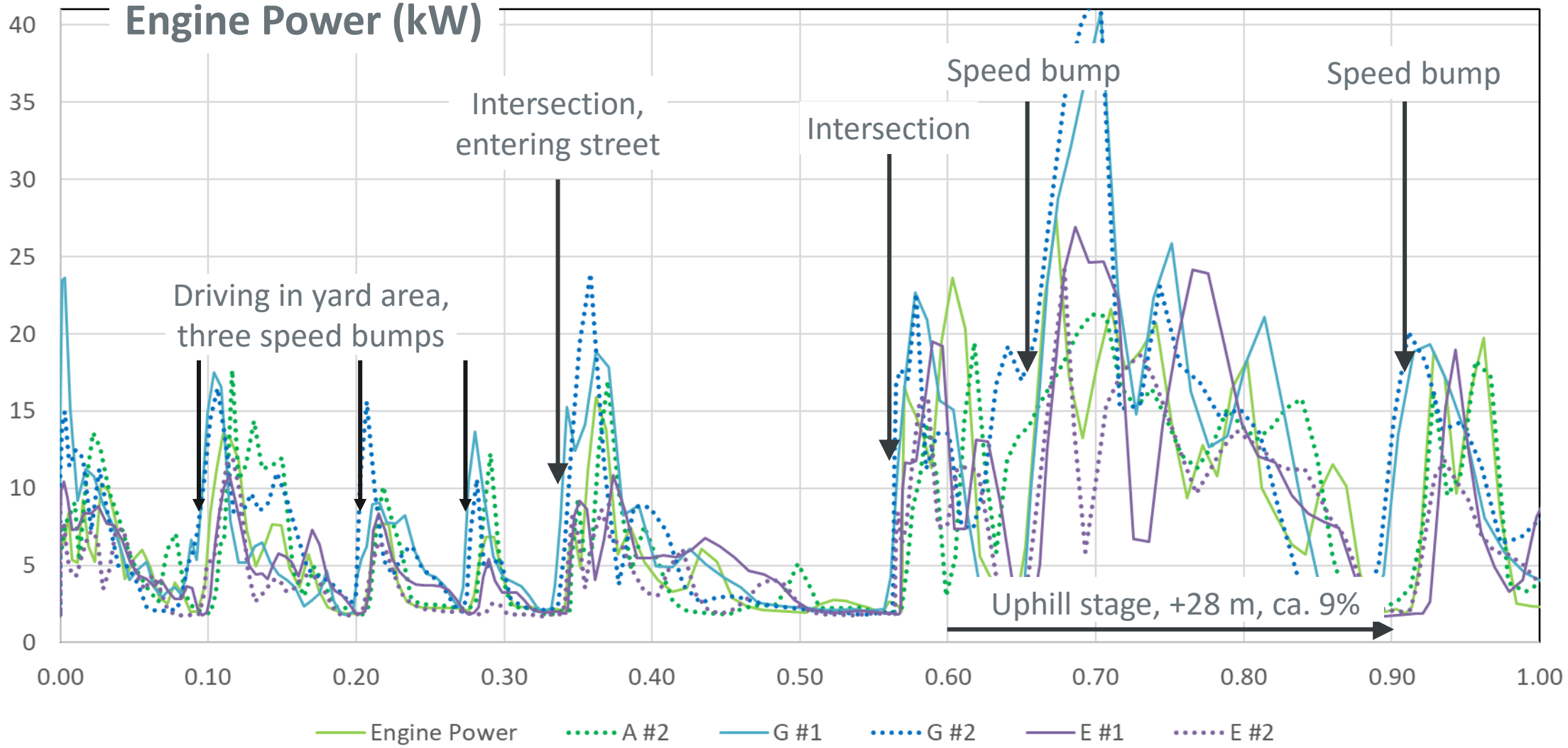
Examples of results

Section: First 1 km - Drivers A, G, E



Examples of results

Section: First 1 km - Drivers A, G, E



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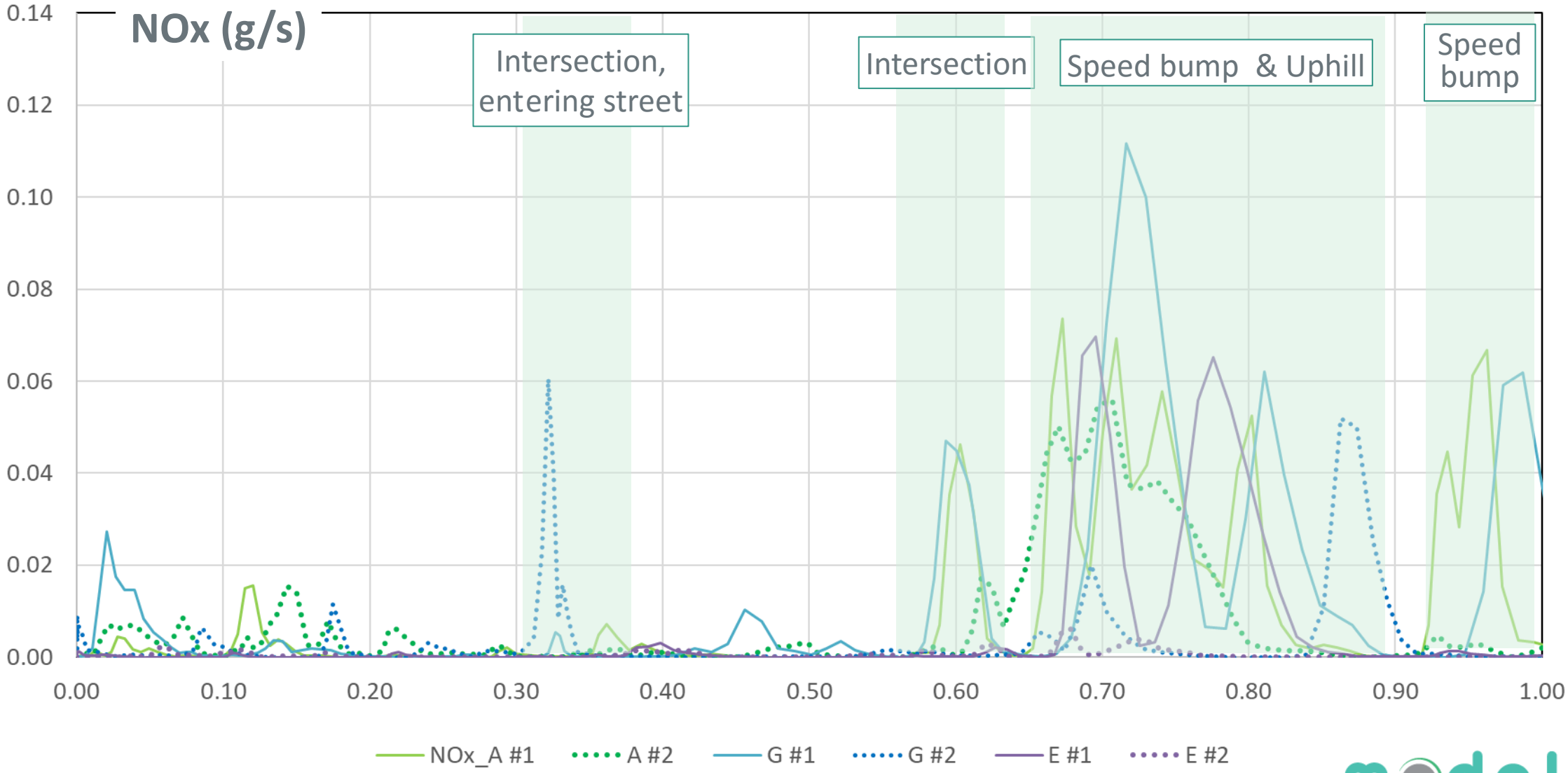
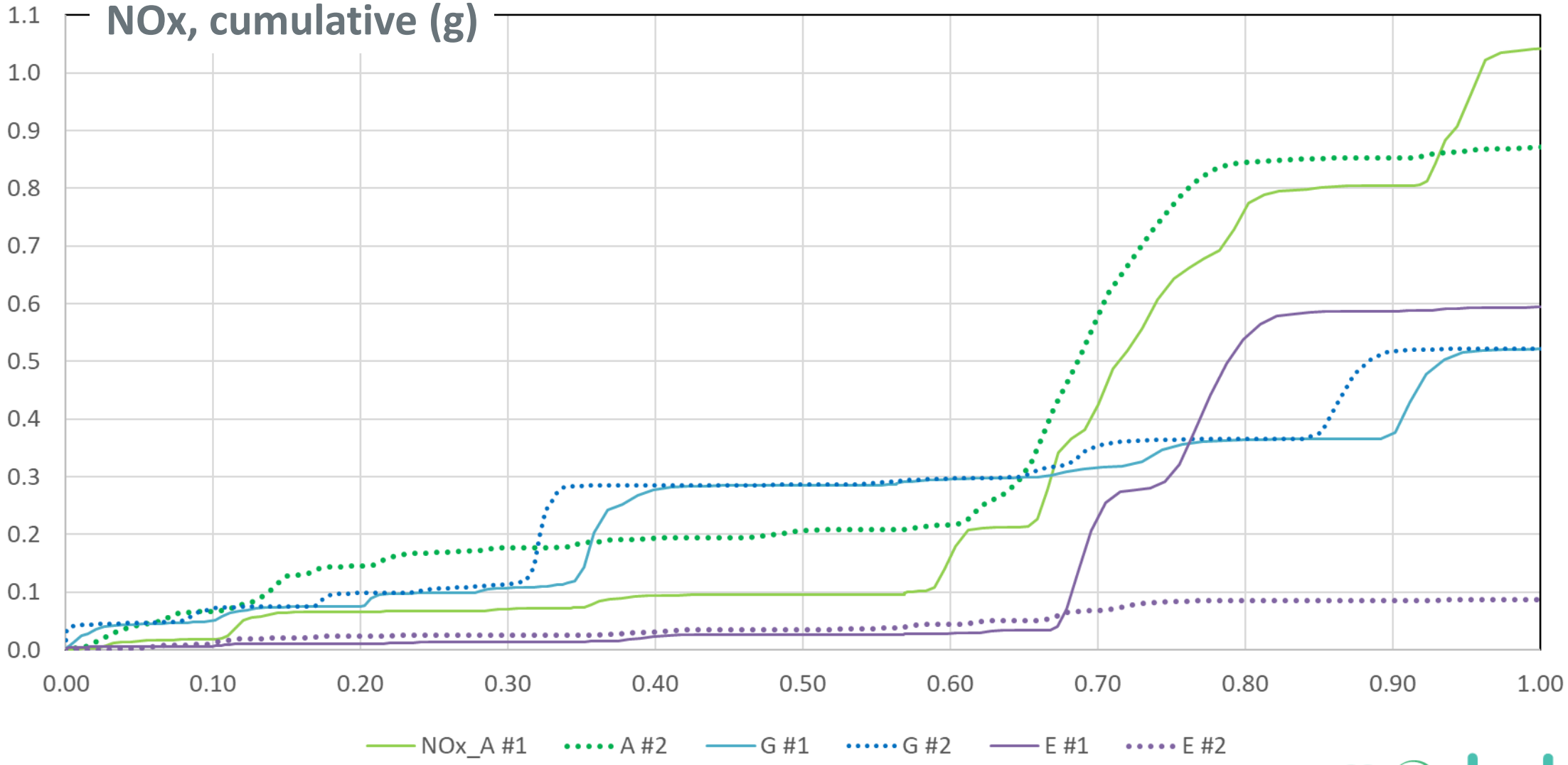


