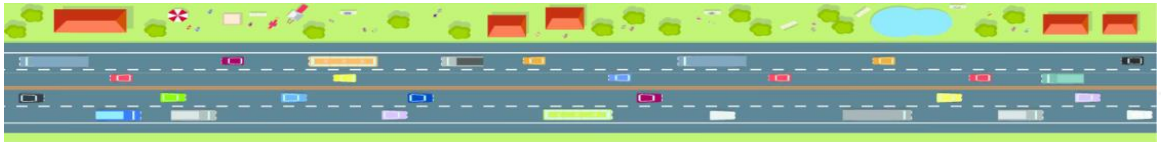

A MODELLING CHAIN FOR ESTABLISHING A LOW EMISSION CORRIDOR THROUGH THE ALPS

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University of Trento - Department of Civil, Environmental and Mechanical Engineering, Italy

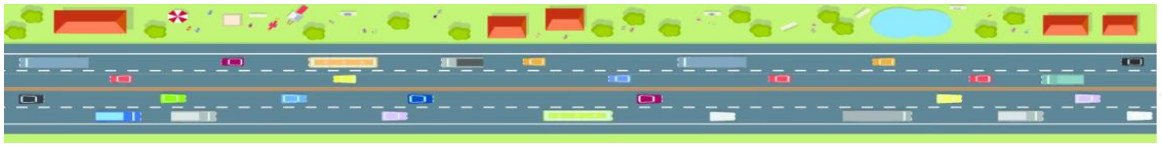
Ilaria Todeschini, Gianluca Antonacci

Cisma SRL, Italy

Roberto Cavaliere

NOI Techpark Südtirol/Alto Adige, Italy

HARMO20 conference, 14-18 June 2021, Tartu, Estonia



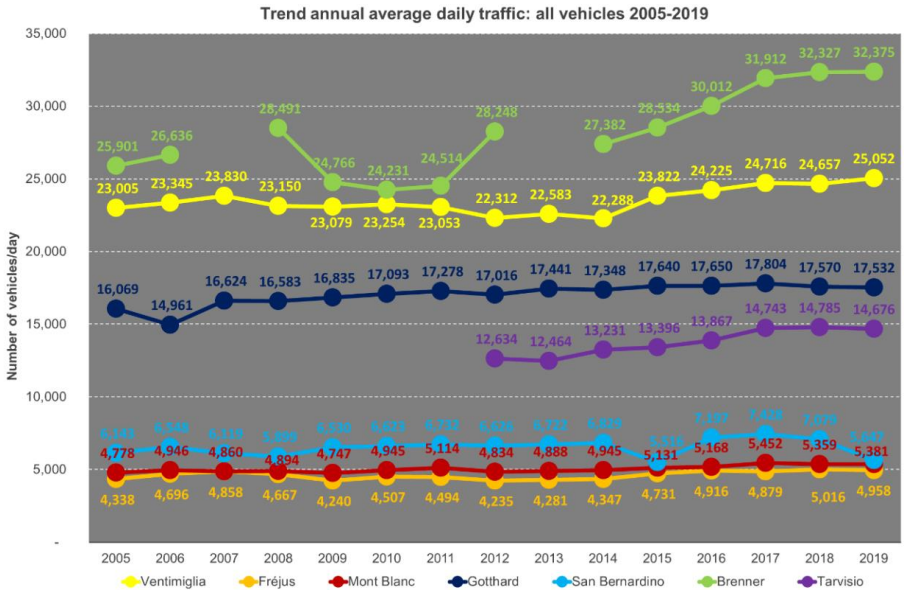
THE «BRENNER LOWER EMISSIONS CORRIDOR» PROJECT

To develop a **«Low Emissions Corridor»** concept to be applied to the Brenner highway (A22) by means of the experimental and scientific study of an integrated set of dynamic policies (i.e., **variable speed limits**) to manage traffic on the basis of a proactive environmental strategy.

1. Speed reduction to increase the motorway capacity
2. **Speed reduction to improve air quality**
3. Joint management of traffic between traffic control centers to minimize the impact of traffic both on urban areas and on the motorway

