

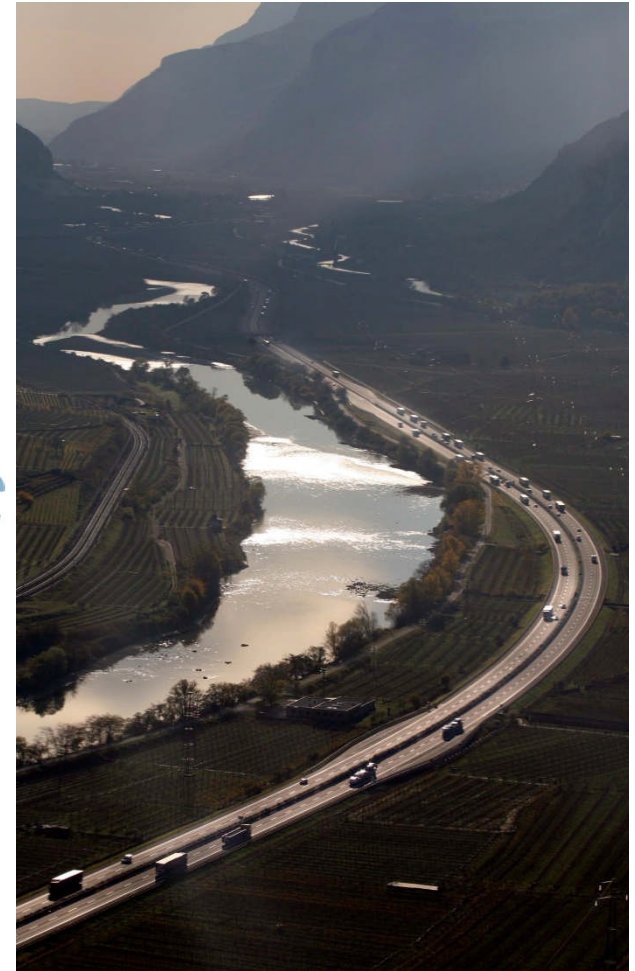
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10<sup>th</sup> September 2020



# The «Brenner Lower Emissions Corridor» project



Ilaria De Biasi  
Head of the European Projects  
Department



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ALTO ADIGE



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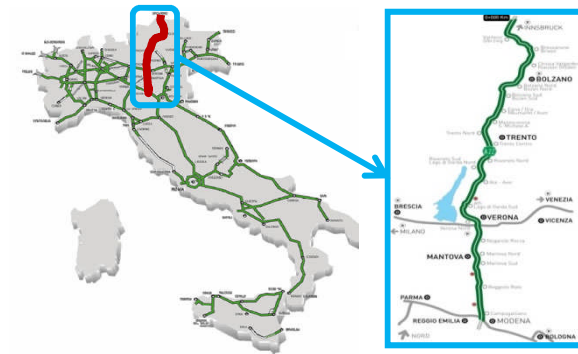


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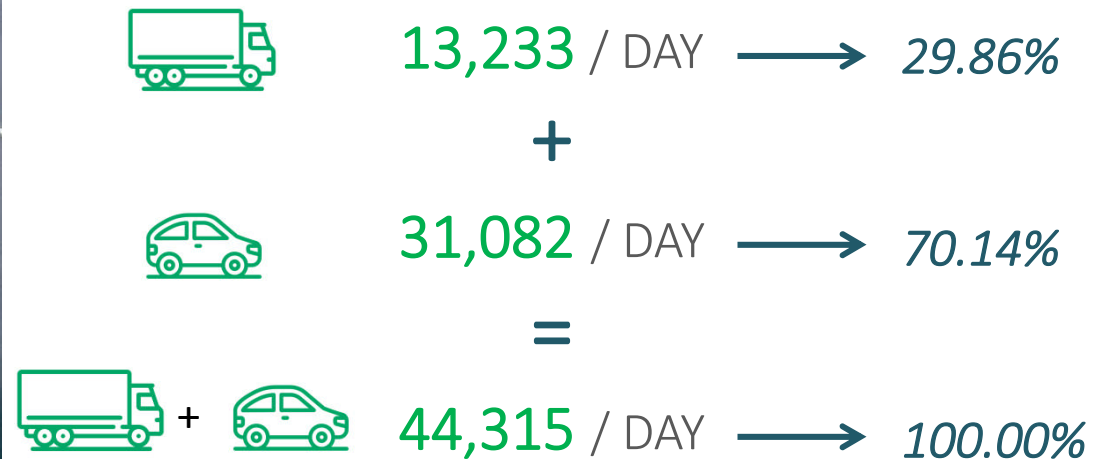
## THE BRENNER MOTORWAY (A22)

- 314 KM
- 1 TRAFFIC CONTROL CENTRE
- 23 TOLL GATES + 1 TOLL BARRIER
- 6 MAINTENANCE CENTRES
- 6 SERVICE CENTRES
- 22 SERVICE AREAS + 1 TRUCK PARK
- 147 OVERPASSES
- 30 MONODIRECTIONAL TUNNELS (12.6 km)
- 144 BRIDGES AND VIADUCTS (31.2 km)
- 139 OVERPASSES
- 427 LAY-BYS
- 84.1 KM OF NOISE BARRIERS
- 1056 EMPLOYEES





## AVERAGE DAILY THEORETICAL VEHICLES 2019



2019

2.44 million Heavy Goods Vehicles  
crossed the Brenner Pass



+ 1.6%

*compared to 2018*



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TECHPARK SÜDTIROL / ALTO ADIGE

## THE «BRENNER LOWER EMISSIONS CORRIDOR» PROJECT

Partner

A22 (coordinator)

APPA – Autonomous Province of  
Bolzano

APPA - Autonomous Province of Trento

University of Trento

CISMA

NOI Techpark



Duration

01.09.2016 – 30.04.2021

Overall budget

€ 4,018,005

Eligible budget

€ 3,311,365

LIFE co-funding

€ 1,922,772 (approx. 60% of the eligible budget)

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## MAIN OBJECTIVE

To develop and demonstrate  
a «**Low Emissions Corridor**» concept  
to be applied on the A22 motorway  
(in the future possibly along the entire  
*Kufstein – Affi corridor*)  
by means of  
an **integrated set of dynamic traffic control measures**  
(in particular **VSL** and **HSR**)  
to be activated on the basis of a  
**proactive logic**



# HOW?

Trying to obtain the  
maximum environmental  
benefits  
with the  
minimum inconvenience  
for travellers,

by

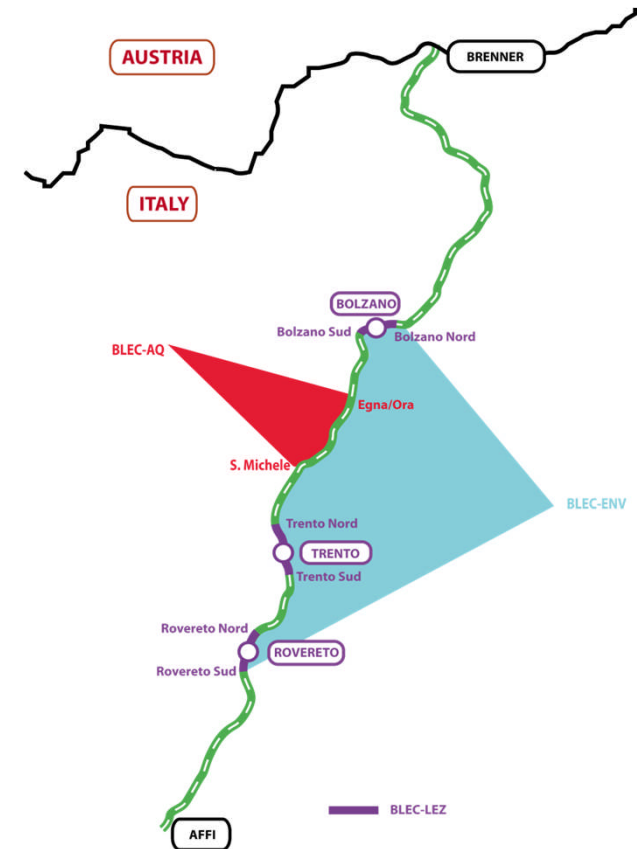
optimally using the  
infrastructure  
and granting under all  
conditions  
the highest safety level