Examples of results

Section: First 1 km - Drivers A, G, E



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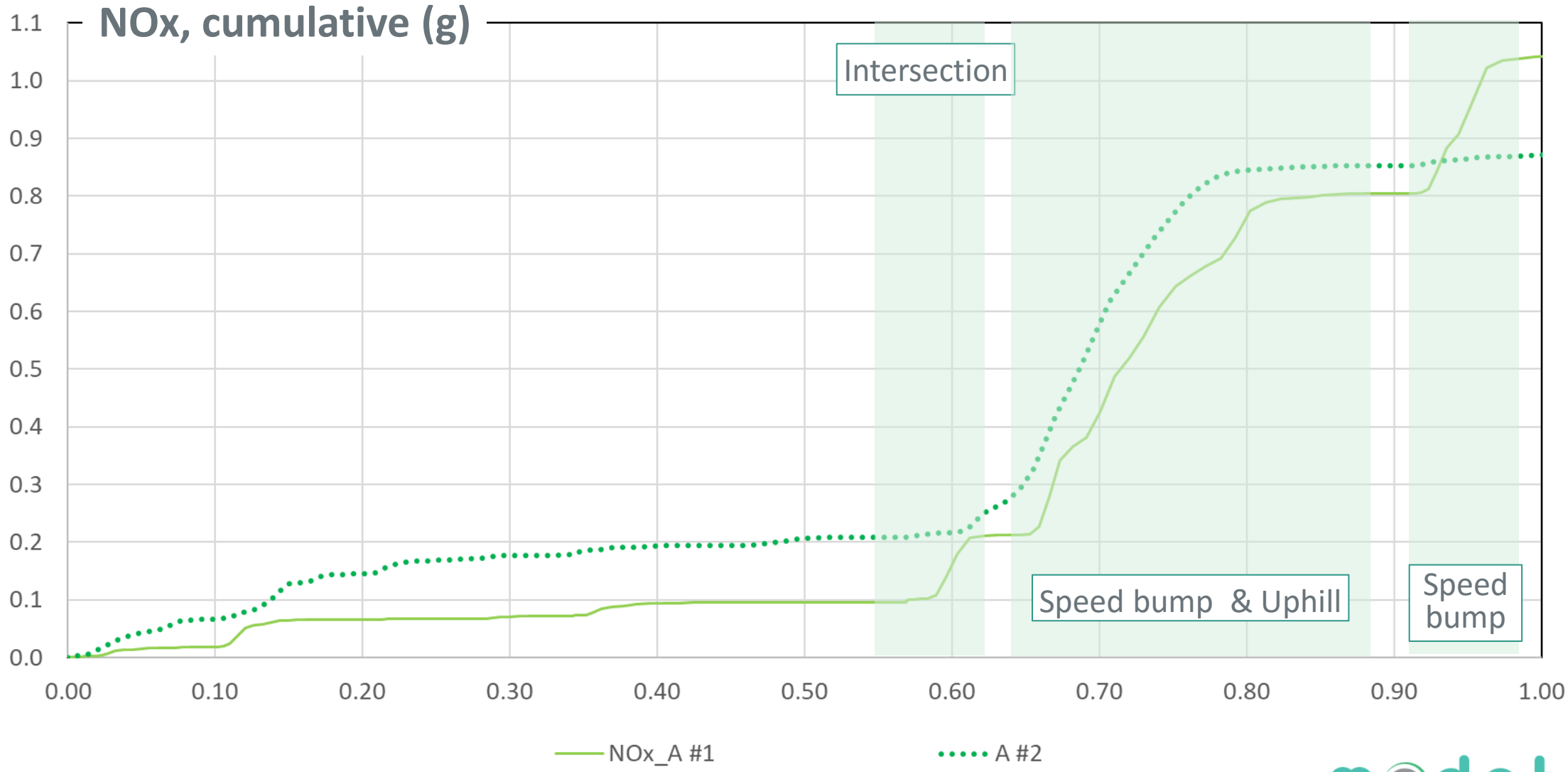
Examples of results

Section: First 1 km - Driver A



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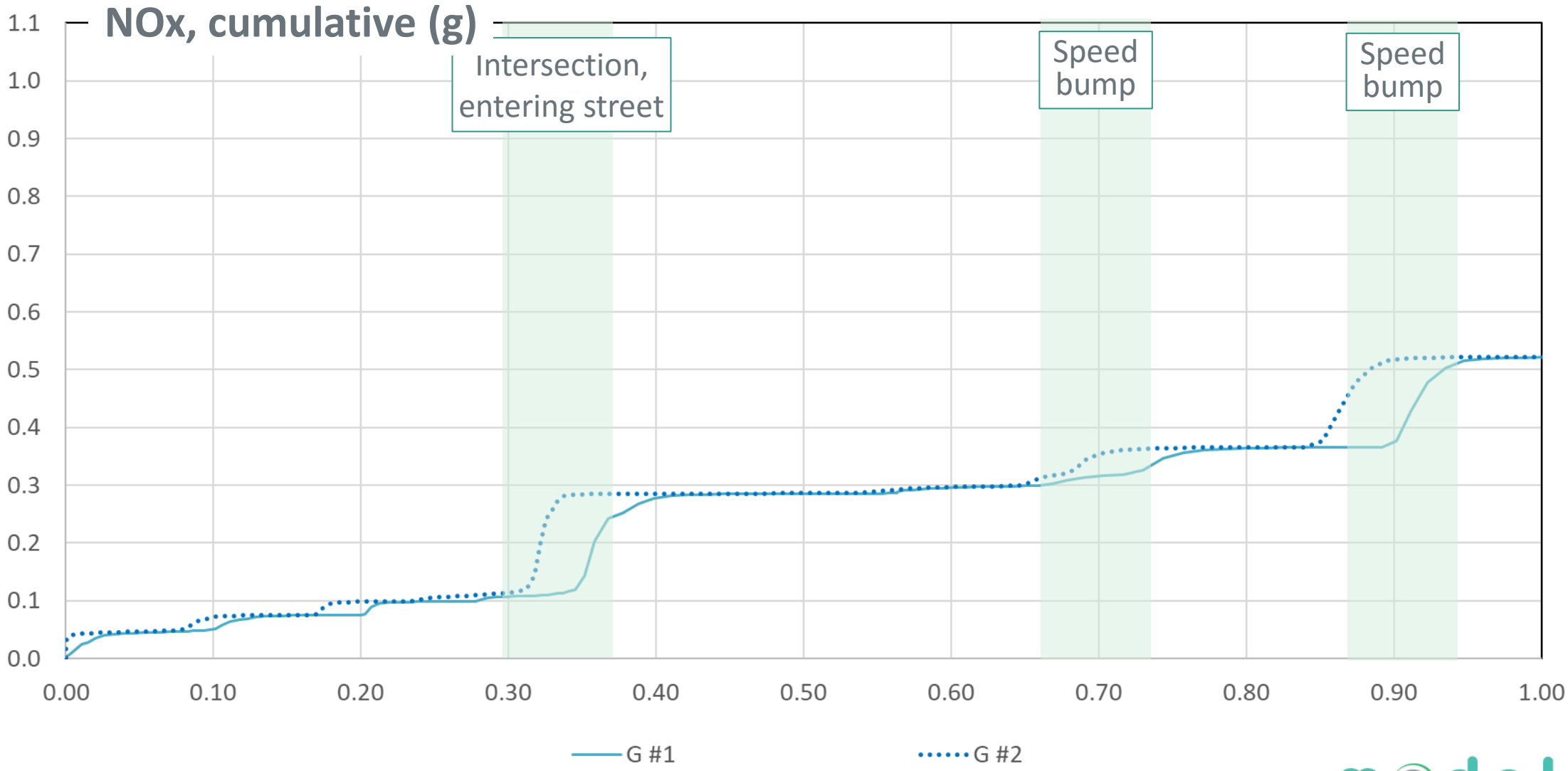
Examples of results

Section: First 1 km - Drivers G



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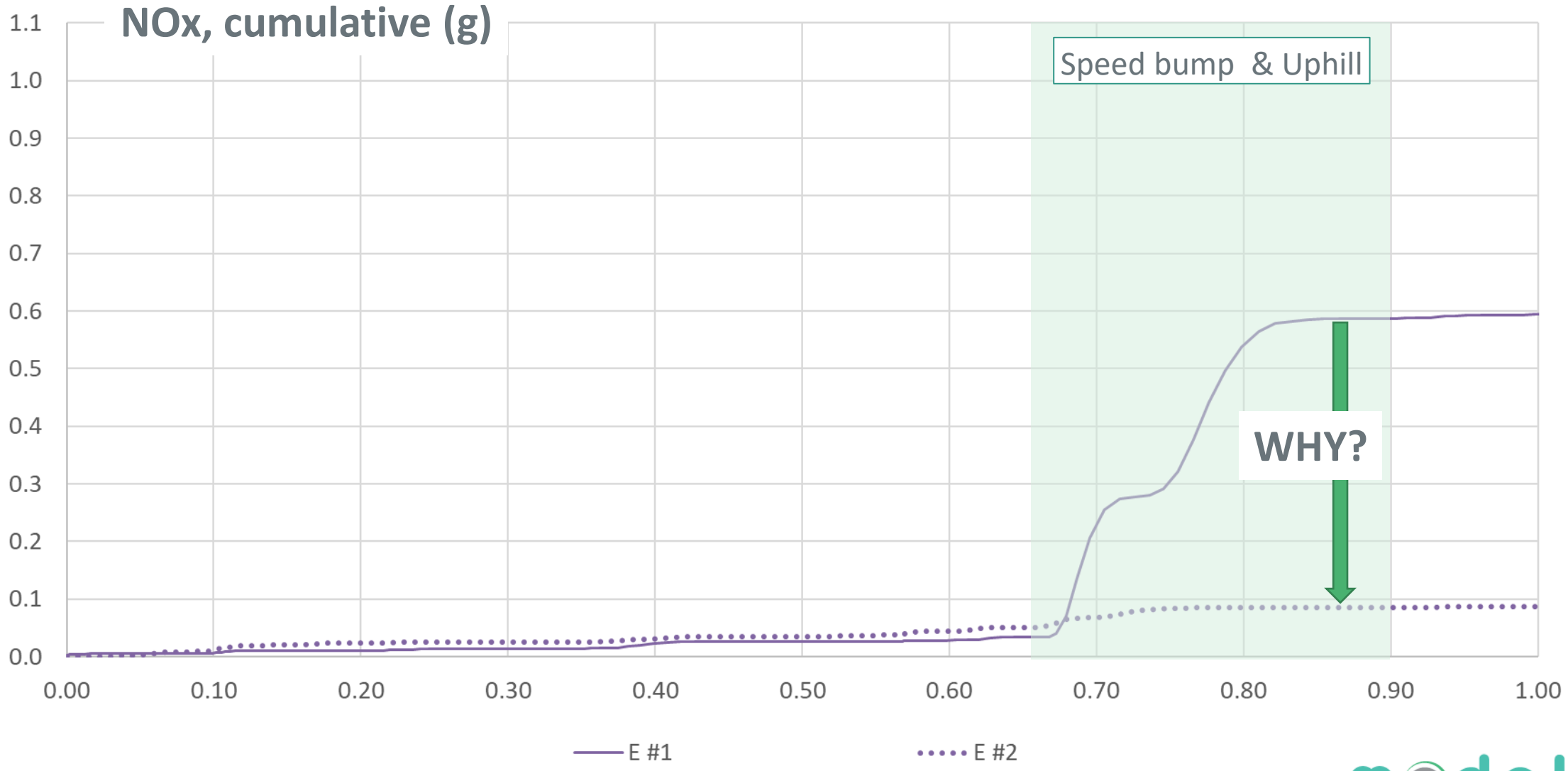
Examples of results