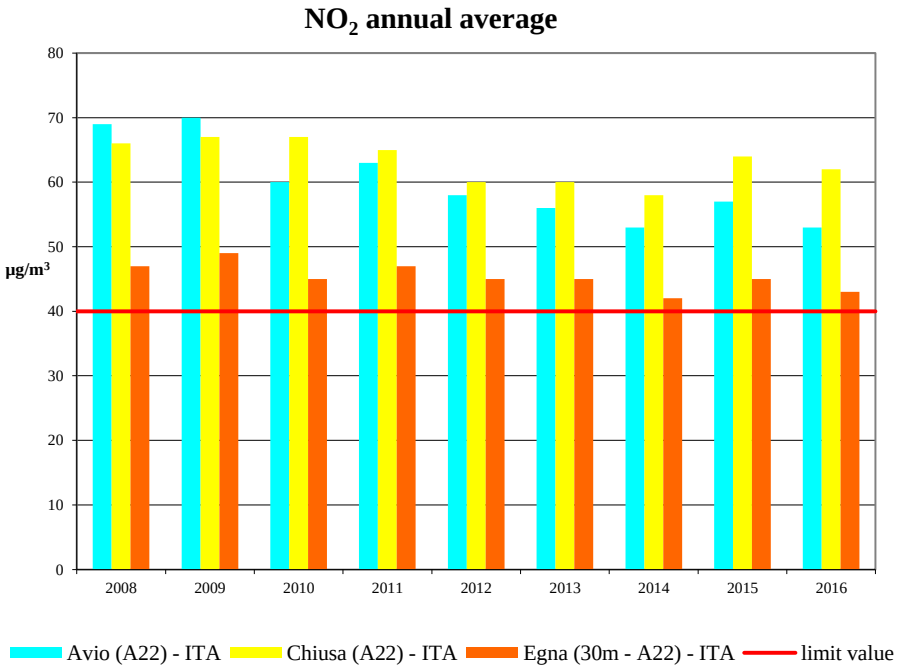
MOTIVATION

High volumes of traffic

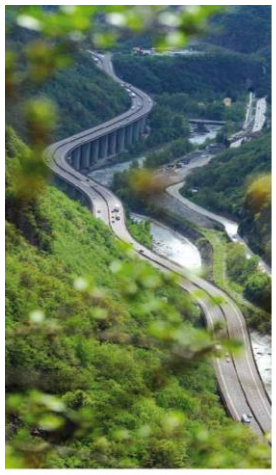


IMONITRAF! Annual Report 2020

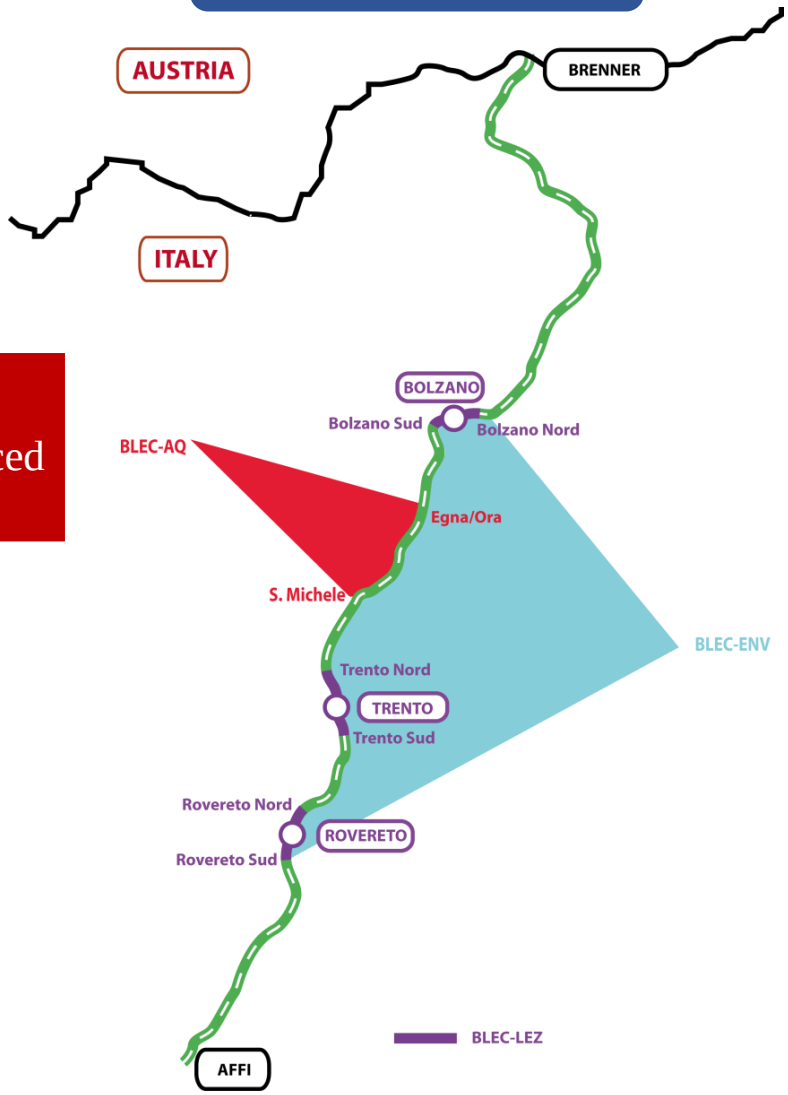
Environmental concern



PROJECT AREA: TRENTINO-ALTO ADIGE REGION



PROJECT AREA



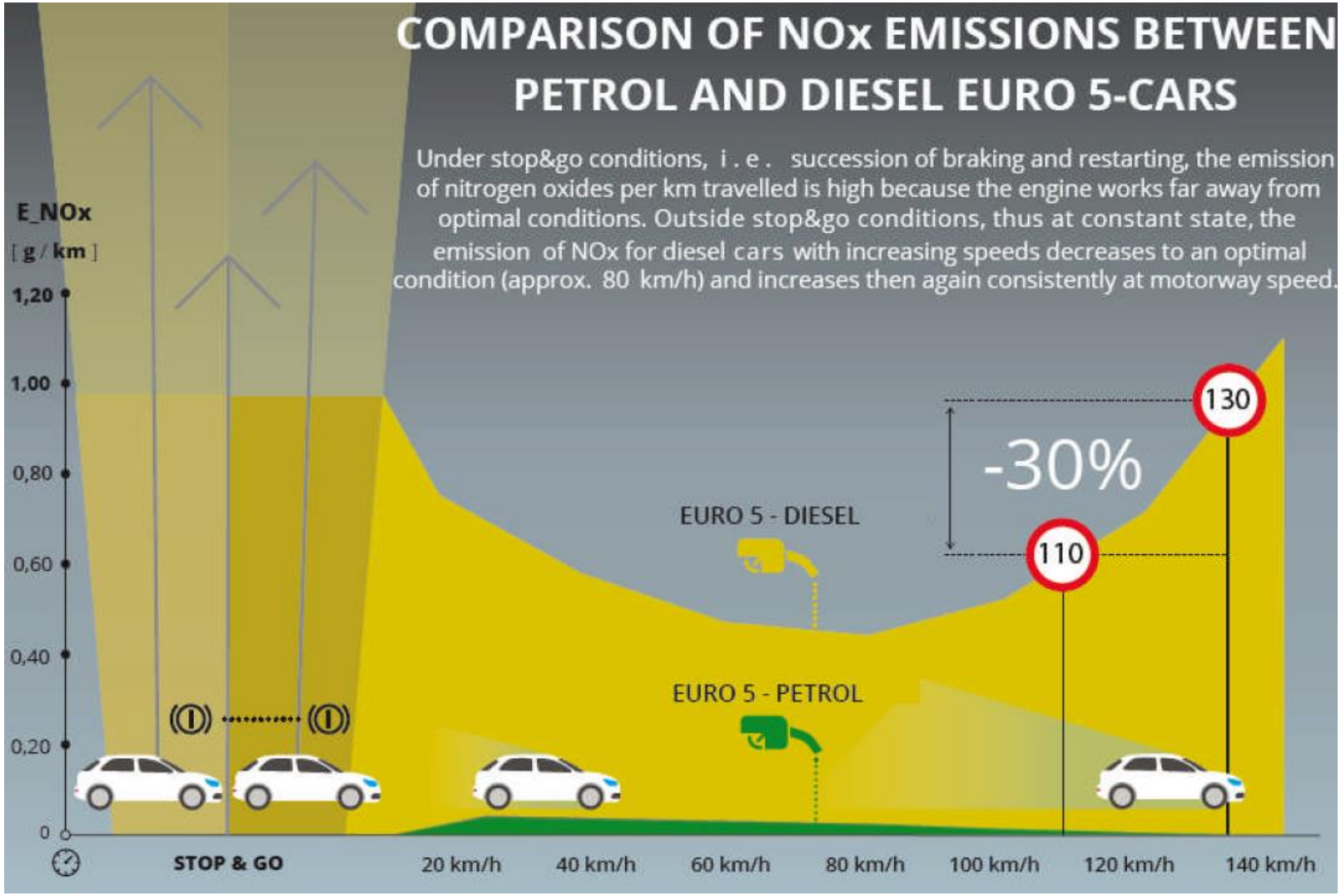
Approx. 12 km

Dynamic air pollution-induced policies calibration

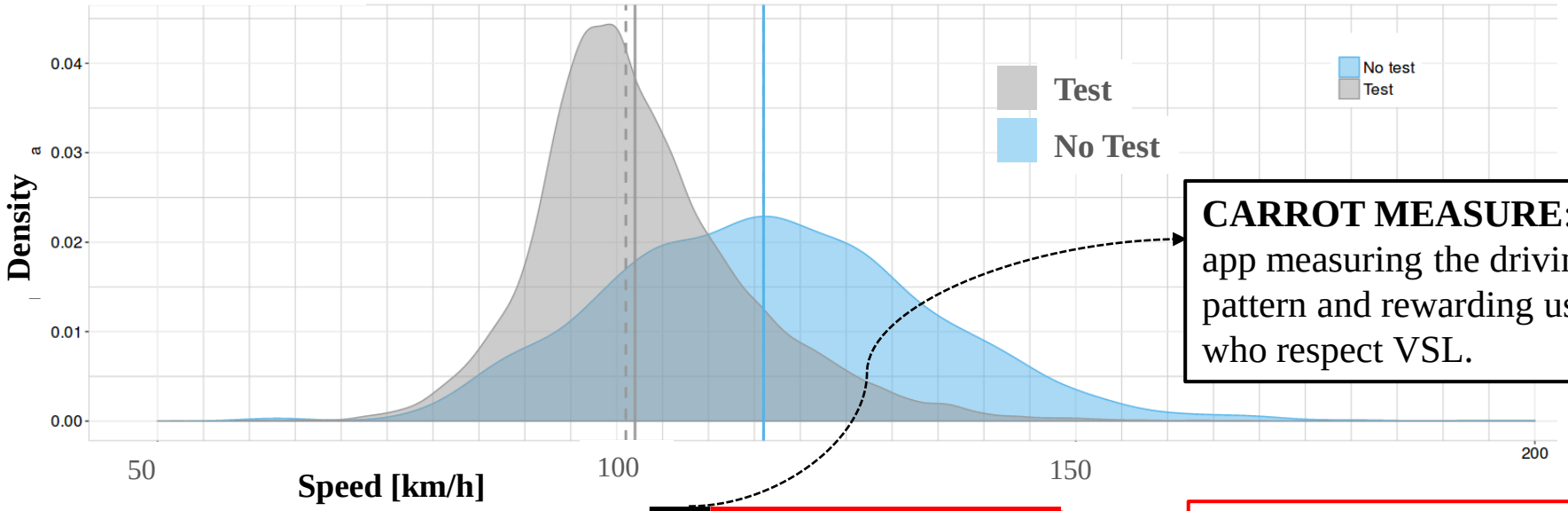
Approx. 90 km

Dynamic traffic-induced policies calibration

SPEED AND EMISSION



DRIVERS' RESPONSE



CARROT MEASURE: app measuring the driving pattern and rewarding users who respect VSL.