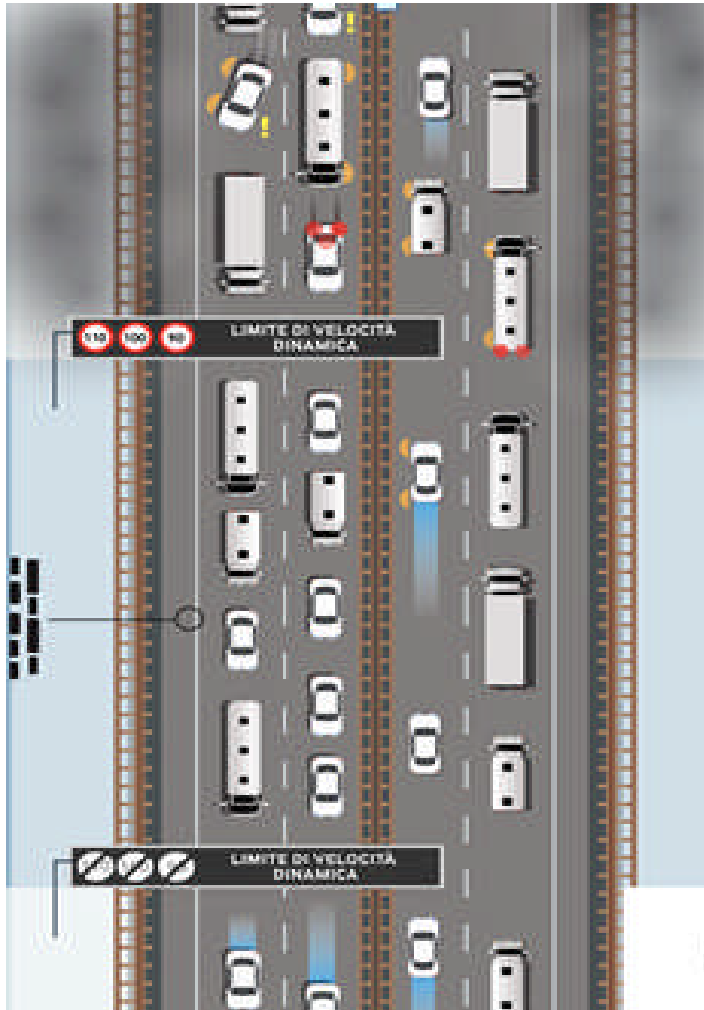




## THREE TRAFFIC MANAGEMENT POLICIES APPLIED WITHIN THE PROJECT

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





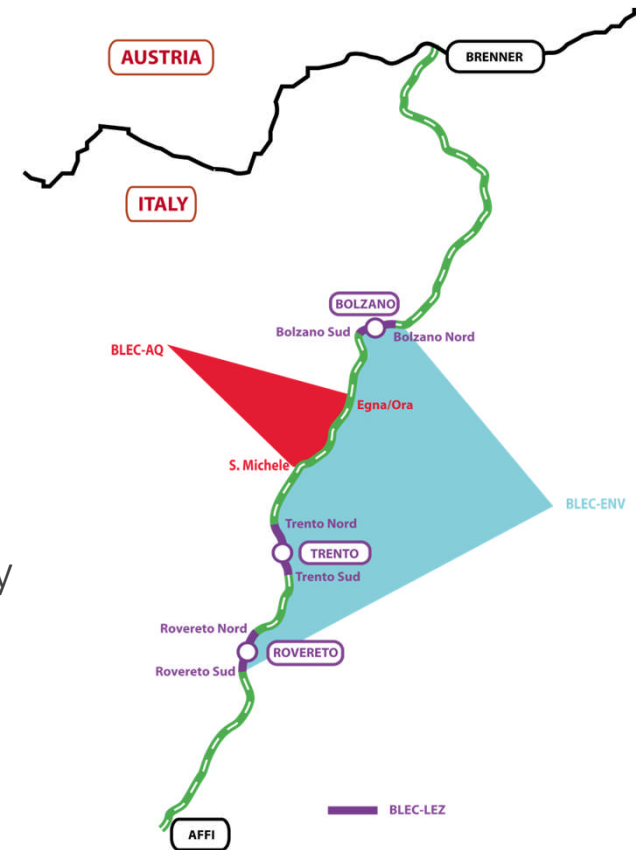
## SPEED LIMITS REDUCTION TO INCREASE CAPACITY

## HARD SHOULDER RUNNING



- To increase the motorway capacity
- To smoothen traffic and reduce stop & go phenomena
- To decrease pollution

Measure well accepted by users







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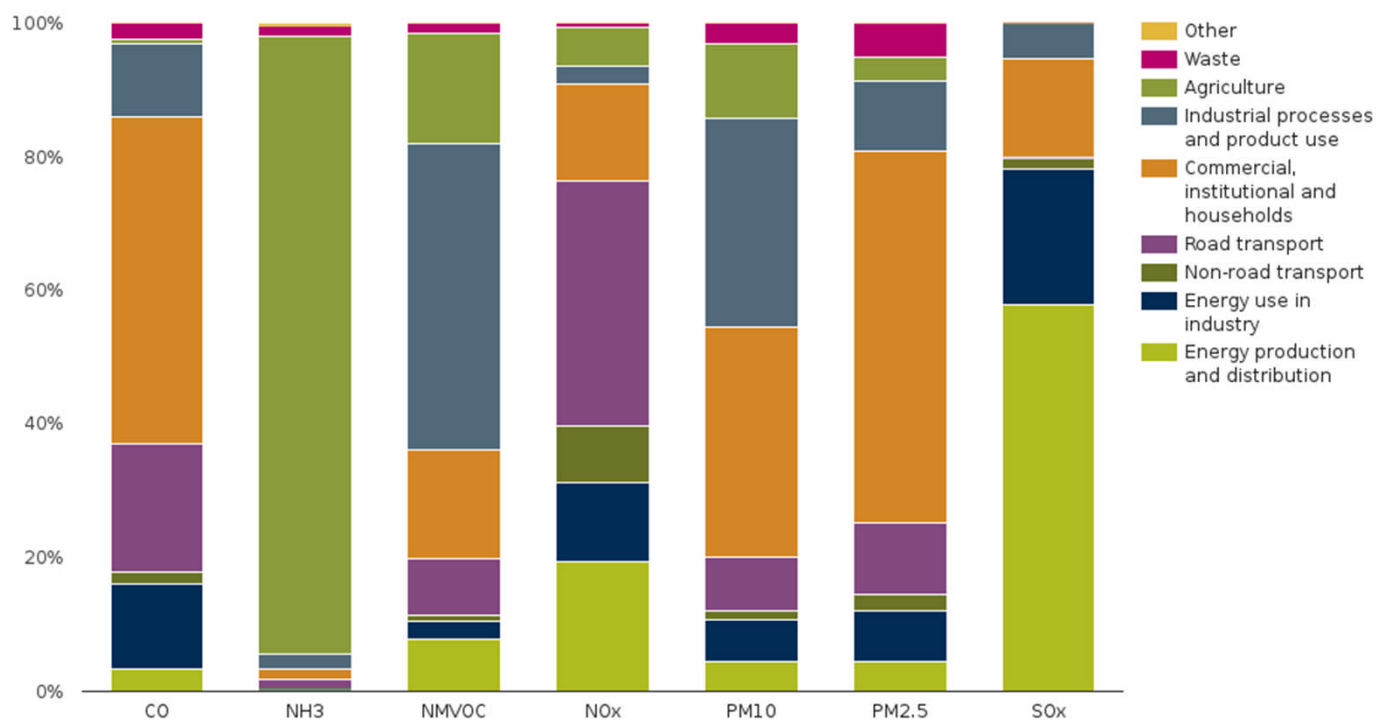