Section: First 1 km - Driver E



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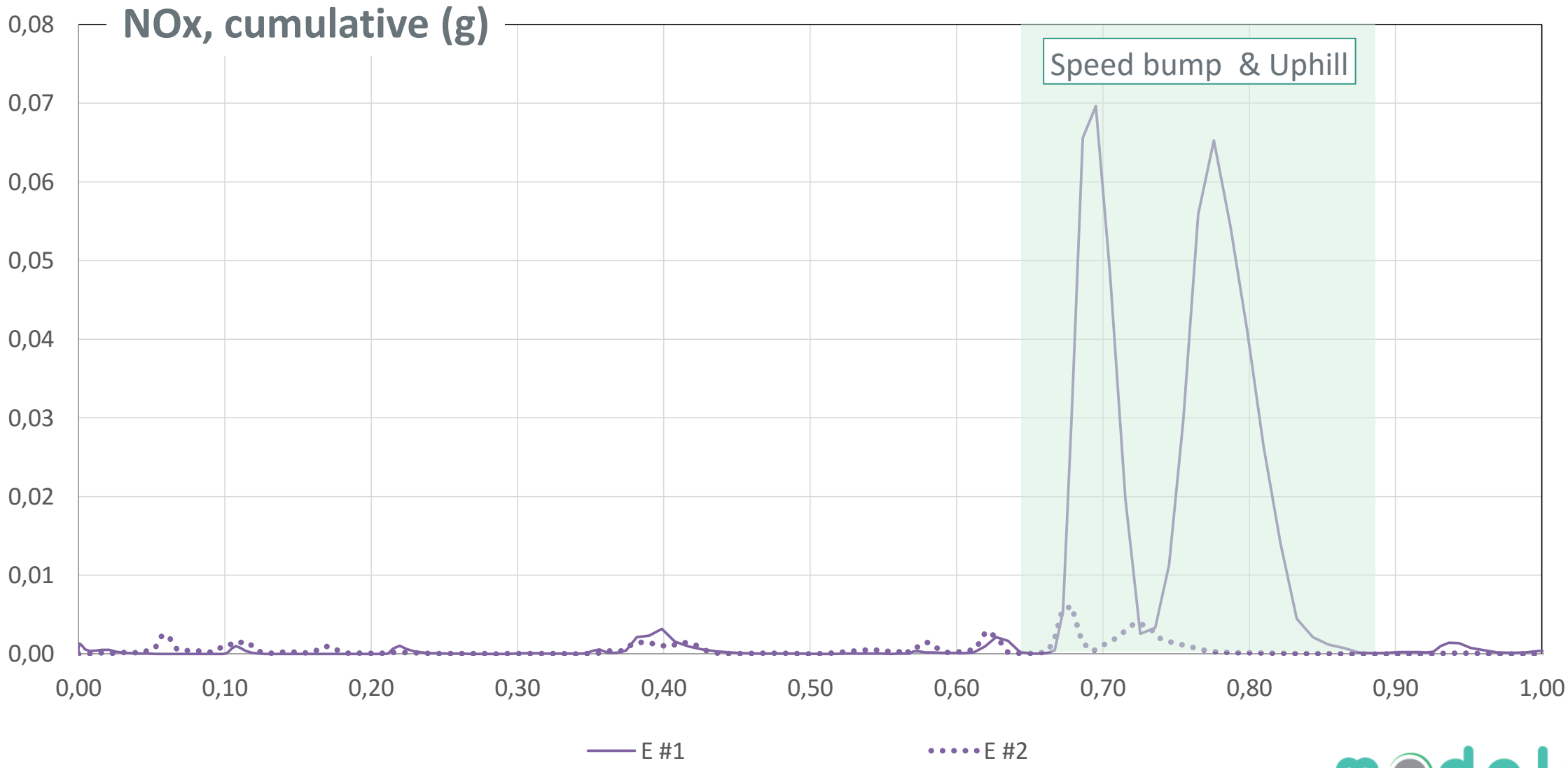
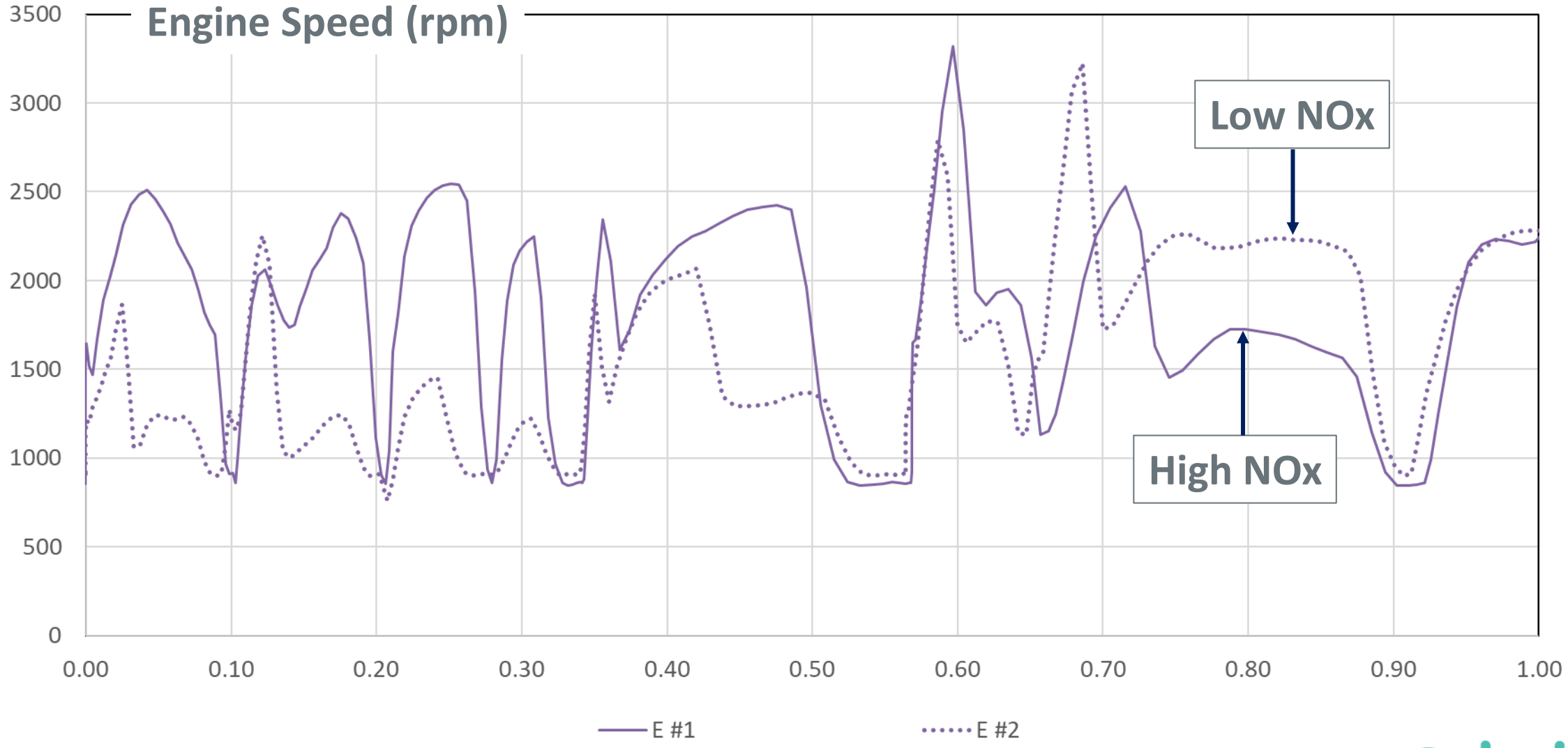
Examples of results