STICK MEASURE: enforcement systems (section control).

"Potentially persuadable" drivers

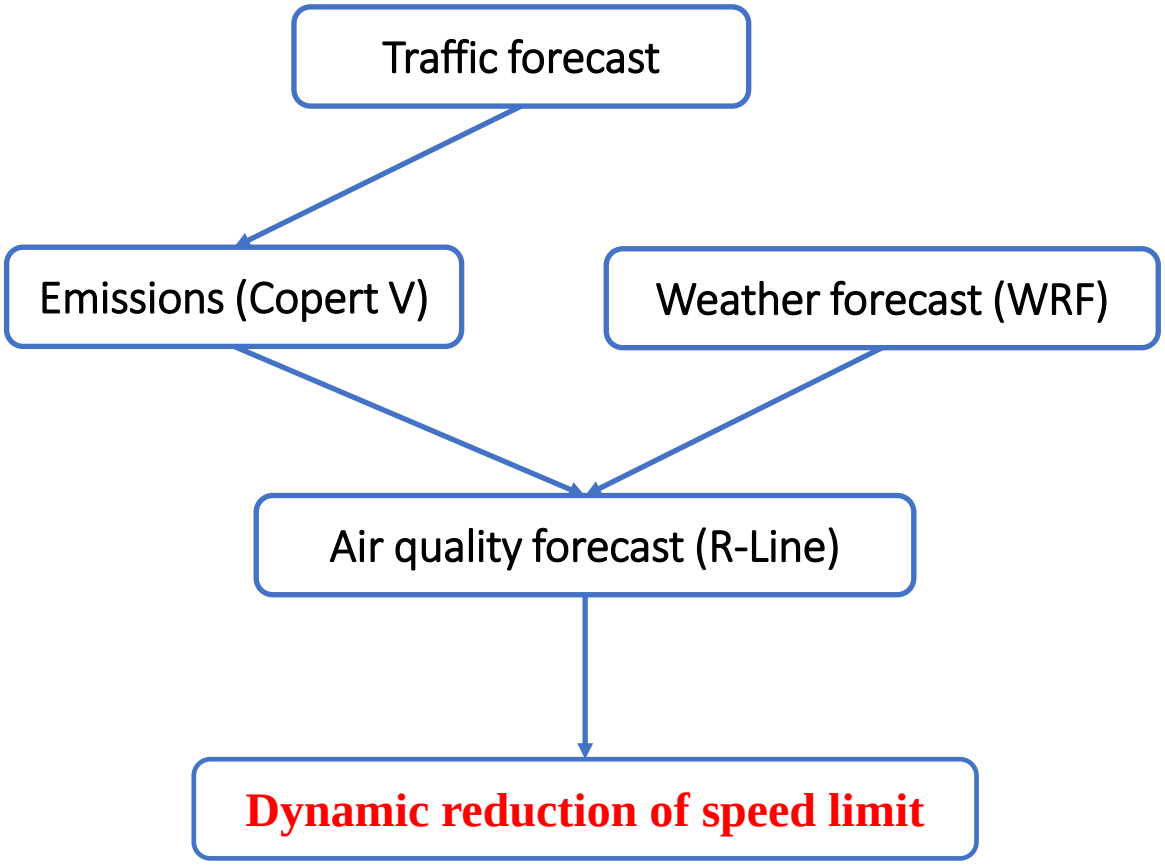
"Unpersuadable drivers"

Issue: VSL for air quality reasons (still) not allowed in Italy….