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## MAIN POLLUTANT FROM TRAFFIC: NO<sub>x</sub> (nitrogen oxides)

Chart – Emissions of the main air pollutants by sector group in the EEA-33



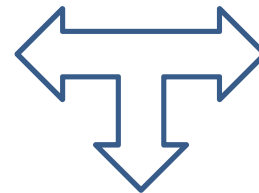


## HOW CAN WE ESTIMATE TRAFFIC EMISSIONS?

### CHARACTERIZATION OF THE VEHICLE FLEET



### SPEED



MODEL  
(COPERT – European  
standard)



POLLUTANT  
EMISSIONS





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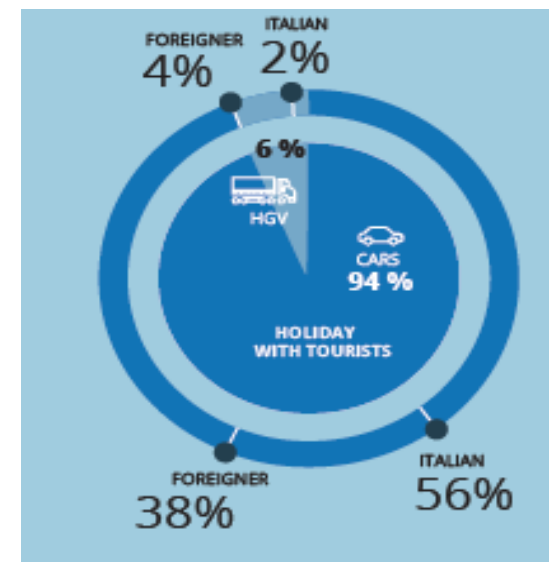
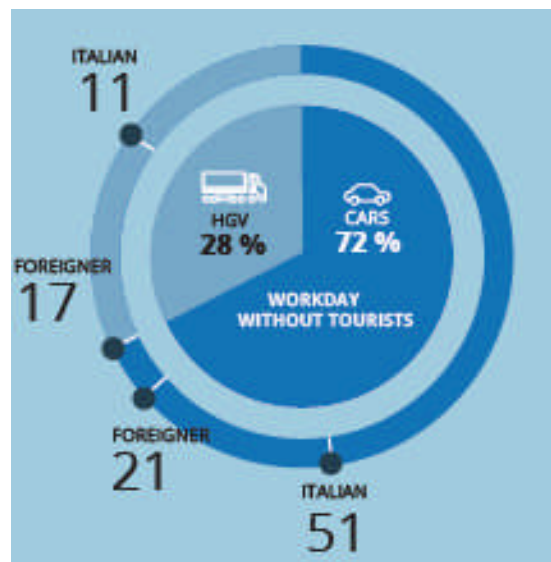


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## CHARACTERIZATION OF THE VEHICLE FLEET ALONG THE A22 MOTORWAY

### CATEGORY OF VEHICLES TRANSITING



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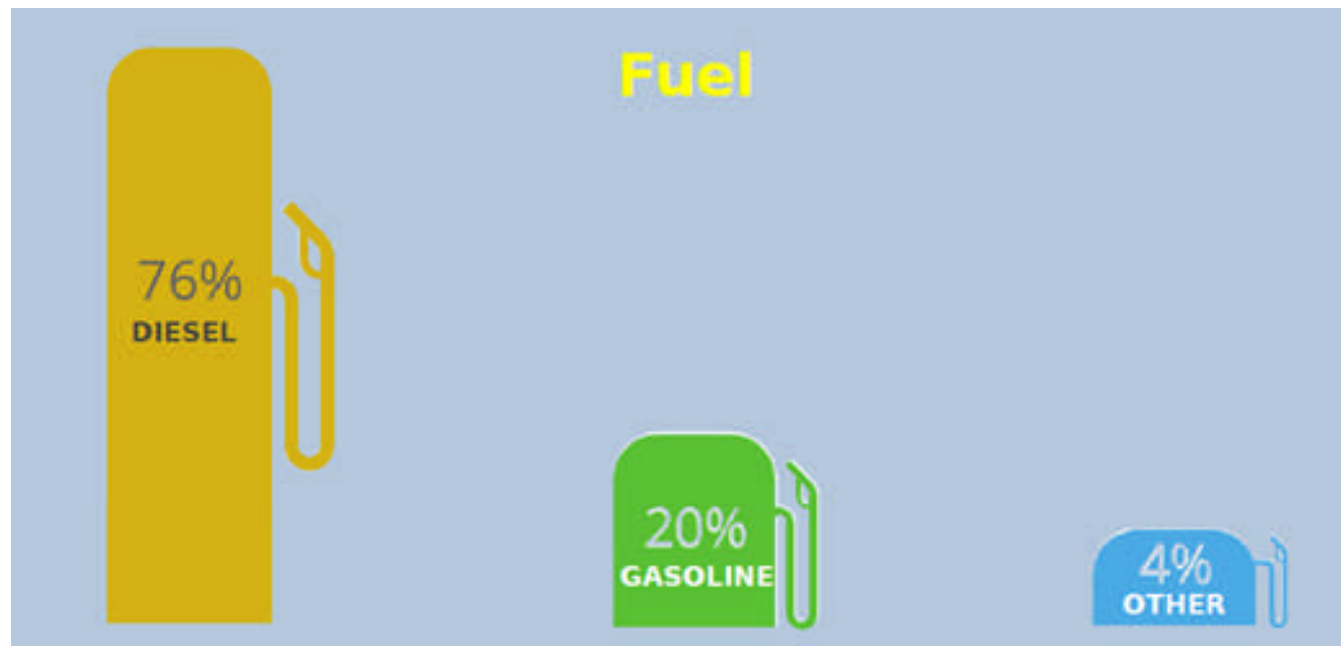
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## CHARACTERIZATION OF THE VEHICLE FLEET ALONG THE A22 MOTORWAY



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## CHARACTERIZATION OF THE VEHICLE FLEET ALONG THE A22 MOTORWAY

### VEHICLE AGE (EURO CLASSES) IS A BASIC PARAMETER



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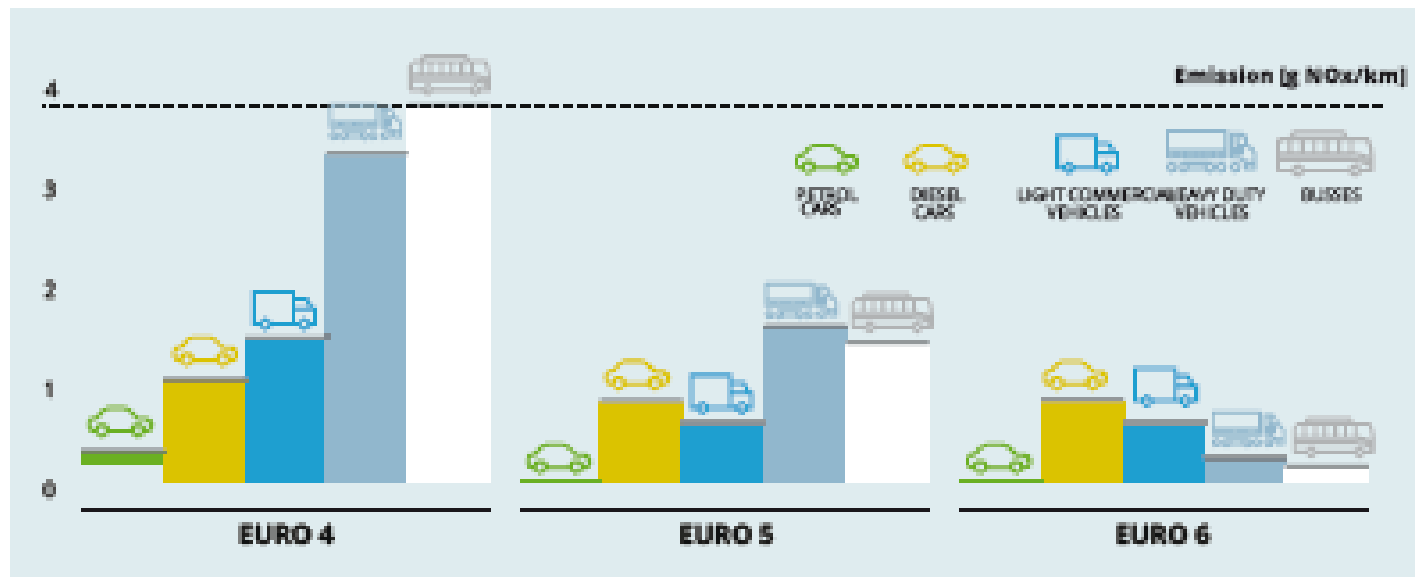