Section: First 1 km - Driver E



Examples of results

Section: First 1 km - Driver E



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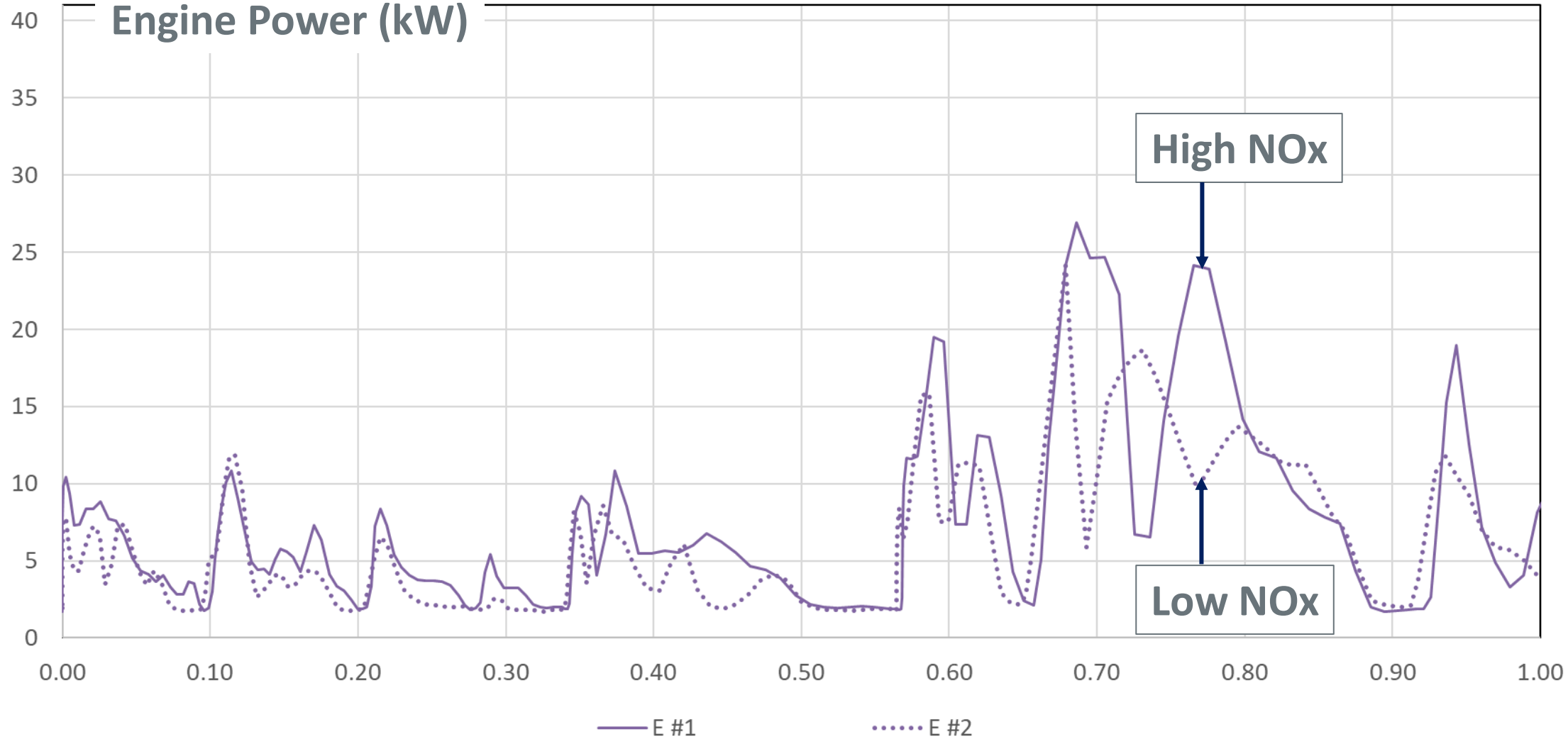
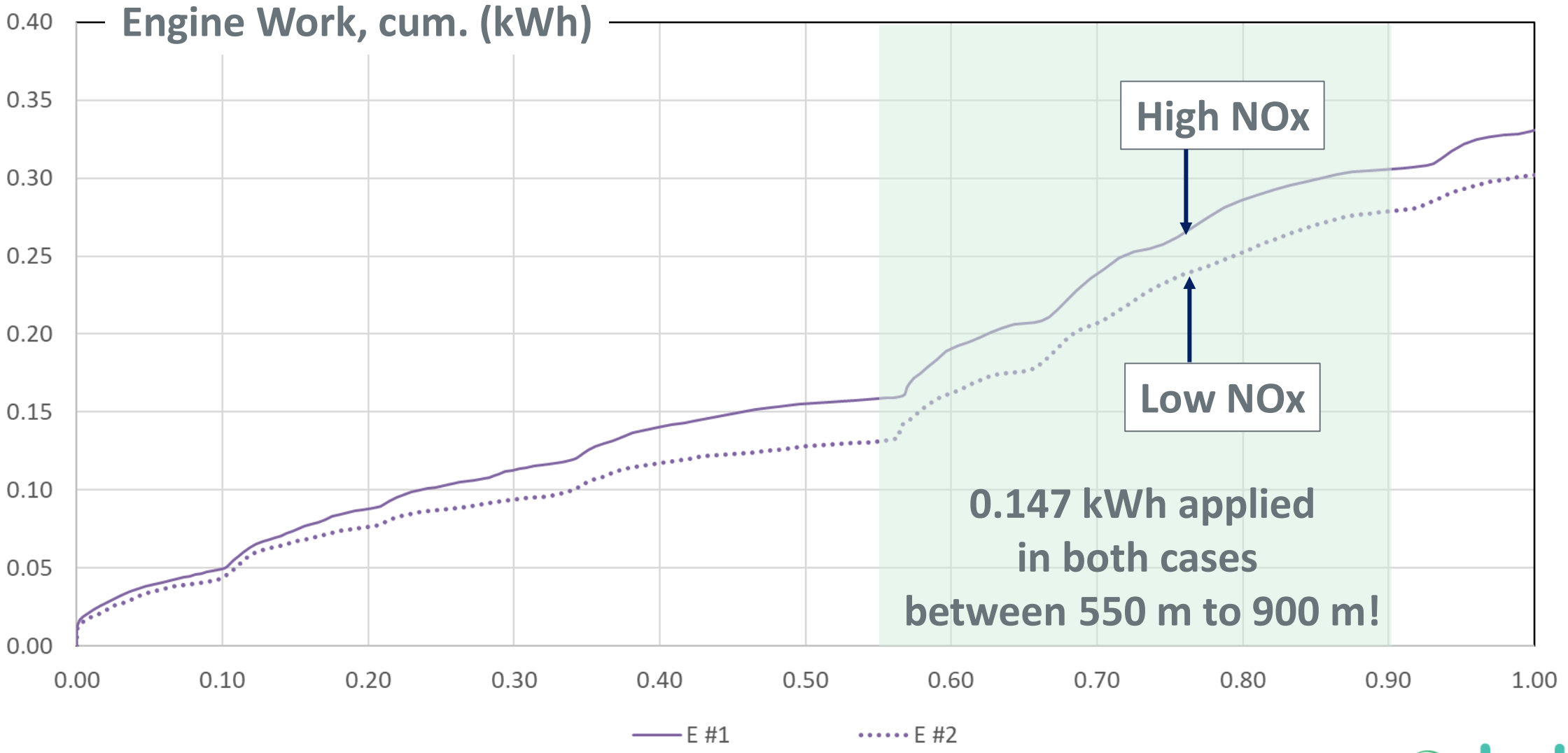


Examples of results

Section: First 1 km - Driver E



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Summary on Exhaust Emissions

- Tailpipe emissions were measured over a 30 km different driving environments
- Pool of 15 drivers to drive 6 different cars (4 petrol, 2 diesel)
- PEMS equipment used to record emissions (CO_2,NO_x,PN)
- Clear driver-to-driver differences detected, with various levels of consistency in driving and emissions
- Data will be used to assess the dependency between driving parameters and tailpipe emissions

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Adapting driver behaviour
for lower emissions

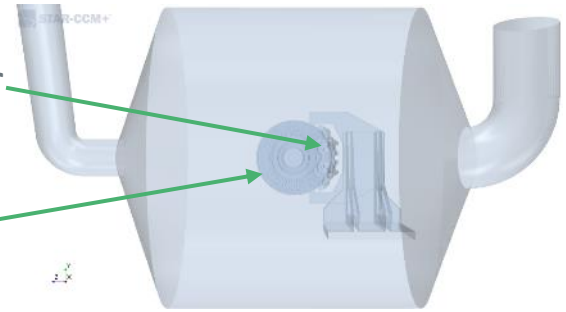
Brake emissions
- methodology and measurements

Mid-term results - “On the Road to Low Emissions” - 28 May 2021

Juhani Laurikko – VTT
with the assistance of
Matteo FREDERICI – BREMBO

Overview of Brake Emissions Experiments

Test Method: brake dynamometer



PM/PN measurement

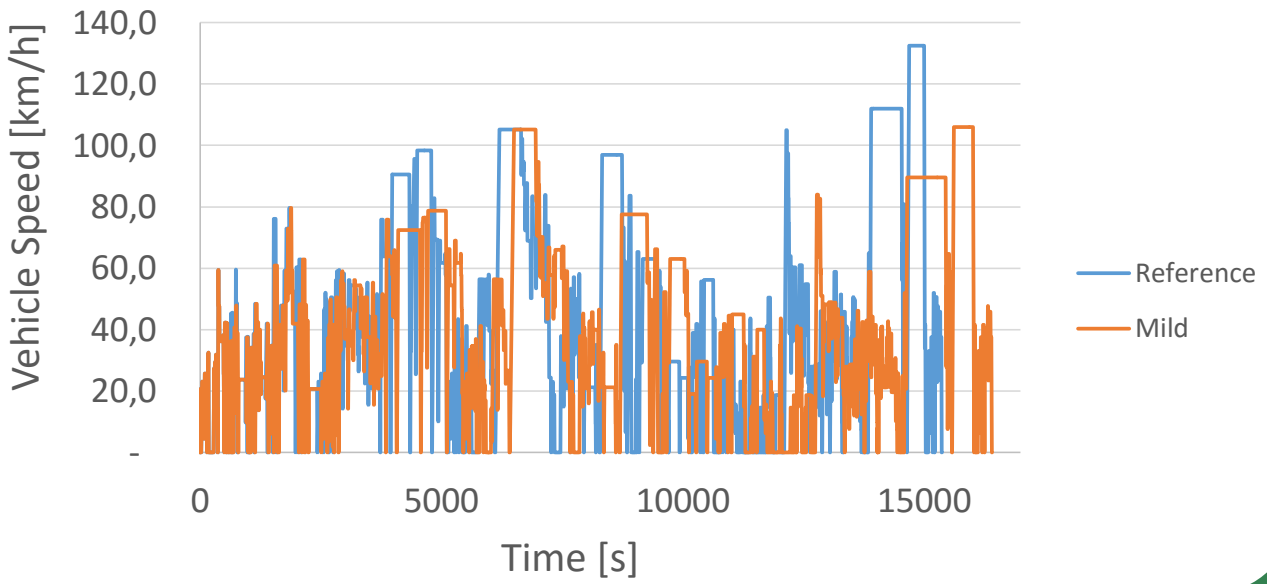
PN_{10} (CPC)

PM_{10} (Impactor)

Reference Vehicle

Testing Cycle

Simulated vehicle speed profile during the test.



The brake cycle has been modified according to the **guidelines for low emission driving**

During the **mild cycle** the brakes **dissipate 20% less energy** than in the case of the reference WLTP-Brake cycle

