THE REAL URBAN EMISSIONS INITIATIVE

FACT SHEET

The Real Urban Emissions (TRUE) Initiative vehicle rating

TRUE is a collaboration of the FIA Foundation, the International Council on Clean Transportation, Global NCAP, Transport and Environment, and C40 Cities to collect and publish real-world data on pollutant emissions from vehicles. The aim is to illuminate the scale and scope of the problem of vehicle pollution in urban areas, to help cities address air pollution from the transport sector, and to allow consumers to make informed vehicle purchasing decisions.

JUNE 2018

THE TRUE RATING

A centerpiece of the TRUE initiative is a three-color rating system that categorizes vehicles by make, model, and year according to their exhaust pollutant emissions in a wide range of driving conditions—that is, in "real-world" driving.

At present, the rating reflects only nitrogen oxide (NO_x) emissions, one factor in Europe's urgent urban air-quality problem. Other key factors in urban air pollution, most importantly particulate matter (PM), are not yet incorporated into the rating system. Eventually, however, the intent is to expand the TRUE rating to encompass those pollutants and others regulated by EU vehicle emissions standards.

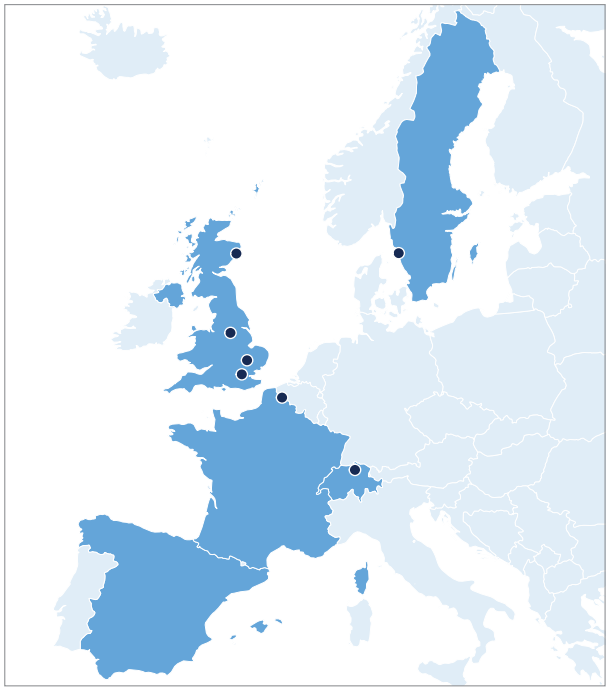
Green: Less than 90 mg/km NO_x

Yellow: Between 90 and 180 mg/km of NO_x, and vehicles that do not definitively fall into green or red categories

Red: More than 180 mg/km of NO_x

The green rating threshold is the same as the most stringent NO_x limit in EU vehicle regulation, the on-road Euro 6d NO_x emissions limit for petrol cars: 90 mg/km. The red rating threshold, 180 mg/km, is the Euro 5 type-approval limit for diesel cars, which all new cars should theoretically have been meeting for at least seven years.

The rating is based on measurements obtained using remote-sensing equipment throughout Europe over the past ten years and pooled together in the CONOX project, funded by the Swiss Federal Office for the Environment. The CONOX data set now totals ~750,000 records. The subset of ~375,000 measurements used by TRUE excludes samples collected from trucks and vans,



In the CONOX project, several research groups have worked together to pool and analyze remote sensing data collected since 2011 at locations in France, Spain, Sweden, Switzerland, and the United Kingdom.

and records that did not include some of the data needed to convert raw data to g NO_x/km.

Initial ratings have been calculated for approximately 4,850 vehicle models, nearly all designed and built to Euro standards 3–6.

A core element of the TRUE project is the ongoing collection of real-world emissions data from in-use vehicles in cities via remote sensing. The initiative recently completed a data-collection campaign in London, and will carry out another in Paris in mid-2018. These two campaigns will eventually yield a database of

Emission standard/ rating system	Measurement type	Date of introduction	NO_x limits (g/km)	
			Diesel	Petrol
Euro 3	laboratory	January 2000	0.5	0.15
Euro 4	laboratory	January 2005	0.25	0.08
Euro 5	laboratory	September 2009	0.18	0.06
Euro 6	laboratory	September 2014	0.08	0.06
	on-road (PEMS)	September 2017	0.168	0.126
	on-road (PEMS)	January 2020	0.12	0.09
TRUE good rating	**on-road (remote sensing)**	**all years**	**<0.09**	
TRUE moderate rating	**on-road (remote sensing)**	**all years**	**0.09–0.18**	
TRUE poor rating	**on-road (remote sensing)**	**all years**	**>0.18**	

TRUE NO_x rating emissions limits compared to regulatory limits

over 200,000 vehicle records to be added to the CONOX data. Data collection will continue as the TRUE initiative grows and expands.

HOW THE RATING IS DETERMINED

Vehicles of the same manufacturer group, fuel type, engine displacement, and Euro standard exhibit real-world emissions of a similar level. For the purpose of the rating, vehicles in the data set are grouped into "families" based on those criteria, and all models in a family receive the same rating.