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## CHARACTERIZATION OF THE VEHICLE FLEET ALONG THE A22 MOTORWAY

### NO<sub>x</sub> emission factors by EURO class



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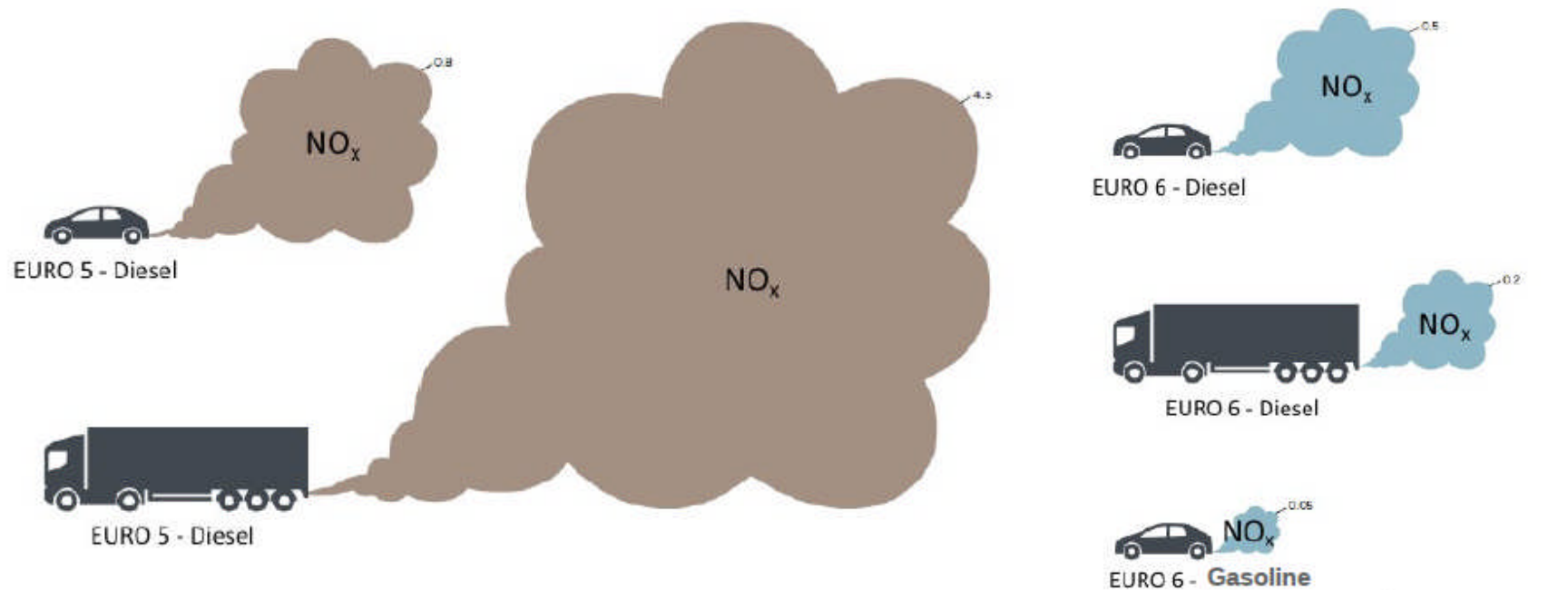
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## CHARACTERIZATION OF THE VEHICLE FLEET ALONG THE A22 MOTORWAY



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## SPEED & EMISSIONS

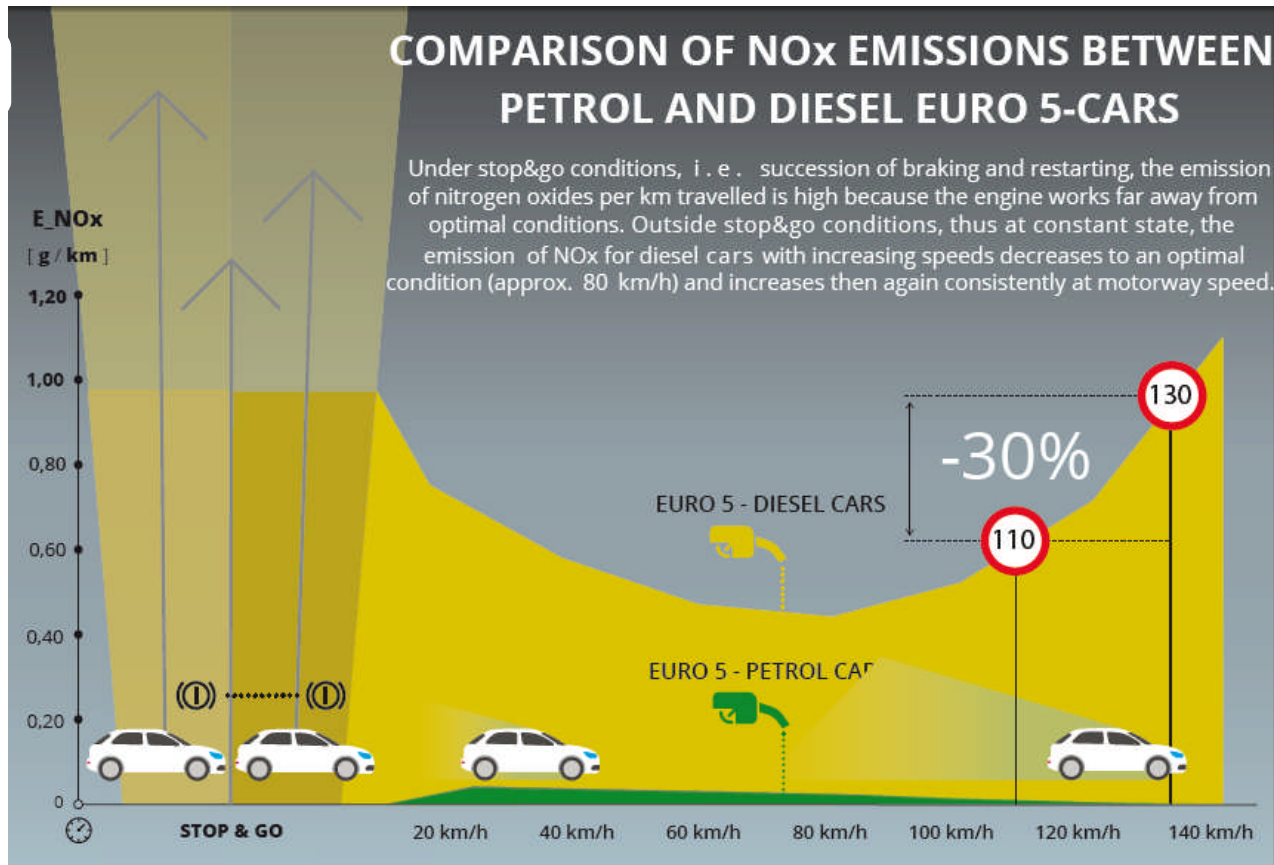
Vehicle speed affects  
vehicle emissions



Speed reduction is  
efficient for diesel  
cars, not for newest  
petrol cars

### COMPARISON OF NO<sub>x</sub> EMISSIONS BETWEEN PETROL AND DIESEL EURO 5-CARS

Under stop&go conditions, i. e. succession of braking and restarting, the emission of nitrogen oxides per km travelled is high because the engine works far away from optimal conditions. Outside stop&go conditions, thus at constant state, the emission of NO<sub>x</sub> for diesel cars with increasing speeds decreases to an optimal condition (approx. 80 km/h) and increases then again consistently at motorway speed.