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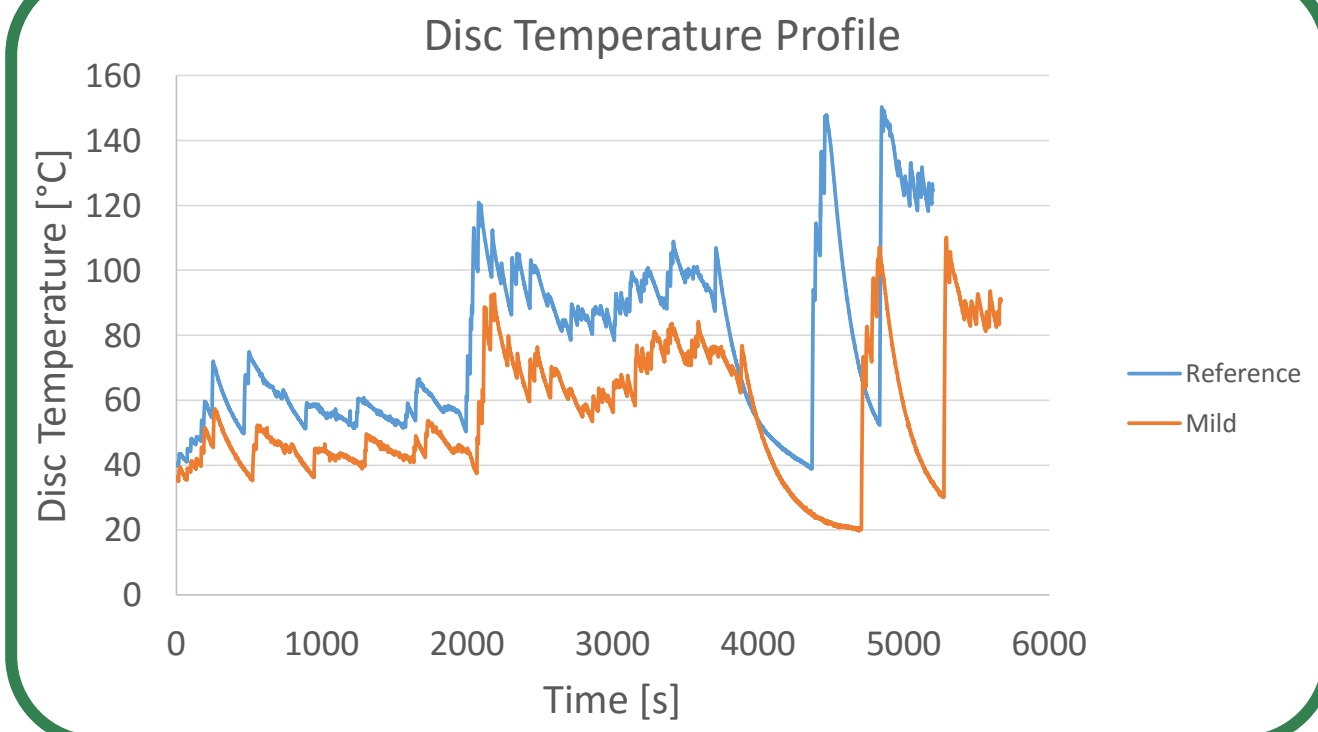
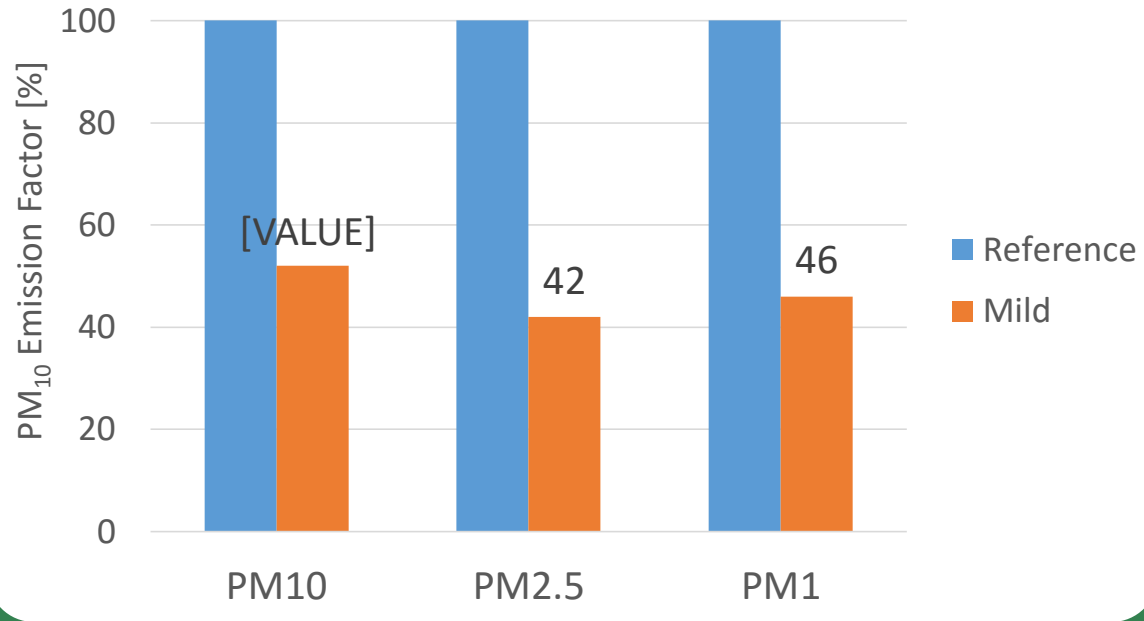
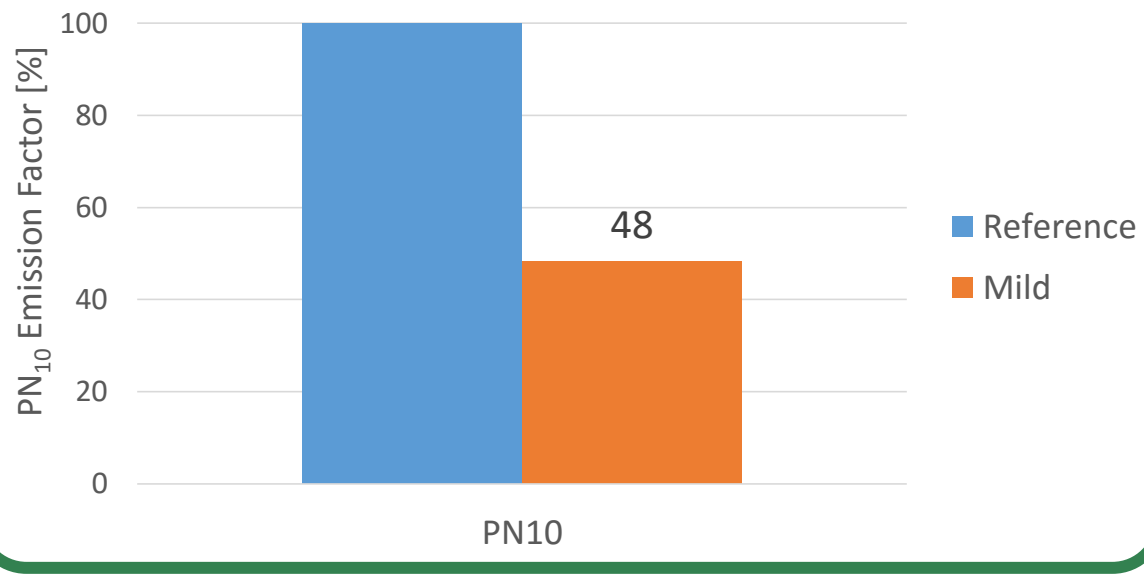
Overview of Brake Emissions Experiments

Main findings



- **The reduction of brake emission, of roughly 50%, was achieved following the MODALES guidelines**
- The data have been shared with partners to generate a FEM model able to describe the emission behavior of braking component – On-going task.





Summary on Brake Emissions

- UNECE/WP29/GRPE: Inertia Dynamometer Protocol to Measure and Characterise Brake Emissions Using the **WLTP-Brake Cycle has been implemented at Brembo lab facility**
- **Real-time data collection on** several parameters related to both **brake hardware and braking events** offered a possibility to **calibrate existing FEM models** and provide **insights for determining** the **most important features** of driving **regarding brake wear** and emissions
- The **modified braking cycle based on MODALES guidelines** was determined, resulting in **50% reduction in brake emissions**

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Adapting driver behaviour
for lower emissions

Tyre emissions
- methodology and measurements

Mid-term results on the road to low emissions: 28 May 2021

Juhani Laurikko – VTT
with the assistance of
Mauro PATELLI – BRIDG

Summary on Tyre Emissions Experiments

Influence domain	Controlled parameter	Physical parameter impacted	Knowledge maturity (0..2)*	Studied in WP3.3	Potential impact (1..3)**
Before driving (preparation)	Trip duration	Tire thermal state --> tire wear impact	2	x	2
	Route choice (grading)	Torque applied at the wheel	2	x	2
	Route choice (type of road)	Road roughness (μ)	1		2
	Load repartition	Tire load repartition	2		1
During driving	Longitudinal acceleration	Ax	2	x	3
	Lateral acceleration	Ay	2	x	3
	Average speed	< V >	2	x	3
Outside a driving phase	Inflation pressure	P	1		2
	Permutations	/	0		1

Parameters	Data
Number of vehicles	75
Tire Position	Front/Rear Left
Tire Specification	Different Type/Size
Tire measurements	3 Months/15 kkm(*)

Cars	Tyre sizes
Toyota Prius	192/55 R16
Toyota Auris	205/55 R16

(*) to be check due to Covid-19

- In **experimental set up** the idea is **to collect**
  - Telemetry data (as per table)
  - Rubber volume loss every 3 months/ 15 000 km*
  - Odometer values at every measurement
  - Front/Rear Left tires
- **Tyre data is collected by**
  - Hand-held device (depth gauge)
  - Laser beam ramp (automatic)

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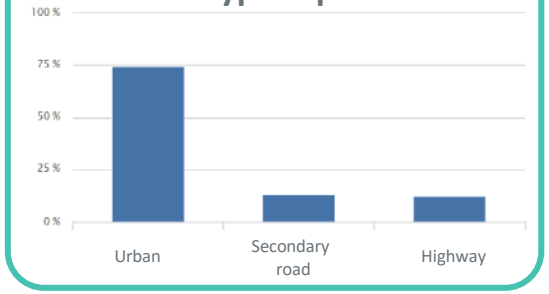
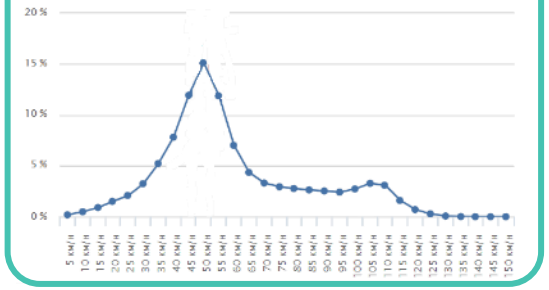
Summary on Tyre Emissions Experiments

Usage data capture

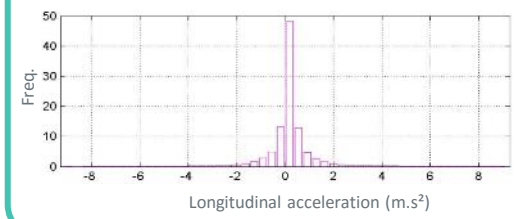
Road type repartition



Speed distribution

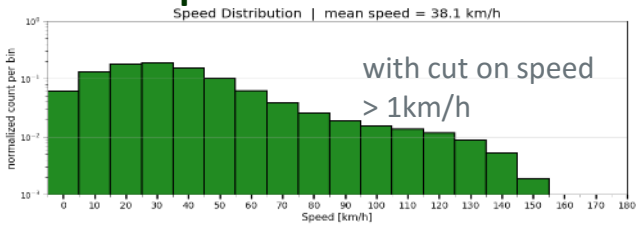


Longitudinal and lateral acceleration distribution

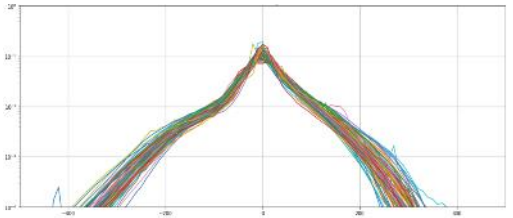


Same Data Graph Sample

Speed Distribution



Acceleration



Timing

End ’19 – Beg ‘20
Test Start

1Q 2021
Intermediate (Jan-Dec ’20)
Data Released

4 months | 4 months | 4 months | 3 months | 3 months | . . .