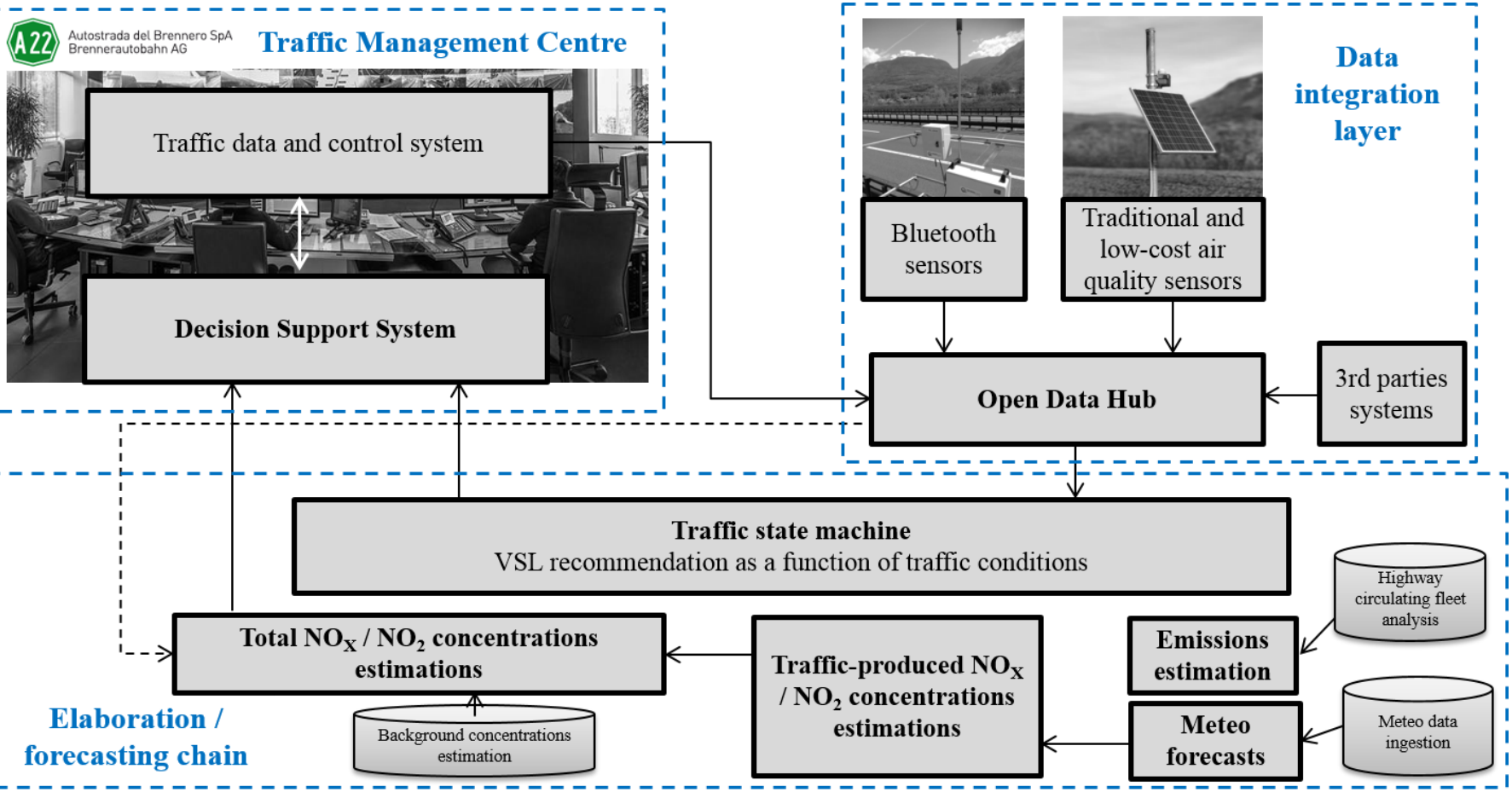
Compulsory

Recommended

FORECASTING CHAIN

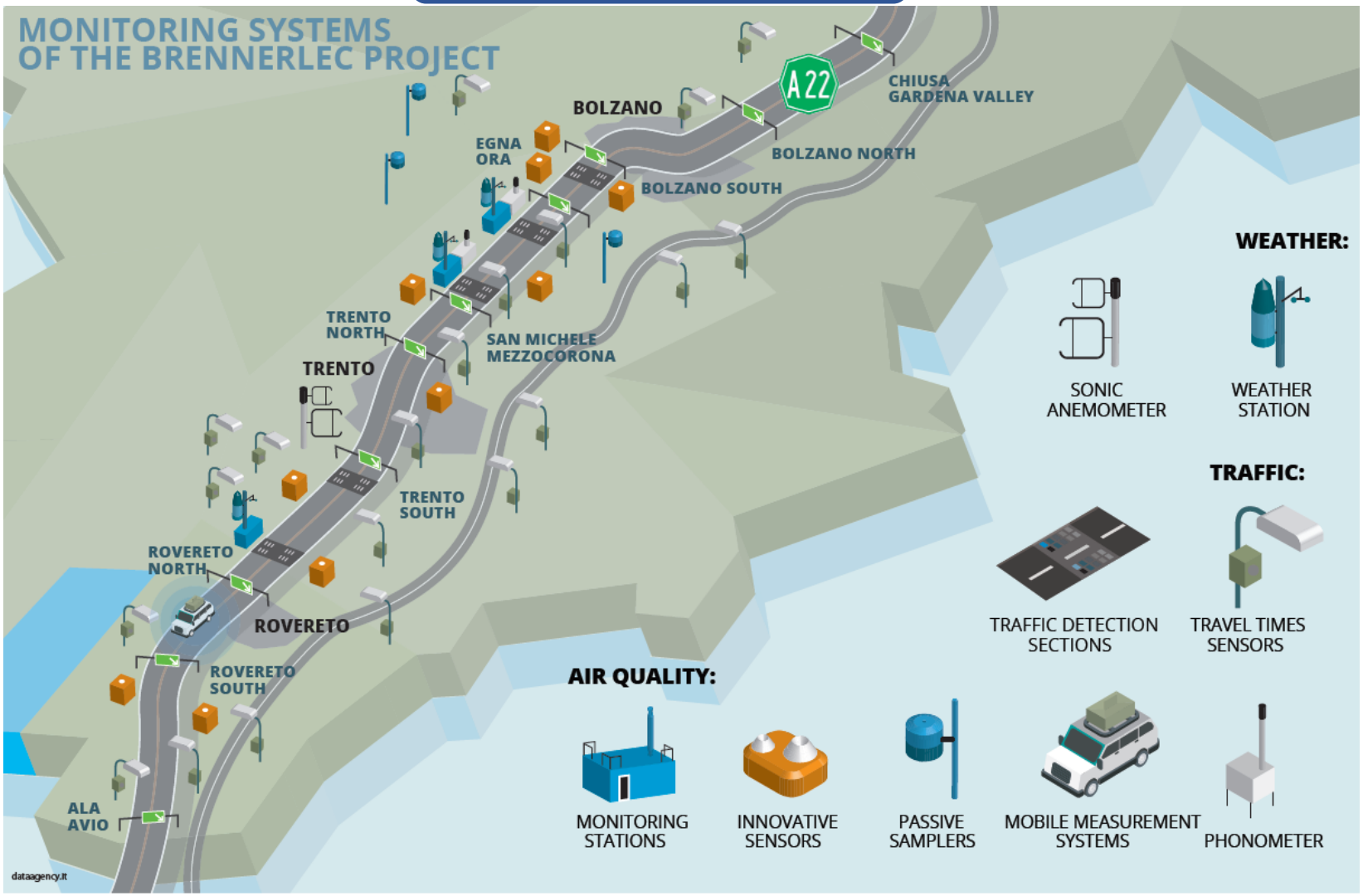


CENTRAL DATA MANAGEMENT SYSTEM AND REAL-TIME APPLICATION

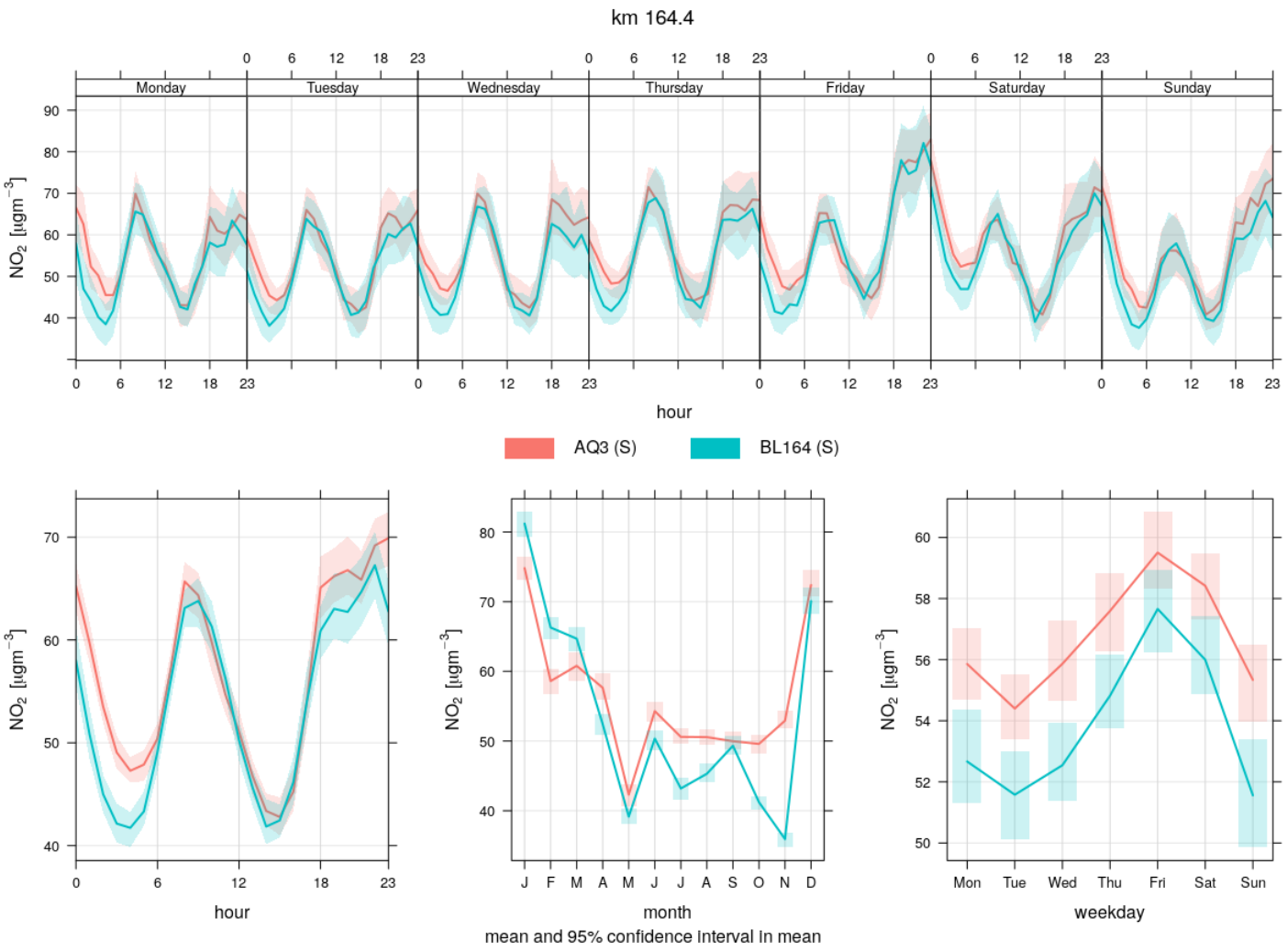


The activation of the VSLs must be proportioned to the effective impact that they may generate!