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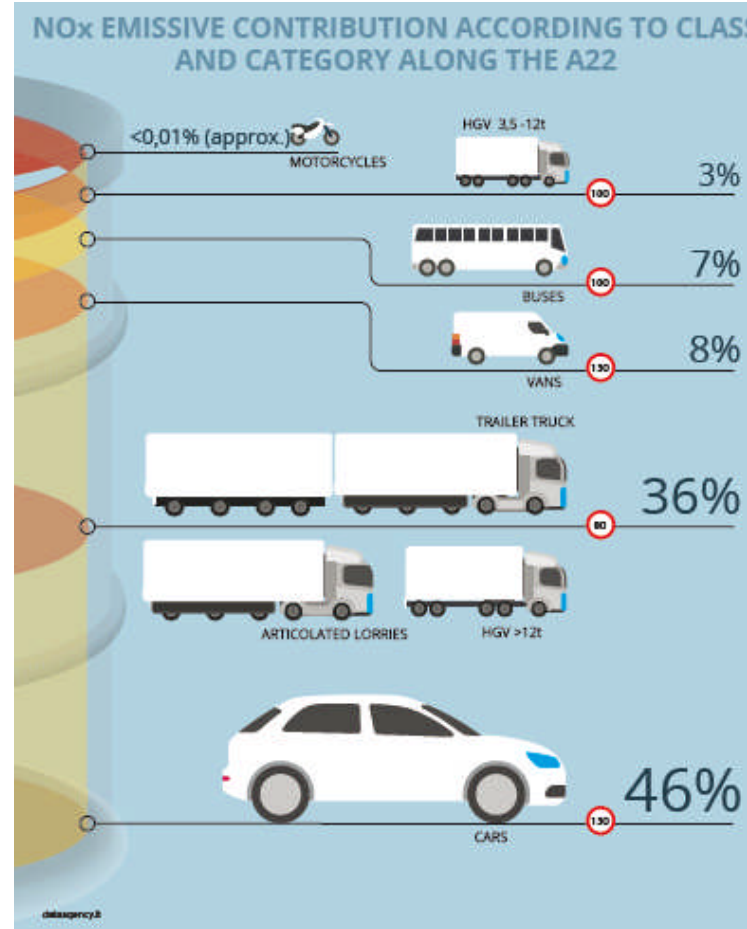
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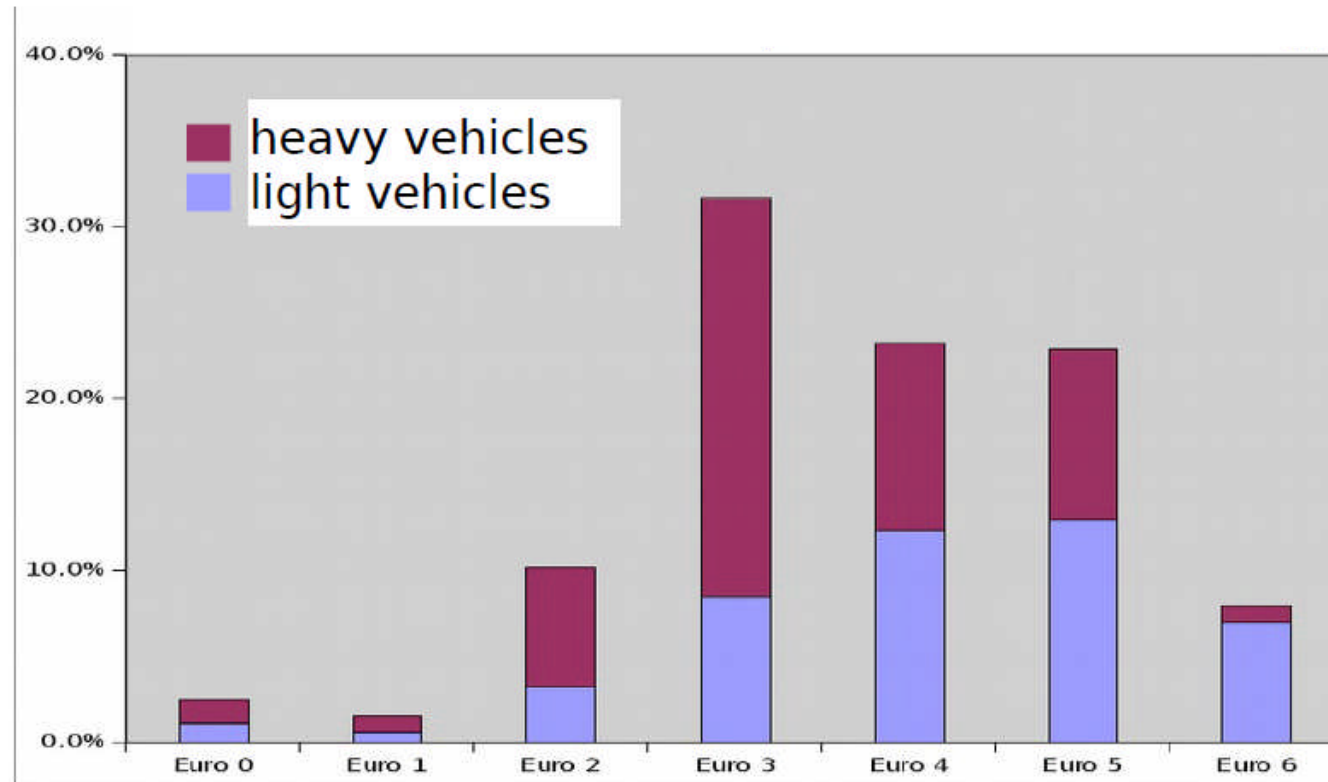


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## NO<sub>x</sub>: % emission by EURO class and vehicle type