July 2021
Final Data Release

Wear mass loss measurement

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Summary on Tyre Emissions

- A real-world **test fleet of 75 cars** was put into service
- **Tyre wear inspected every 3 months**/15,000 km
- **Real-time measurement of driving parameters** with **OTA telemetry** was used **to collect data that characterises driving**
- Collected **data was used to calibrate existing FEM models** and **provide perceptions of key performance indicators on tyre wear**

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Summary and Key Messages

- **Unique experimental exercises were implemented** to study both **exhaust and non exhaust emissions** in relation to **characteristics of driving**
- **Interdependence between driving style and tailpipe emissions** was established, allowing **parametrisation of low emissions driving**
- Using collected data and models a **list of key indicators of driving regarding both tyre and brake wear** could be nominated
- **Public Deliverable due end of June 2021!**

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Adapting driver behaviour
for lower emissions

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Thank You for Your Attention!

This project has received funding from the European Union's Horizon 2020
research and innovation programme under grant agreement No 815189.

Adapting driver behaviour
for lower emissions

Low-emission driving training – the MODALES approach

Ted Zotos

IRU

Mid-term results on the road to low emissions: 28 May 2021

Overview

- Trainings – a review of previous eco-driving training efforts
- Eco-driving VS Low-emission driving
- From guidelines to training
- User groups
- Aspects covered
- Geographical coverage
- Next steps

Trainings – a review of previous eco-driving training efforts

A desktop research was conducted on previous training efforts by EU-funded projects and other initiatives such as TREATISE, ECO-EFFECT, ECODRIVEN, CIVITAS, Kesko, STIB, MOBIEL and others

- Positive results on **fuel savings from 1% to 16.9%** were achieved
- Road safety benefits - **22% reduction of accidents**

Eco-driving VS Low-emission driving

- Eco-driving trainings are widely spread across Europe
- Most of the drivers –the majority of professional ones – are familiar with techniques to reduce fuel consumption
- The newly introduced term of “low emission driving”, goes beyond the fuel savings approach and includes the impact driving behaviour has on emissions such as the tyre & brake

Parameters	Eco-Driving	Low-emission driving
Targets		
Fuel consumption reduction	√	**
Exhaust emissions reduction (CO_2)	√	**
Exhaust emissions reduction (pollutant emissions, e.g. NOx)		√
Brake emissions		√
Tyre emissions		√

** = indirect benefit from low-emission driving – not main objective

From Guidelines to Trainings

- More than **30 concrete guidelines** were identified from different activities in the project
- The guidelines were categorised in **4 categories**:
  - Pre-trip preparation and route choice
  - Driving
  - Maintenance
  - Additional tips
- The guidelines were translated into **concrete tips for drivers** taking into account **incentives and the impact of certain behaviours** (cost or benefit of driving in a certain way)

User groups

Professional drivers

Training and guidelines adapted to vehicle type, activity and roads driven

Private/Individual Drivers

Flexible and not too specific or difficult to follow guidelines

General Public: Awareness Campaigns

Principles of low emissions driving and most easy/ famous guidelines

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Aspects covered

+ Pre-trip checks and planning

Driving behaviour

Training will be delivered on emissions savings by changing behaviour (idling, gears, breaking, accelerating etc.)

Proper maintenance

By maintaining the vehicle properly, emissions savings can be achieved

Use of the MODALES app

The MODALES app will assist drivers consulting them to drive environmentally friendly

Aspects studied - MODALES

1. Human factor

6. Retrofits

2. Devices

5. Exhaust emissions

3. Maintenance

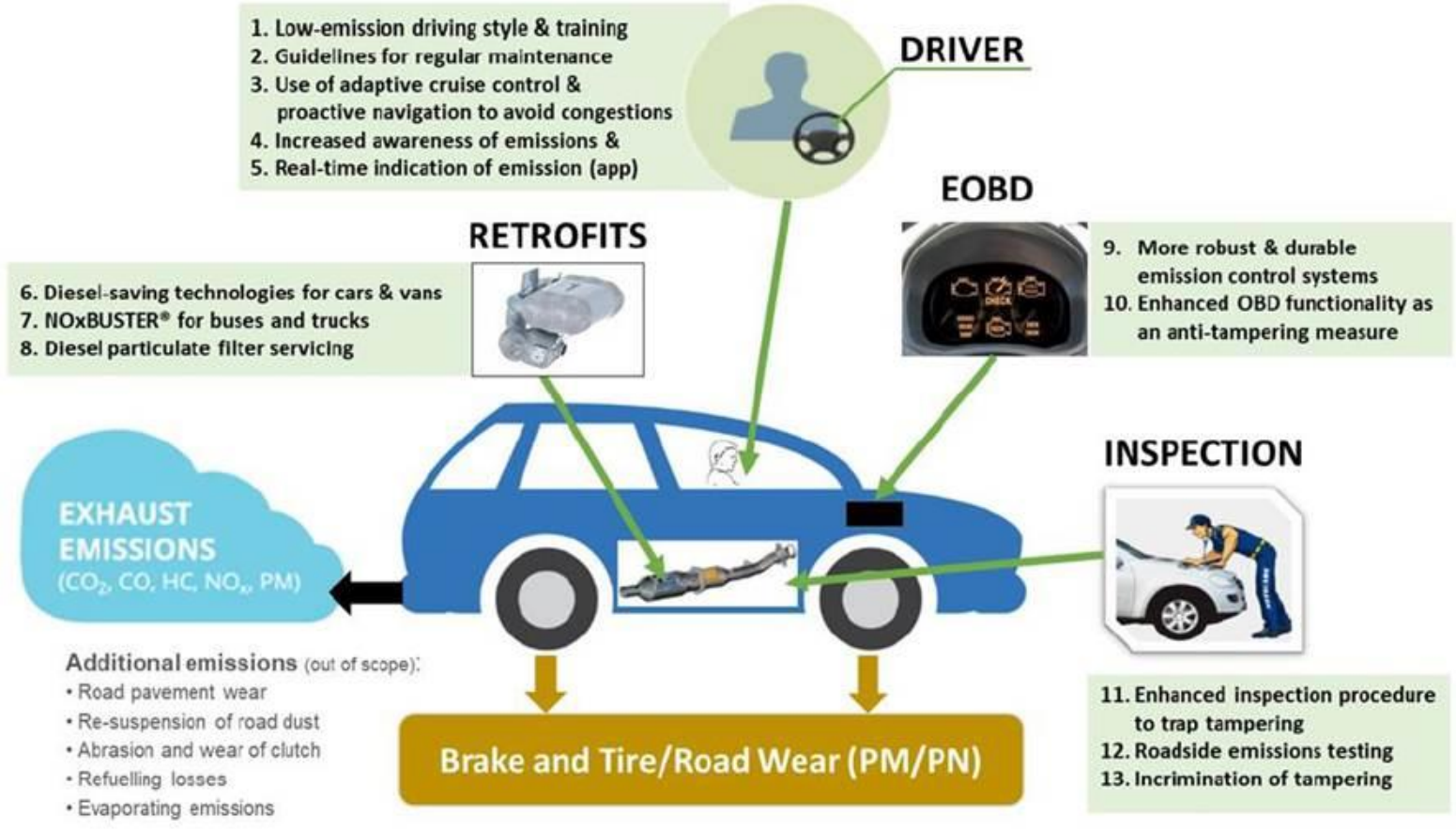


Figure 2: Overview of the MODALES' innovation areas and candidate solutions

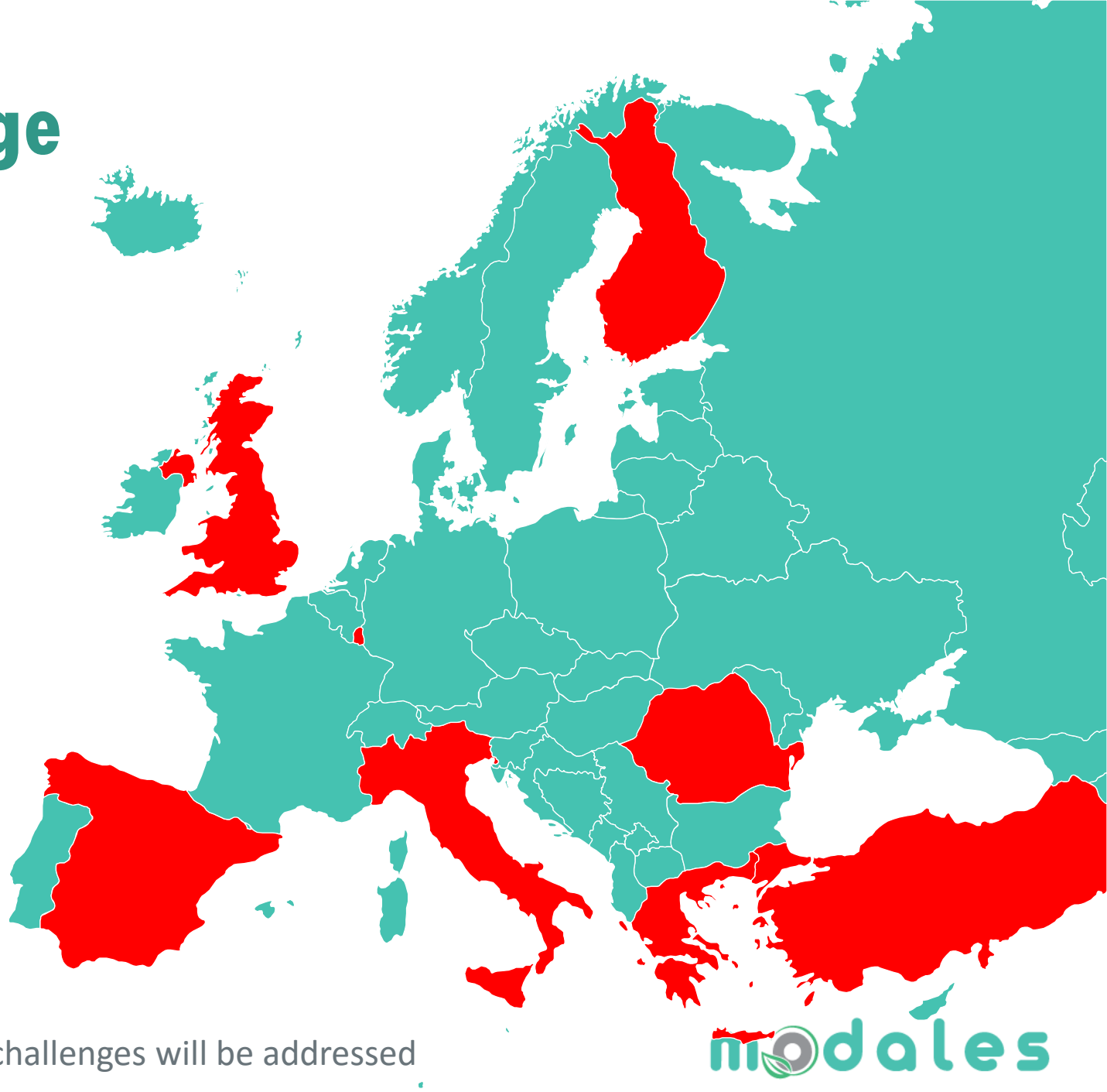
4. Brake and tyre emissions

Geographical coverage

Pilot-sites will be launched
and trainings will take place in:

- Leeds, UK
- Helsinki, FI
- Luxembourg, LU
- Barcelona, ES
- Bergamo, IT
- Thessaloniki, GR
- Istanbul, TR
- Bucharest, RO*
- Nanjing, CN*

* testing of app only



Language challenges will be addressed

Next steps

- Train the trainer manual to be finalised
- Videos for virtual trainings will be developed
- Certification for pilot participants by MODALES – incentive for drivers
  - Pre and post - training evaluation on low-emission background and progress
- Exploitation plan for the training

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Thank you

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Adapting driver behaviour
for lower emissions

Mobile Assistant for Low-Emission Driving

Mid-term results on the road to low emissions, 28 May 2021

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Luxembourg Institute of Science and Technology (LIST)

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

Introduction to in-vehicle data collection and standards: a complex situation!