MONITORING SYSTEM



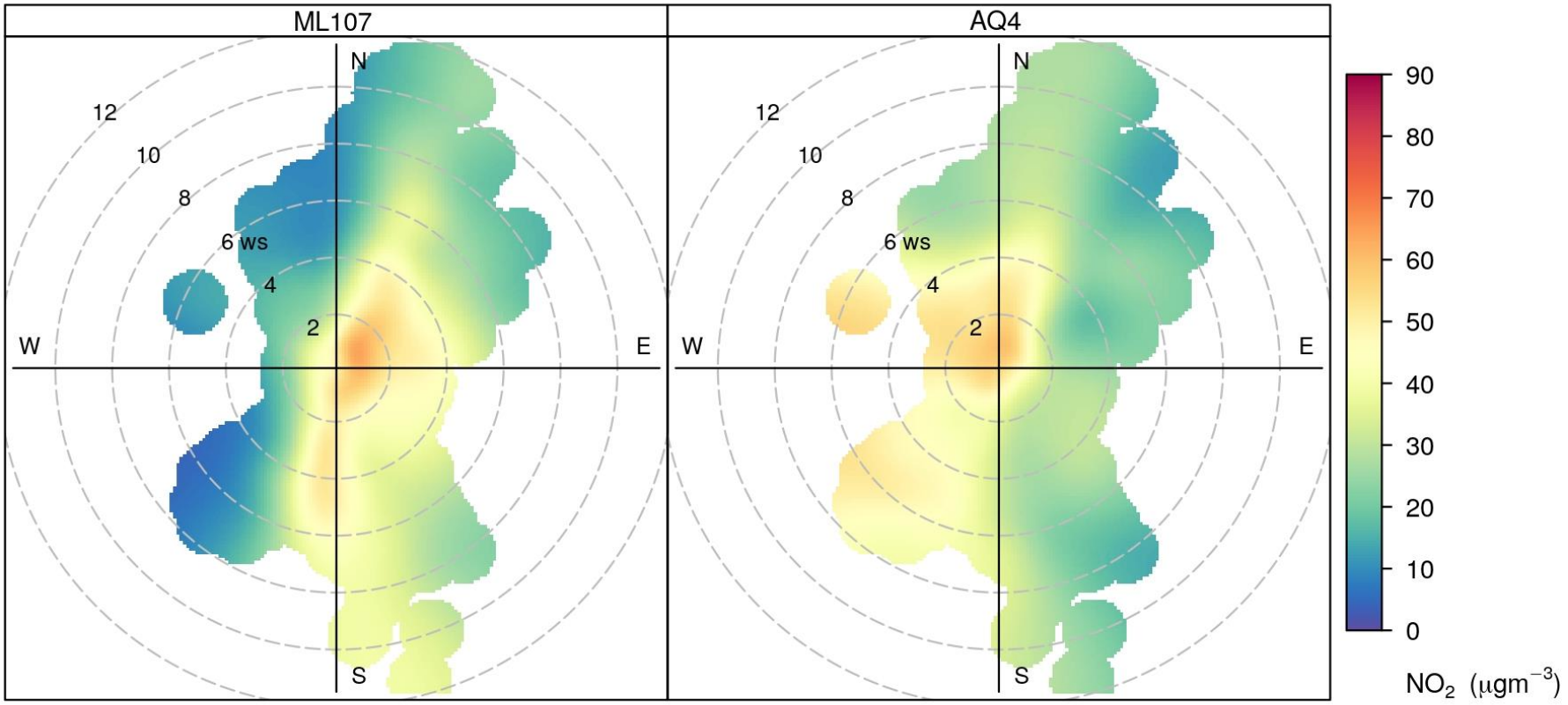
LOW-COST SENSORS



LOW-COST SENSORS

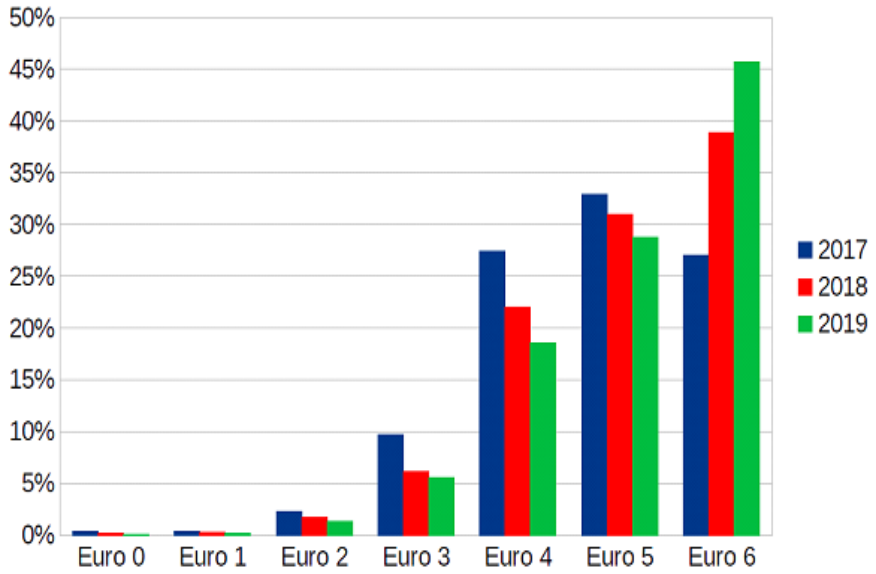
South carriageway

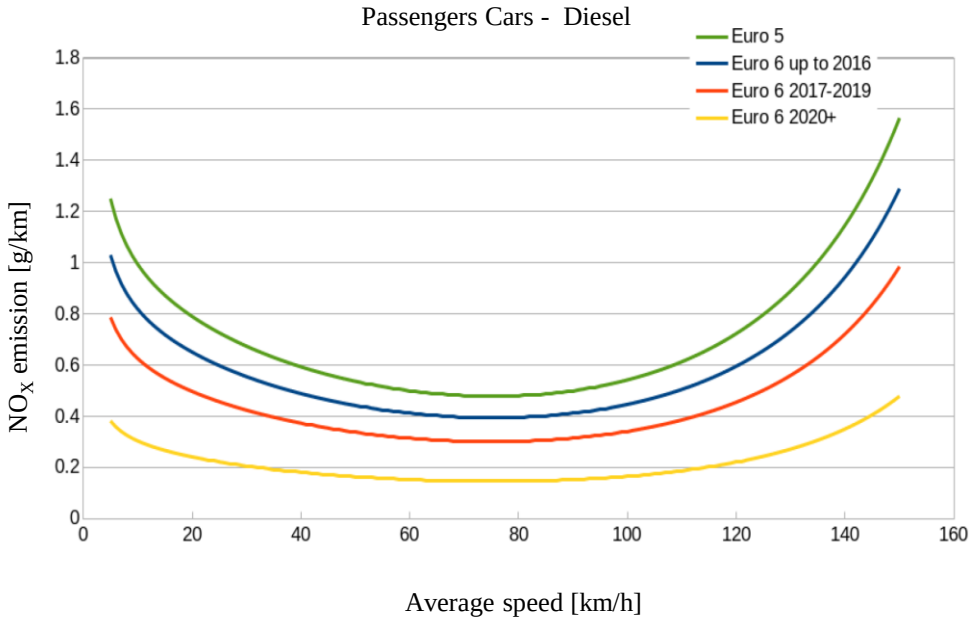
North carriageway



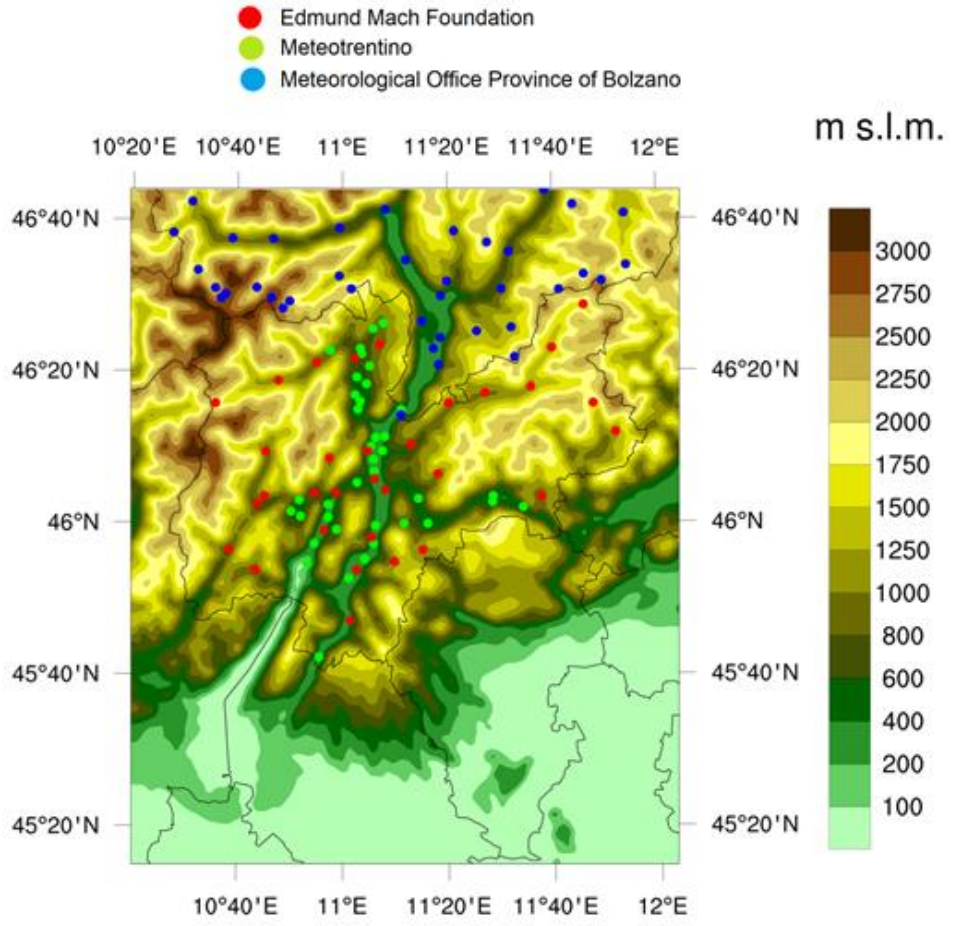
ESTIMATION OF POLLUTANTS EMISSIONS FROM TRAFFIC

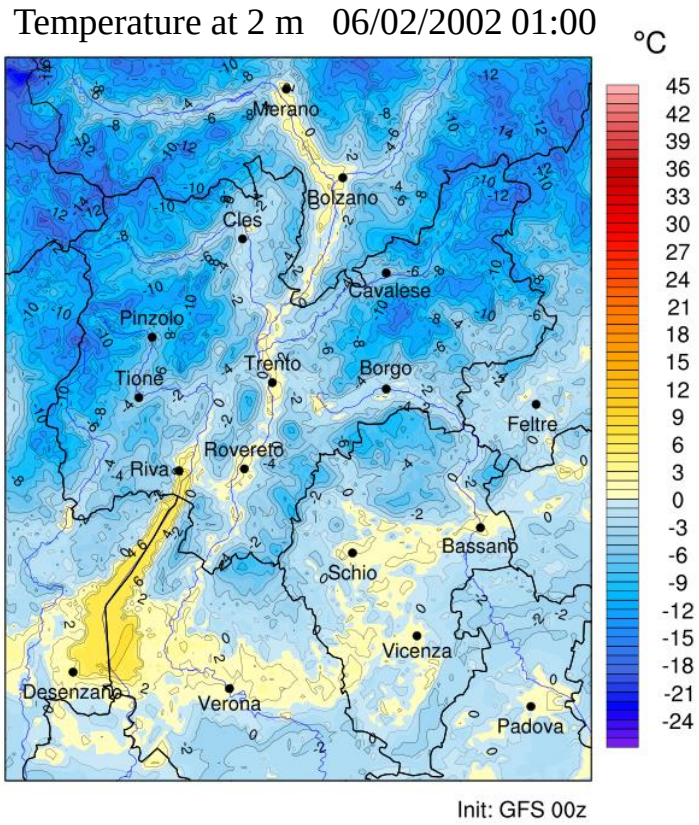
- The **estimation of effective circulating fleet** on the A22 highway is based on a comprehensive data-driven analysis.
- The **estimation of traffic volumes and traffic behaviour** is based on the analysis of historical data, collected from different inductive loops located inside the test stretch.