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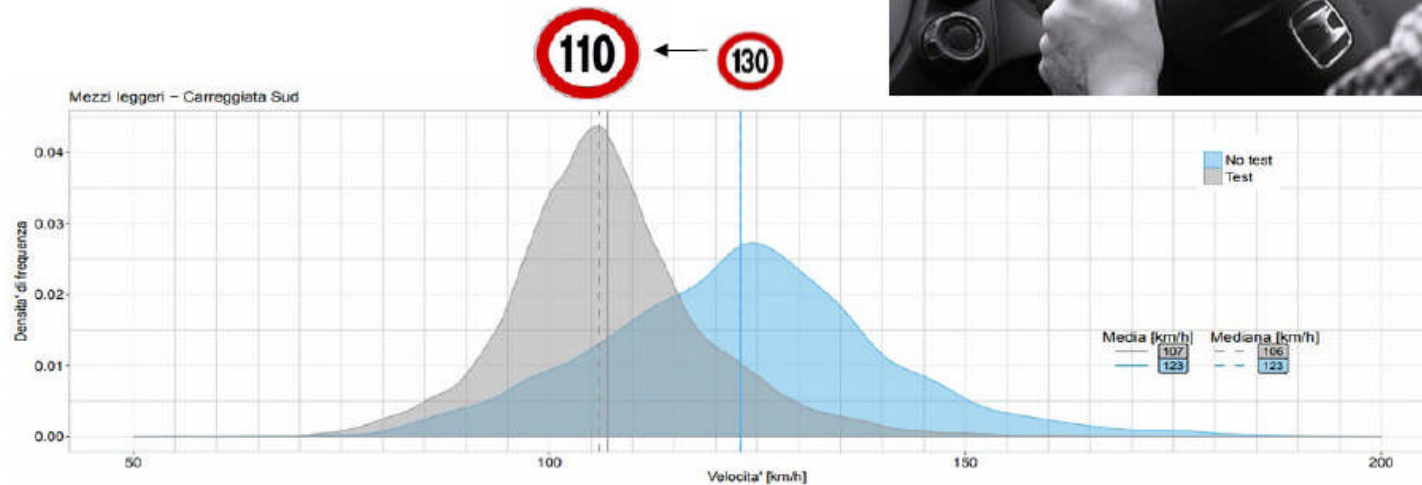
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## SPEED REDUCTION



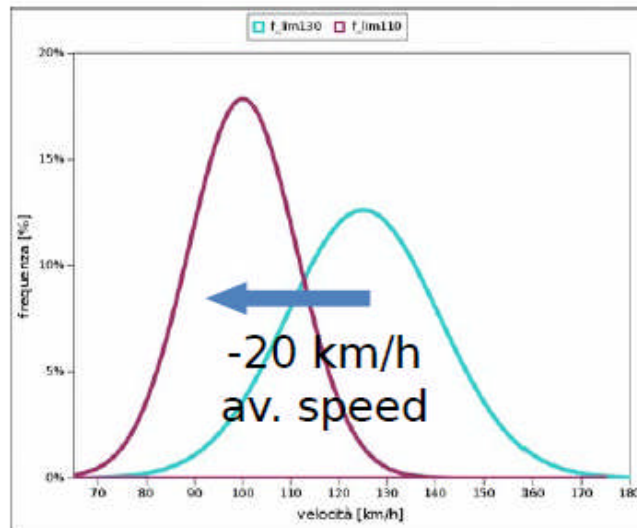
### Drivers' response



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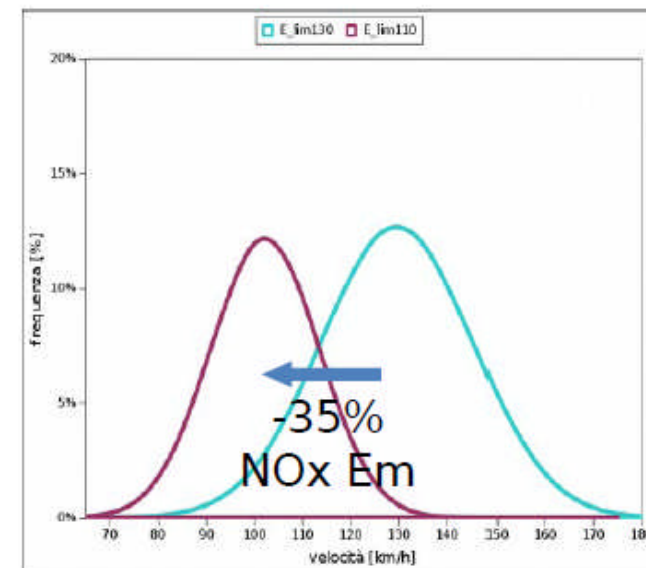


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Speed distribution with an average speed of **125 km/h** and **105 km/h** (light vehicles)

Emissions distributions: reduction by 35% of NOx emissions.





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Emissions forecast  
system

+

Weather forecast  
system

+

System for the forecast of  
NO<sub>2</sub> / NO<sub>x</sub> concentrations  
produced by traffic

=

Assessment of the need to  
adopt dynamic speed limits

## REAL-TIME OPERATIVE CHAIN

- ❑ The model chain produces a forecast output on a daily basis, every day at 11 o'clock, valid for the following day
- ❑ The model chain has a real-time control chain aiming at verifying situations which are very different from those foreseen or the presence of events which might require the deactivation of a potential suggested activation



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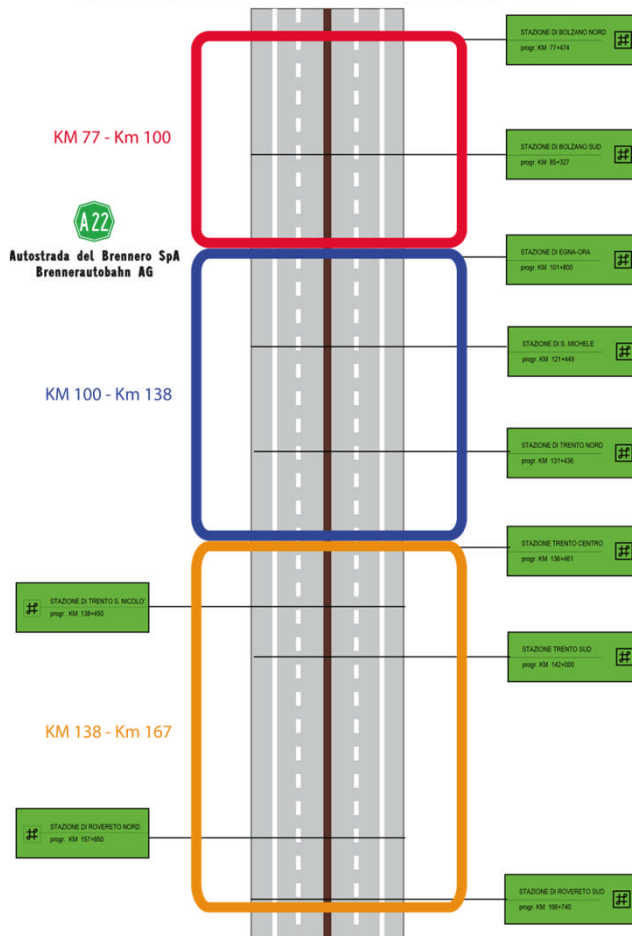
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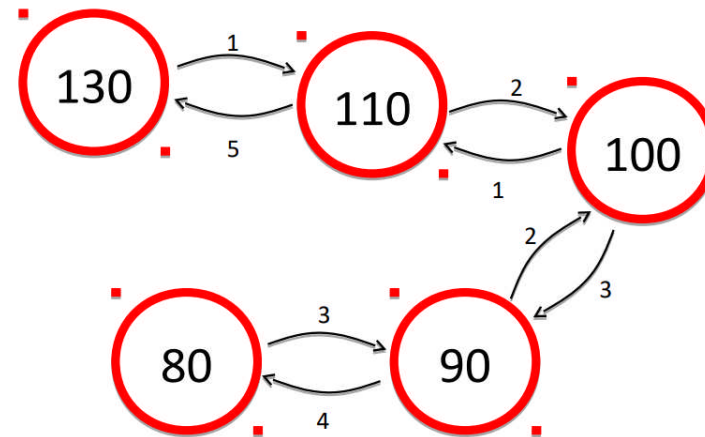


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## STATE MACHINE

- 1: Se  $105 < v < 115$  [km/h] && Portata  $> 1500$  [veicoli]
- 2: Se  $95 < v < 105$  [km/h] && Portata  $> 1800$  [veicoli]
- 3: Se  $85 < v < 95$  [km/h] && Portata  $> 2000$  [veicoli]
- 4: Se  $v < 85$  [km/h] && Portata  $> 1500$  [veicoli]



5: Nessuna delle 4 condizioni precedenti

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CRUSCOTTO BRENNERLEC ARGOWEB