OSI Layer			CAN			Passenger Cars			Trucks and Bus		Tractor with Trailers	
						UDS	OBD	WWH-OBD	J1939			
7	Application Layer					ISO 14229-1 ISO 14229-3	ISO 15031-5 / SAE J1979	ISO 27145-3	SAE J1939-71 SAE J1939-73	SAE J1939-01 SAE J1939-81	ISO 11992-4	ISO 11992-2 ISO 11992-3
6	Presentation Layer						ISO 15031-2 / SAE J1930-DA ISO 15031-5 / SAE J1979-DA ISO 15031-6 / SAE J2012-DA	ISO 27145-2 / SAE J2012-DA	SAE J1939-DA (SPN) SAE J1939 Appendix C (SPN) SAE J1939-73 Appendix A (FMI)			
5	Session Layer					ISO 14229-2					ISO 14229-2	
4	Transport Layer					ISO 15765-2		ISO 27145-4			ISO 15765-2	
3	Network Layer								SAE J1939-31			
2	Datalink Layer	LCC - Logical Link Control MAC - Medium Access Control	CAN Controller	ISO 11898-1		ISO 15765-4			SAE J1939-21		ISO 11898-1	
1	Physical Layer	PLS - Physical Media Signaling										
		PMA - Physical Medium Attachment	CAN Transceiver	ISO 11898-2 ISO 11898-3 *ISO 11898-4* *ISO 11898-5* *ISO 11898-6*	*SAE J2284-1* *SAE J2284-2* *SAE J2284-3* *SAE J2284-4* *SAE J2284-4*				SAE J1939-11 SAE J1939-12 SAE J1939-14 SAE J1939-15		ISO 11992-1	
		PMS - Physical Medium Specification	CAN BUS Medium									
		MDI - Medium Dependent Interface	CAN Bus Connector									

*Download the complete report (D2.2 – Real effectiveness of OBD inspection and maintenance, and retrofits) on **modales-project.eu**.*

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Relevant data to be accessed via OBD

- VIN
- Gear
- Gas pedal
- Brake pedal
- Steering wheel
- Speed
- RPM
- Acceleration
- Torque
- Engine power
- Fuel consumption
- Mass Air flow
- Air pressure
- Temperature
- NOx
- Trouble codes

The role of OBD in MODALES

Process in MODALES:

- Identifying **brands** and **models** of OBD dongles in the market (as of July 2020)
- Identifying **characteristics** of OBD dongles
- Development of a **competitive matrix**
- Defining of a list of **selection criteria**
- Initial **testing** of dongles
- Specification of **minimum requirements** of dongles for the experimental phase (WP6)

Minimum requirements identified:

- J1962M Connector for light vehicles
- Support **all OBD-II protocols** (including EOBD) and J1939
- Interface: **Bluetooth**
  - Physical pairing button
  - At least 128-bit data encryption
  - Minimum Class 2 Bluetooth v3.0 transmission
  - Profiles: SPP, iAP2
  - Support for iOS and Android
- Standby current < 2 mA
- **Environmental working conditions** -20°C to 55°C at a humidity of 10% to 85% (non-condensing)
- **100 PIDs/second**
- **Certifications**: RoHS, REACH, CE (ETSI EN 300 328 V1.8.1 (2012-06)), E, Mark ECE R10, EN 60950-1
- AT and ST command set.
- Genuine products that can prove the source of the OBD interface chip.

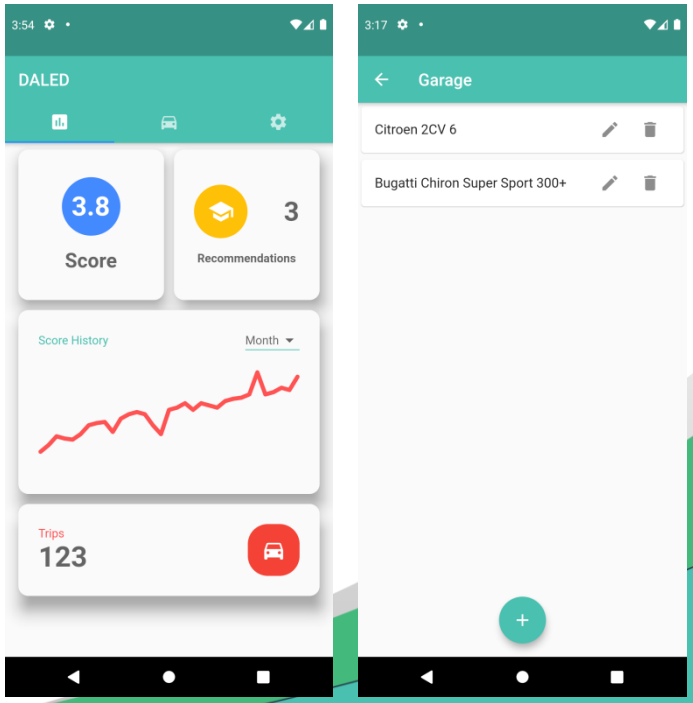
A mobile app, you said?

Mobile analytics to understand, assess and guide user's driving choices:

- Module 1 – In-vehicle data collection from:
  - Smartphone sensors
  - OBD dongles
- Module 2 – Data interpretation:
  - On-device artificial intelligence techniques will be preferred
  - Privacy-friendly approach
- Module 3 – Recommendations
  - Game-based training will be considered
  - A central dashboard will be set up to retrieve anonymized statistics

Flutter

(mock-ups)



- All these modules will be made available to the users through a **mobile app developed for both Android and iOS**.
- Release date (expected): **09/2021**.

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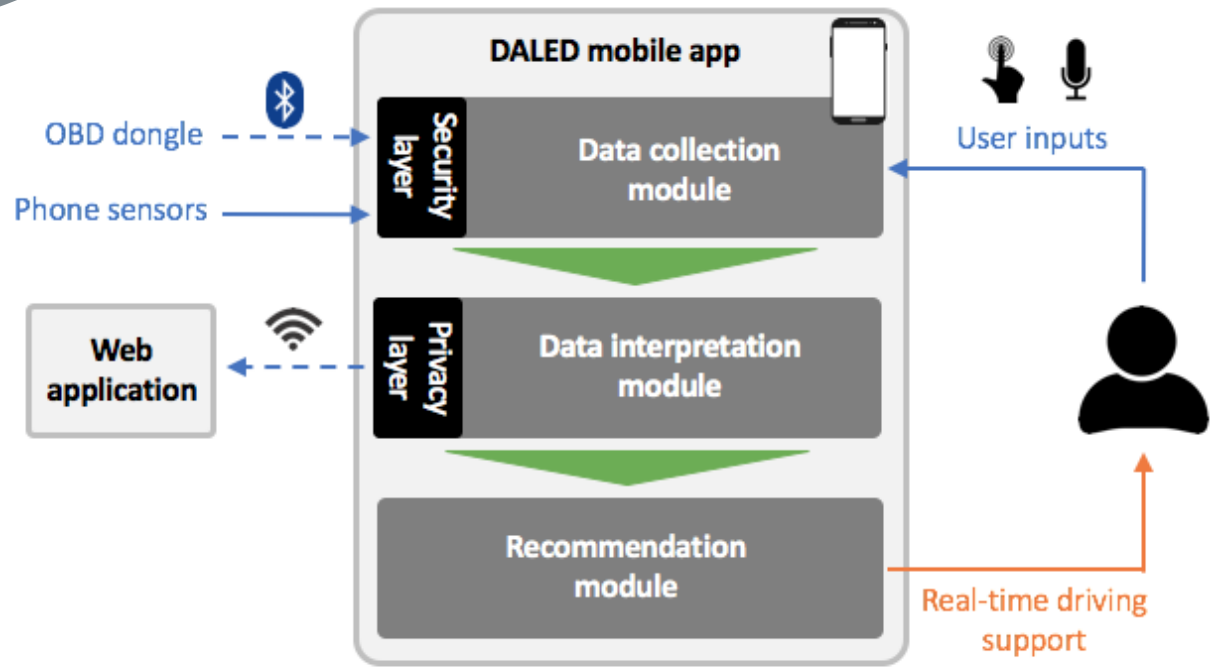
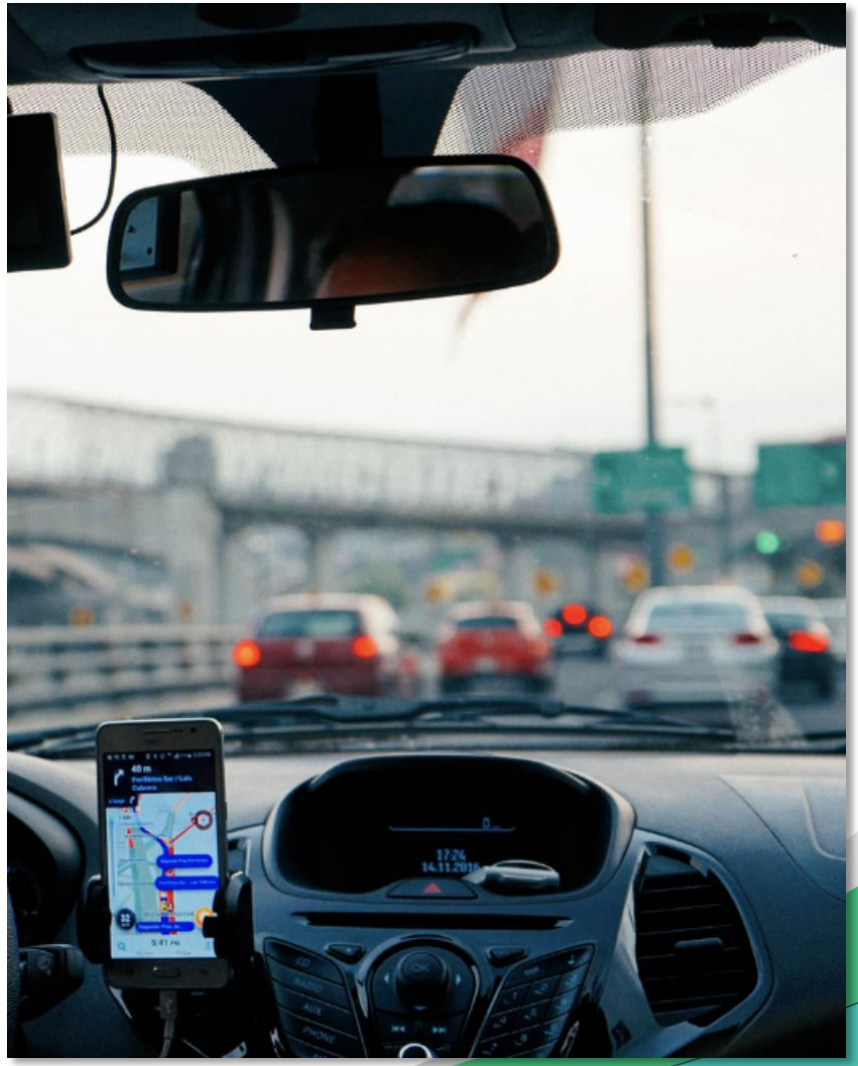
High-level interaction diagram