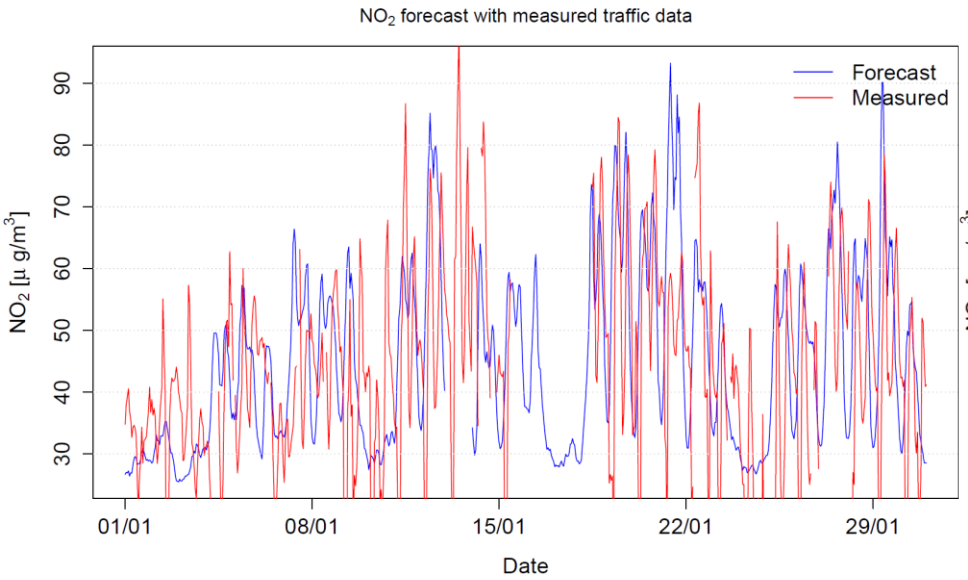


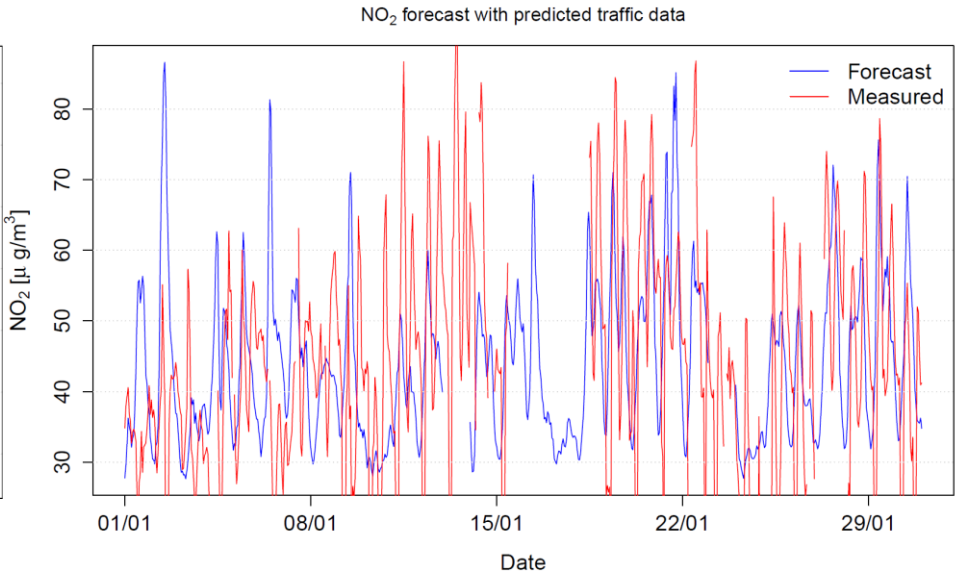
METEOROLOGICAL FORECASTING





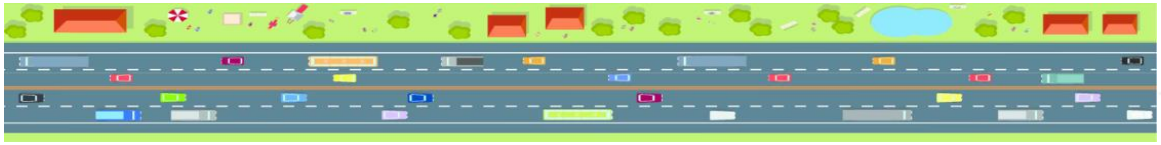
AIR QUALITY FORECASTING





The activation of VSLs is suggested to the TMC 24 hours in advance and is based on a comparison between concentrations' forecasts and a reference threshold.

VSLs are not activated if traffic volumes or NO_2 concentrations from sensors are significantly lower than the forecasts for a certain time (3 consecutive hours).



RESULTS: ENVIRONMENT BENEFITS IN TERMS OF NO_X CONCENTRATION

1470 hours of test: homogeneous distribution over seasons, days of the week, hours the of day.

Average reduction of speed: **14 km/h**

Speed reduction [km/h]	NO_2 concentration reduction [µg/m³]	NO concentration reduction [µg/m³]
0-5	-1.8	4.6
5-10	0.3	5.5
10-15	2.6	9.2
15-20	5.1	11.8
>20	4.7	7.1

Light vehicles per hour	NO_2 concentration reduction [µg/m³]	NO concentration reduction [µg/m³]
0-500	0.7	2.1
500-1000	2.3	8.5
1000-1500	4.0	8.3
1500-2000	6.9	15.8
2000-2500	5.8	18.2
2500-3000	6.1	18.0
> 3000	5.2	14.6

RESULTS: ENVIRONMENT BENEFITS IN TERMS OF NO_X CONCENTRATION

1470 hours of test: homogeneous distribution over seasons, days of the week, hours the of day.