TRATTO	STATO	EVOLUZIONE	TENDENZA	STORICO
<b>T1</b> Da: BOLZANO Km: 77 A: EGNA Km: 100	Velocità: 128 Km/h Portata veicoli: 1214	130	↓	B3
<b>T2</b> Da: EGNA Km: 100 A: TRENTO Km: 138	Velocità: 117 Km/h Portata veicoli: 1637 NO2 KM 103: 11.9 NO2 KM 107: 11.8	130	↓	B3 B4
<b>T3</b> Da: TRENTO Km: 138 A: ROVERETO Km: 168	Velocità: 124 Km/h Portata veicoli: 1586	130	=	B3

GRAFICI 2 ORE

DIREZIONE NORD DIREZIONE SUD

SEZIONE DI RILEVAMENTO KM. 0,2 - BRENNERO GALLERIA

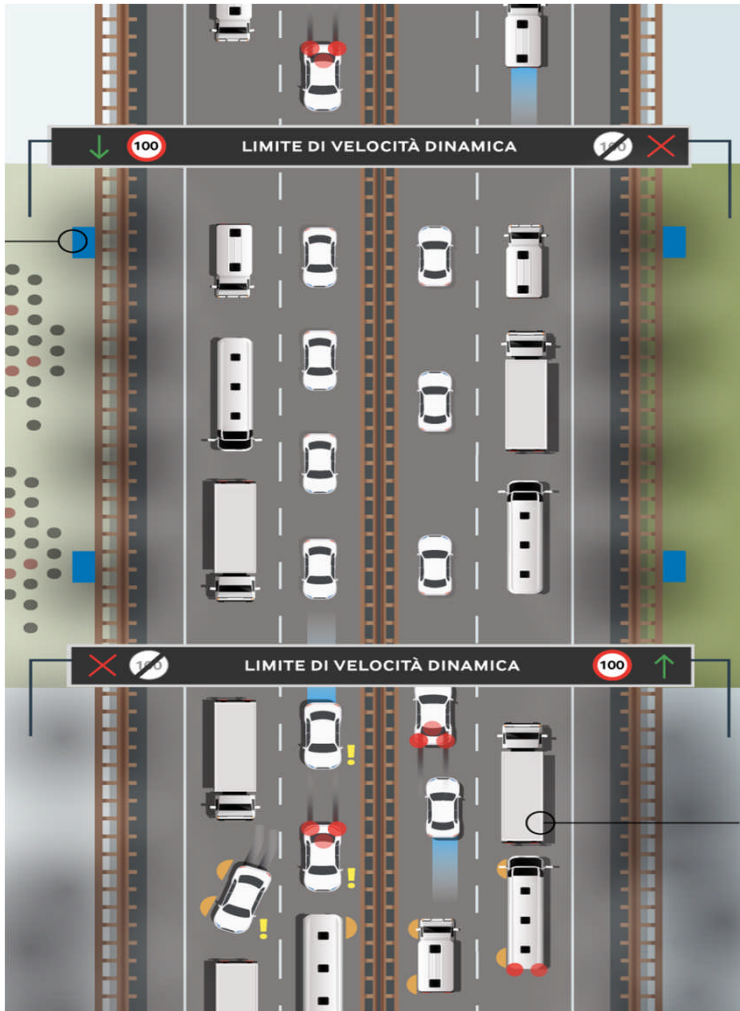
N.Veicoli/h	Velocità Km/h	MARCIA	SORPASSO
744	58.8	9.8	15.3

SEZIONE DI RILEVAMENTO KM. 012,200 RADAR

N.Veicoli/h	Velocità Km/h	MARCIA	SORPASSO
540	95	5.8	0.7

SEZIONE DI RILEVAMENTO KM. 36,7 - FORTEZZA GALLERIA

N.Veicoli/h	Velocità Km/h	MARCIA	SORPASSO
0	0	0	107.1



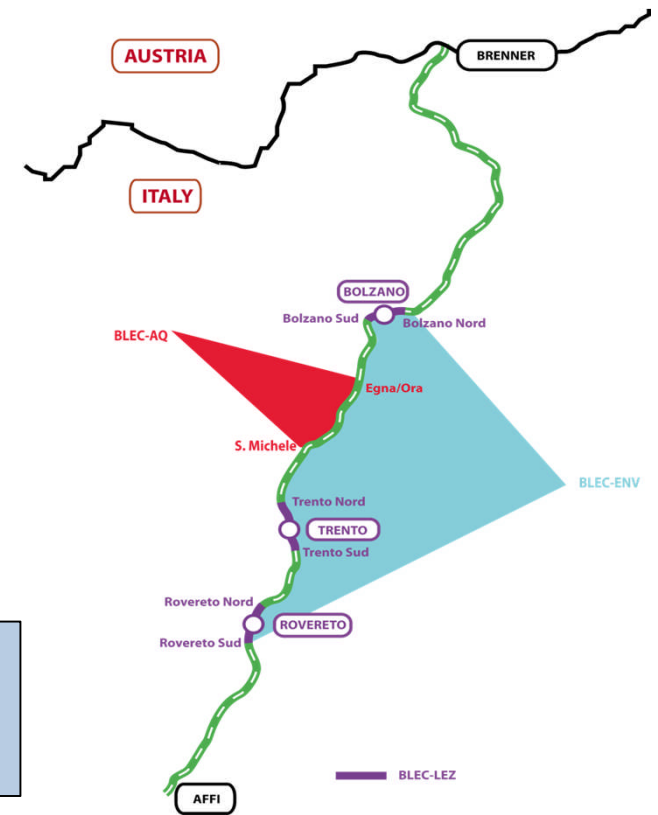
## SPEED LIMITS REDUCTION TO REDUCE EMISSIONS

Under conditions of  
atmospheric  
pollution



*To reduce emissions*

Measure less  
accepted by users





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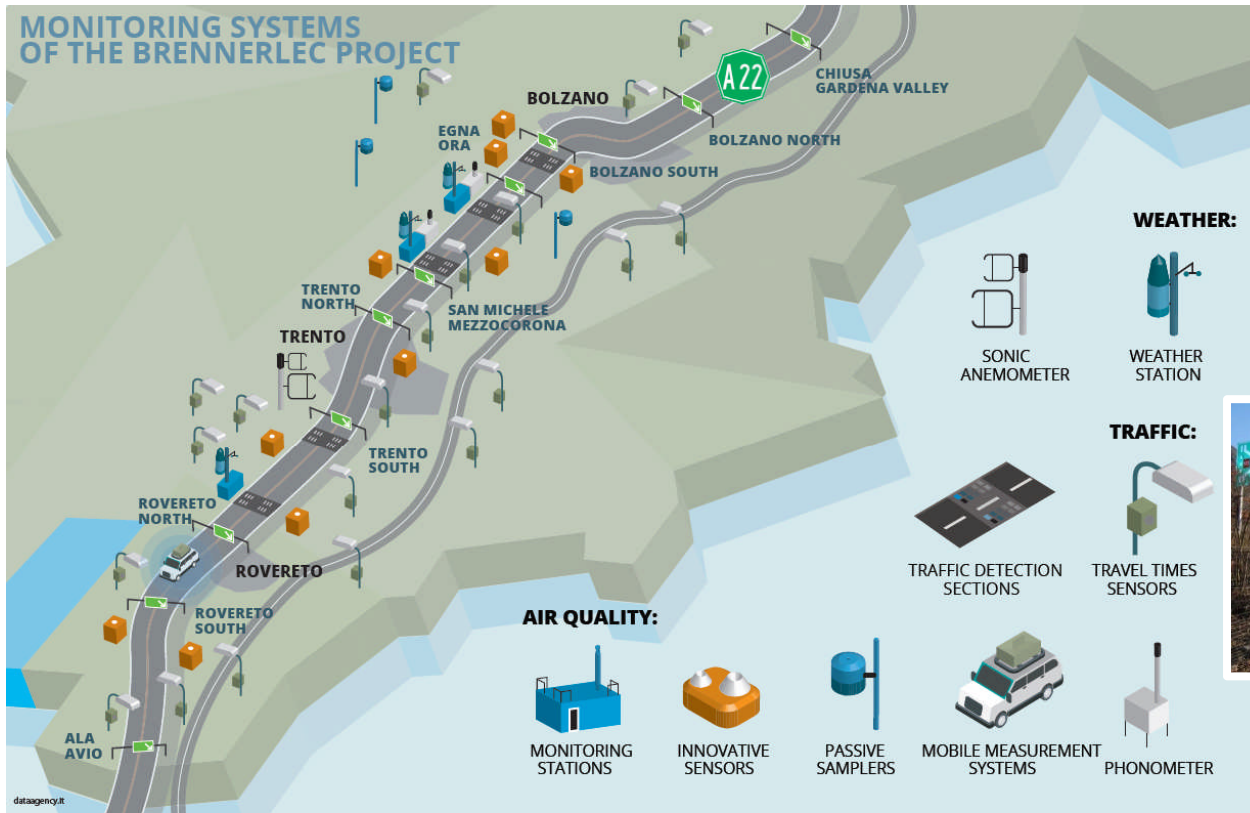
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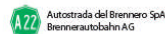
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## MONITORING SYSTEMS OF THE BRENNERLEC PROJECT