Focus on recommendations

The app will create two types of recommendations:

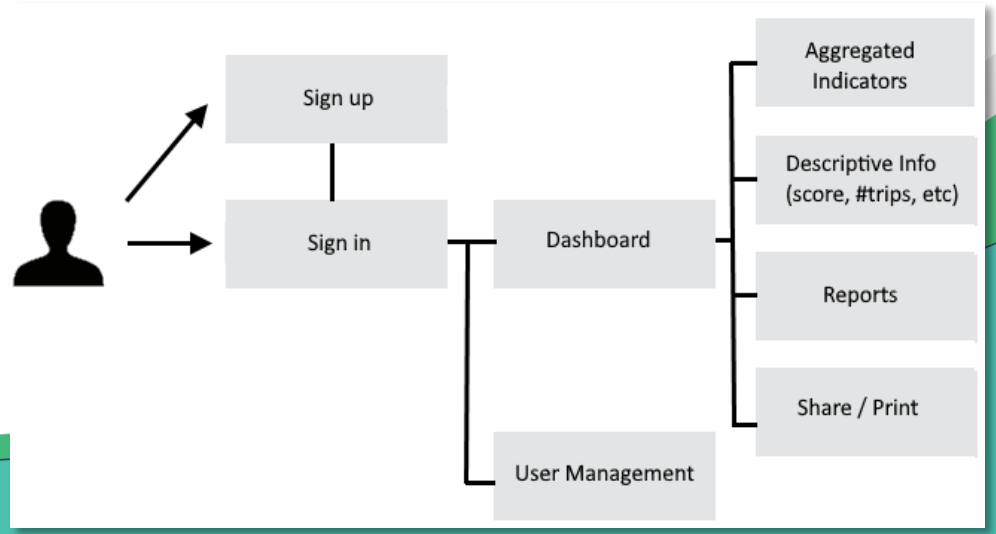
- Active recommendations:
  - When the user is driving
  - Research prototype → simplified recommendations and HMI, using only the phone sensors
- Passive recommendations:
  - After a trip
  - Complete report, using the phone sensors, OBD data and external web services (e.g., weather, traffic index)



Web dashboard

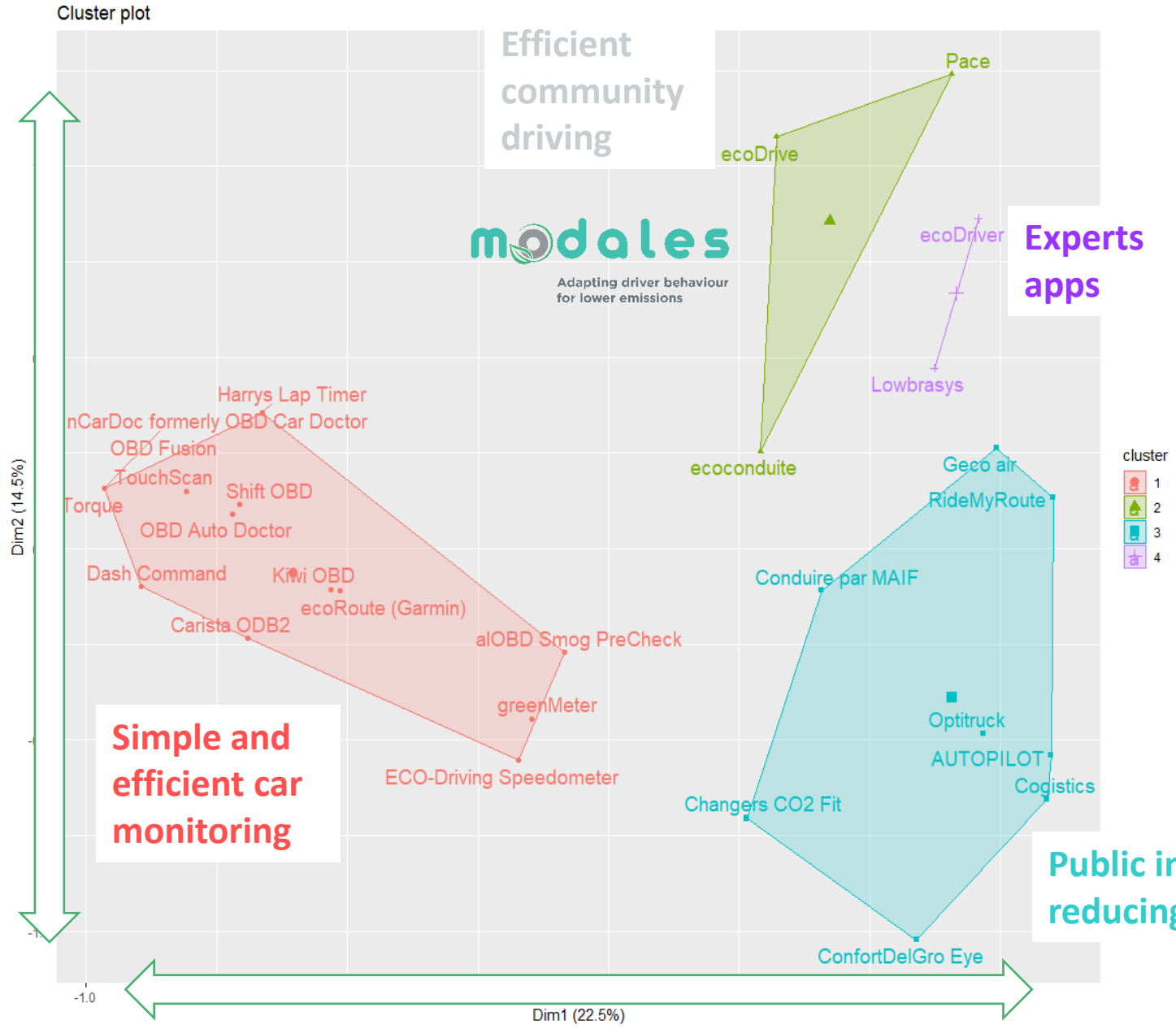
The web dashboard will provide to local authorities:

- Descriptive information about the number of trips, driving score
- Aggregated indicators:
  - For the general fleet population (for example average NOx emissions),
  - For each trial site; for all trial sites (Vehicle emissions, Fuel Consumption),
  - Vehicle emissions vs vehicle type
  - Vehicle emissions vs road type (urban, highway, etc)
  - Vehicle emissions vs user profile (e.g., age, gender)



What's the novelty?

26 Apps selected for analysis



Good level of service

Low level of service

Commercialized apps
Low level of user feedback
Low sensing capabilities

Public-funded apps
Good level of user feedback
Good sensing capabilities

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Demo

Dr. Ramiro Camino

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LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 815189.

Adapting driver behaviour
for lower emissions

On-road trials with real users

MODALES Mid-term Event

28th may, 2021

Joan Domingo ACASA – RACC

MODALES Trial Sites

Barcelona

Bergamo

Helsinki

Istanbul

Leeds

Luxembourg

Thessaloniki

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Purpose of the on-road trials

- Validate capacity of MODALES App and Training to change user driving behaviour
  - Identify user groups in which MODALES had most of the impact
  - Test user acceptance of the MODALES App and Training

- Quantify the MODALES impact on reducing vehicle induced emissions from driving

Methodology and Planning of the on-road trials

- User recruitment
  - Selection questionnaire
  - User profile
    - All age groups
    - Man and women equally (if possible)
    - Different levels of experience
    - Different driving routines (rural areas, urban areas, motorways)
  - Cars preferred
    - All cars are accepted
    - Cars Euro 3, 4 and 5 and preferred. Euro6 also accepted.
    - All types of fuel are accepted
  - Data Privacy management
    - Consent forms
    - Local data management officers
    - Anonymised data: Only local partner will know the identity of the user

Methodology and Planning of the on-road trials

- Data collection tools
  - MODALES App as data collection module
  - OBD Dongles provided to users
  - Questionnaires to users
    - Selection Questionnaire
    - Base-line questionnaire
    - Final Evaluation questionnaire
  - Communication channels with local partner
    - Reporting of problems, questions, comments, etc.

Activities within the User trials

1: Ramp up (on-going: April-May 2021)

- Only in Barcelona and Luxembourg
- 9 participants recruited in Barcelona and 10 in Luxembourg
- The App working as collection module only
- Equipment:
  - MODALES App: as data collection module (no recommendations sent to users)
  - OBD: Some participants in Luxembourg are using OBD dongle + App
- Purpose:
  - Testing the App and get user feedback before the main release
  - Testing the App's collecting data capacities
  - Testing the user recruitment process, questionnaires and consent forms designed for the large-scale trials
  - Validation of data flow processes form local privacy data management officers

Activities within the User trials

2: Large-Scale user trials (from July to end of 2021)

- All trials sites will participate
- About 30 passenger cars per site are expected to be recruited
- Users participating in the ramp-up can participate in that activity if they wish
- Professional drivers will be included in all trial sites
  - Taxis
  - LDV
  - HDV
- Two phases to compare driving profiles:
  - The base-line
  - Trials with the App and training

3: Data analysis (from January to May 2022)

Large –scale user trials phases

Phase 1: Base-line

- Equipment:
  - All participants will use the App as collection module only
  - Users will use an OBD Dongle in all test sites
- Purpose:
  - Analyse user’s driving profile when do not receive any recommendation related to their driving

Large –scale user trials phases

Phase 2: Trials with the App + Training

- The users have to be the same than the base line
- Equipment:
  - All participants will use the App as collection module only
  - Users will use an OBD Dongle in all test sites
  - The App will incorporate feedback to drivers
    - Active recommendations while driving
    - Passive recommendations
  - Users will receive training developed by MODALES
- Purpose:
  - Analyse each user's driving profile when users are receiving training and recommendations on their driving profile
  - Be able to compare how the same users changed its driving profile compared to the base-lien

Participation in the on-road trials

What's in it for your company?

- Training and driver support for your drivers
- Data on driving behaviour (before and after training and app) from your drivers
- Benefit from the results of our trials: what are the lessons learnt and quick wins to reduce emissions while driving?
- Promote safer, less polluting and more fuel-efficient driving among your employees.
- Recognition of your company's participation (logo, news article) on the MODALES website (http://modales-project.eu) and other media
  - Your local partner media
  - ERTICO Newsroom (news on Intelligent Transport Systems in Europe: https://erticonetwork.com)
  - Project presentations in online and physical events.
- You will also be showing your company's green credentials by supporting this important European research activity.

Contact joan.domingo@racc.es

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Thank you

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