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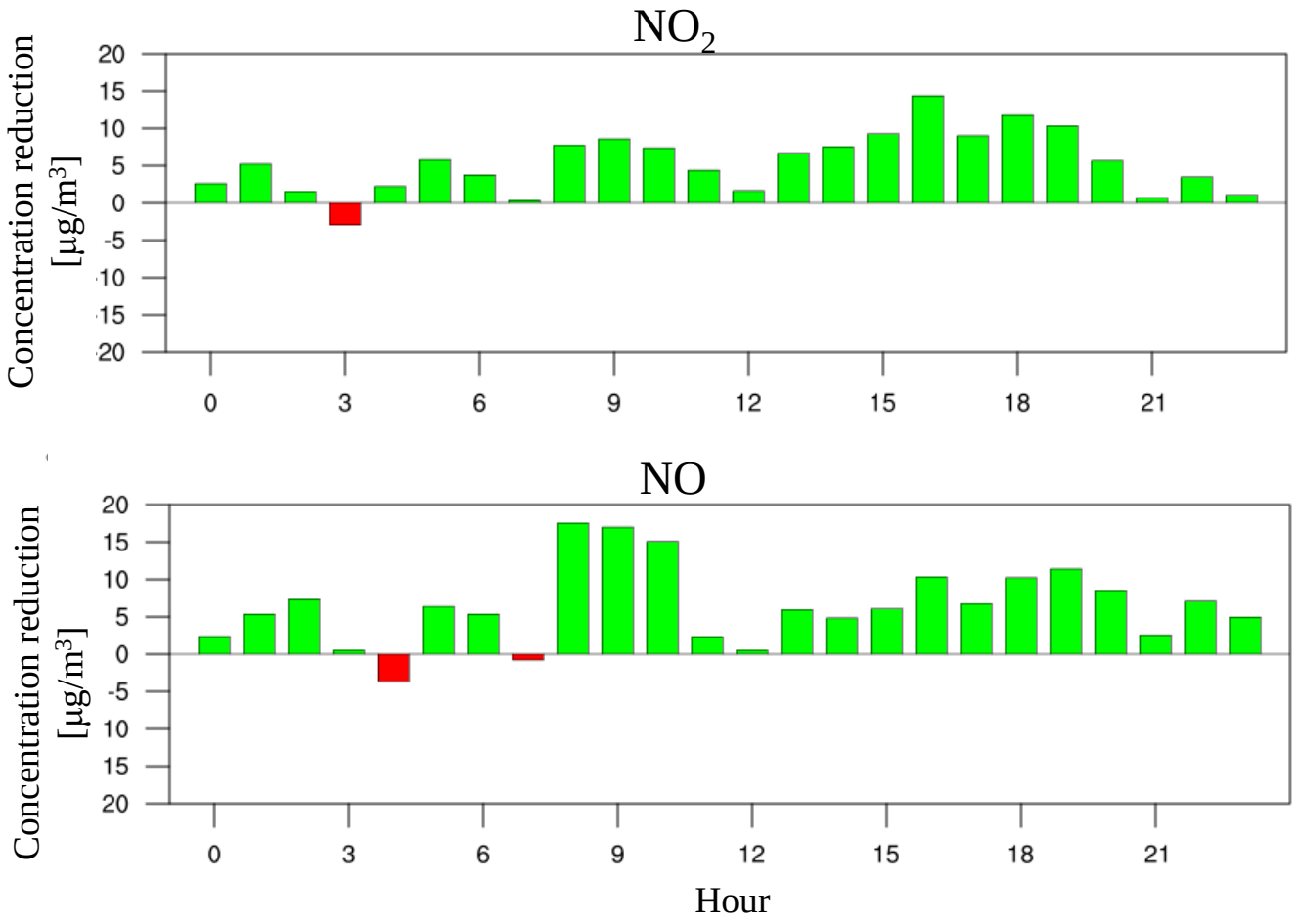
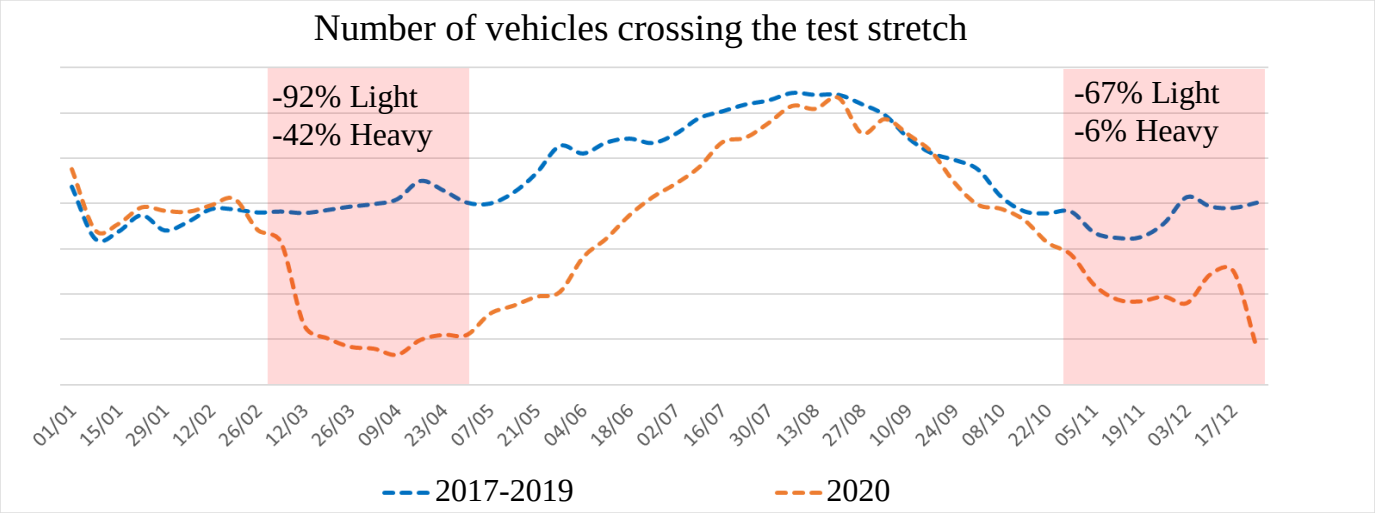
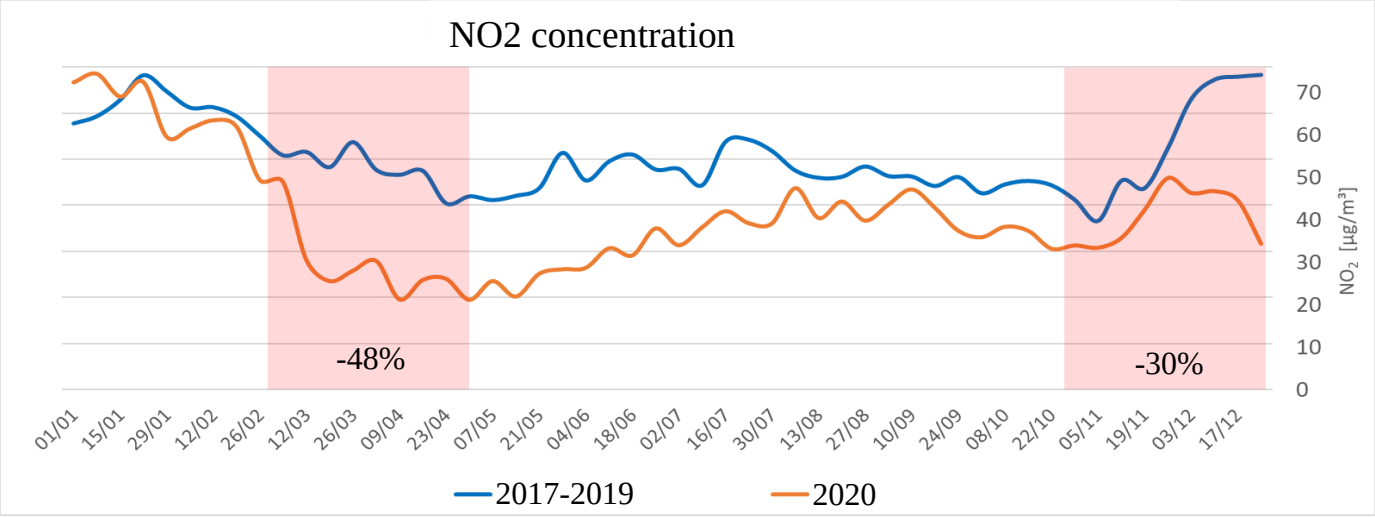
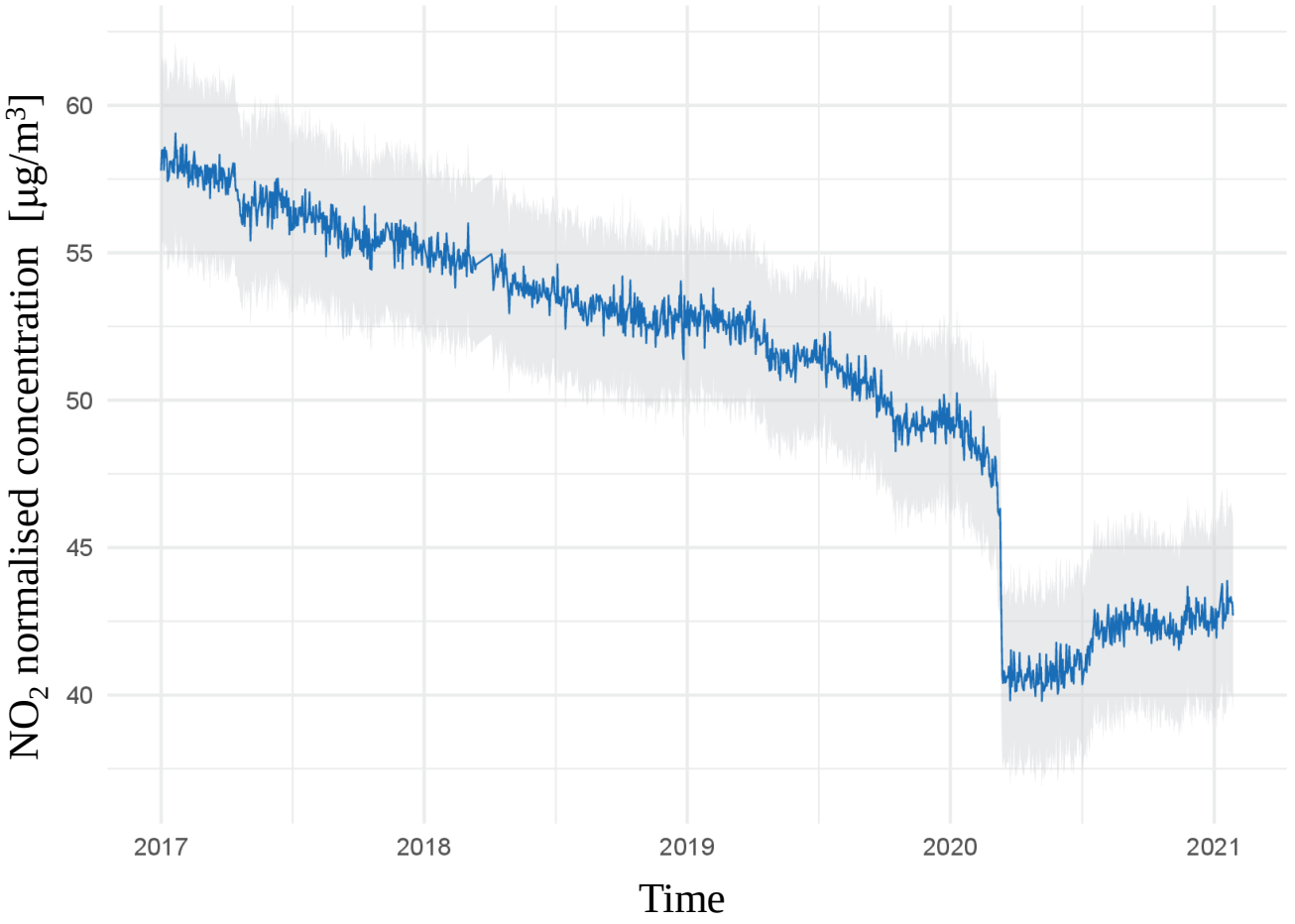


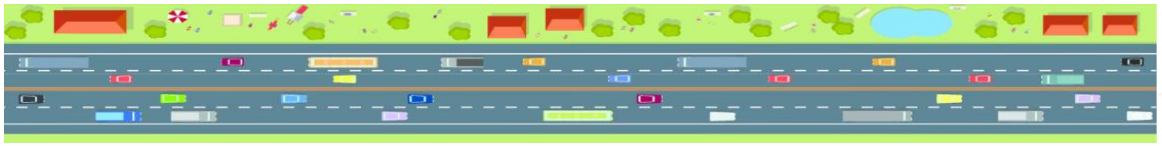
EFFECTS OF COVID-19 LOCKDOWN MEASURES





METEOROLOGICAL NORMALIZATION OF NO_2 CONCENTRATION





CONCLUSIONS

After an intense testing of VSL applications on the A22, it has been possible to collect solid evidences regarding the benefits of this kind of measure on traffic-related air pollution.

THANKS FOR THE ATTENTION!