dataagency.it



SONIC ANEMOMETER

### WEATHER:

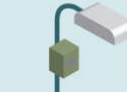


WEATHER STATION

### TRAFFIC:



TRAFFIC DETECTION SECTIONS



TRAVEL TIMES SENSORS

### AIR QUALITY:



MONITORING STATIONS



INNOVATIVE SENSORS



PASSIVE SAMPLERS



MOBILE MEASUREMENT SYSTEMS



PHONOMETER



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## Phase 1 and 2

Test planning based on a calendar

Lunedì	Martedì	Mercoledì	Giovedì	Venerdì	Sabato	Domenica
				1	2 B4 S103/107 100	3
4 B4 S103/107 100	5	6 B4 S103/107 100	7	8 B4 S103/107 100	9	10 B4 S103/107 100
11	12 B4 S103/107 100	13	14 B4 S103/107 100	15	16 B4 S103/107 100	17
18 B4 S103/107 100	19	20 B4 S103/107 100	21	22 B4 S103/107 100	23	24 B4 S103/107 100
25	26 B4 S103/107 100	27	28 B4 S103/107 100	29	30 B4 S103/107 100	31

### Phase 1

Use of compulsory speed limit



### Phase 2

Use of compulsory and recommended speed limit



The average speed was approximately 114 km/h during tests and 119 km/h during normal conditions  
The recommended speed limit sign was observed by approx. 21% of the car drivers.





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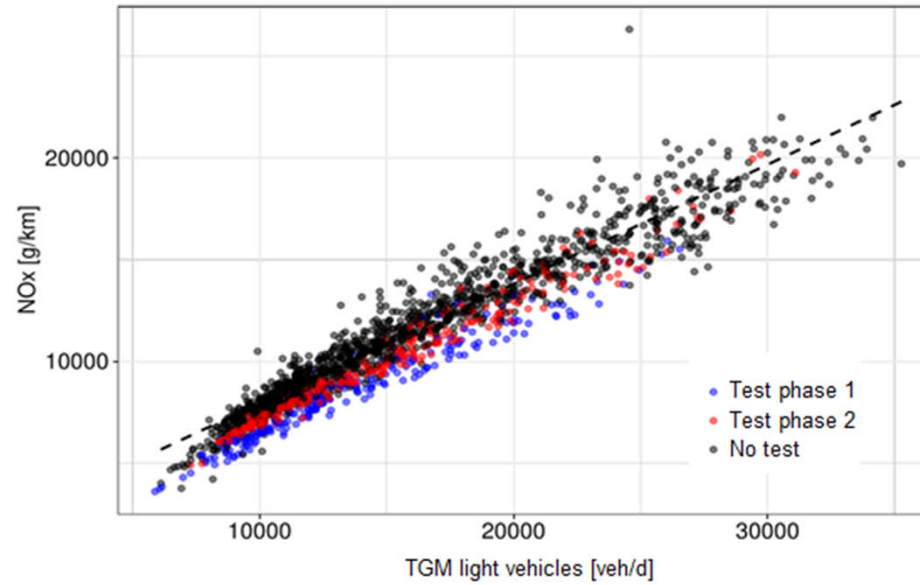


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NO<sub>x</sub>

Reduction of NO <sub>x</sub> emissions [%]	North	South	Average
Phase 1	-17,6%	-11,8%	-14,7%
Phase 2	-7,8%	-6,0%	-6,9%
Average	-11,9%	-8,4%	-10,1%





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### Phase 3

Tests based on forecast outputs for:

- traffic
- weather conditions (atmospheric stability)

Stabilità atmosferica (gradiente di temperatura)

Classe	Stabilità atmosferica (gradiente di temperatura)		
	$\Gamma > 5^{\circ}\text{C}/\text{km}$	$-5 < \Gamma < 5^{\circ}\text{C}/\text{km}$	$\Gamma < -5^{\circ}\text{C}/\text{km}$
n < 500	x	x	x
$500 \leq n < 1000$	x	x	✓
$1000 \leq n < 1500$	x	✓	✓
$1500 \leq n < 2000$	✓	✓	✓
$2000 \leq n < 2500$	✓	✓	✓
$2500 \leq n < 3000$	✓	✓	✓
n ≥ 3000	✓	✓	✓

Traffico (autovetture)

Confirmation of the less efficacy of the recommended speed limit

Same observance of the recommended speed limit than in Phase 2

### Phase 4

**Proactive system** - Activations based on the forecasting model and on real-time air quality data





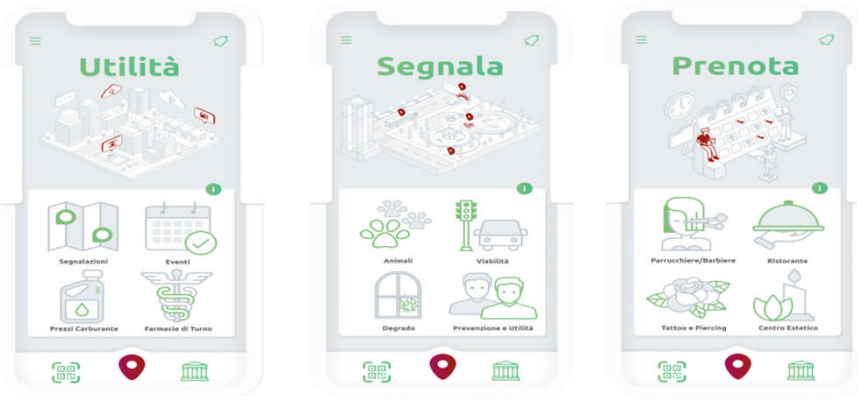
## COVID-19: RECOVERY PLAN

A recovery plan has been worked out for the final test phase. The plan foresees an **extension of the project from April 2021 to September 2021** so as to keep up with the tests which could not be undertaken during Spring and Summer 2020 .

The goal of the final test phase is to **assess** the **benefits** of the implemented policies, but also to assess the **opportunity to replicate** the action **along the Alpine corridor Affi – Brenner/Kufstein**.



## AN APP TO INDUCE USERS TO CHANGE THEIR DRIVING BEHAVIOUR



- Already existing app to inform citizens about events happening around them
- Support for users' with audio notifications to avoid distractions while driving
- Real-time information about the BrennerLEC experimentation but also about traffic, according to their position
- No need to set a travel route to get info
- The app works even when it is not open (just installed)

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