This method of grouping the data permits the TRUE rating to cover more than 90% of EU car registrations from Euro 3 to 6 by monitoring around 760 families averaging six vehicle models each.

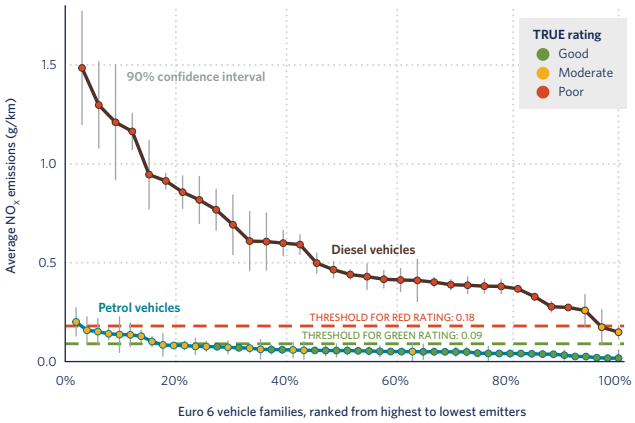
To determine the TRUE rating, remote-sensing data for a vehicle family is analyzed. We then determine the average as well as the 90% confidence bands of all remote-sensing data collected for that vehicle family.

The three-color system incorporates the statistical confidence of the estimate of real-world emissions. If the entire confidence interval falls into a single bin, the remote-sensing result is equivalent to that bin. If the confidence interval overlaps multiple bins, the rating result of the remote sensing analysis is a yellow rating.

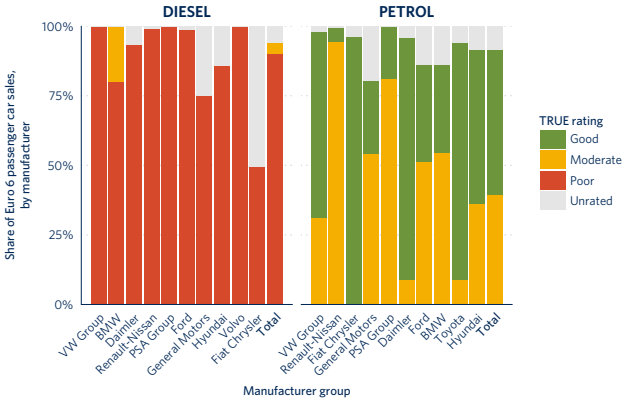
The ability to adjust the rating is one of the core benefits of the TRUE rating system. As vehicles age, their emissions controls may deteriorate and become less effective. Conversely, cleaner new models should enter the fleet, and high-emitting older models may be recalled and fixed. The ongoing collection and incorporation of new remote-sensing data permits the system to reflect changes over time in vehicle performance on the road.

WHAT DOES IT MEAN?

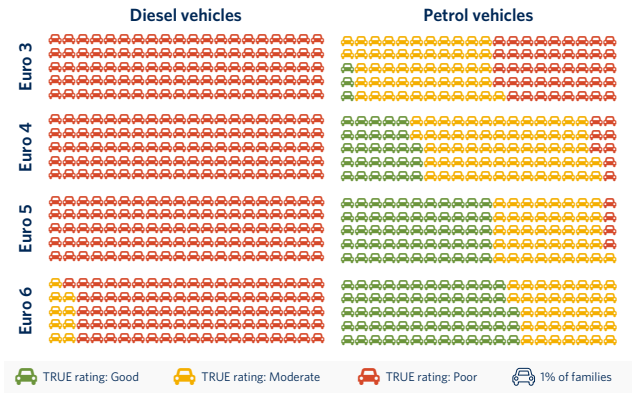
- New vehicles are by definition certified to emissions levels at or below the legal limit. The TRUE rating does not reflect a vehicle model's compliance with an emissions regulation, but rather its real-world emissions.
- Real-world vehicle emissions exceeding regulatory limits may be caused by several factors. Systemic causes that affect all vehicles of a particular model (as opposed to isolated individual vehicles) include deterioration of emissions control systems, software that increases emissions during normal driving



Diesel and gasoline Euro 6 vehicle families, showing TRUE rating, thresholds, and 90% confidence intervals. Four diesel car makers have a Euro 6 vehicle family with average emissions >12 times the type-approval limit.



TRUE ratings of top-selling manufacturers of diesel and petrol Euro 6 passenger cars. Manufacturer groups are sorted from highest to lowest sales. Total bar represents all cars, not just top-10 manufacturer groups. BMW is the only top-selling manufacturer group selling Euro 6 diesels with a yellow rating.



Passenger vehicle families by rating, fuel type, and Euro standard. The red category includes both vehicles that only slightly exceed the rating's 180 g NOX/km threshold and gross emitters that exceed the regulatory limit by 18 times or more. Nearly all diesel vehicles on European roads today received a "poor" rating, meaning they exceed the Euro 5 diesel NO_x emissions limits introduced in 2009.

(aka defeat devices), defective parts, and driving conditions outside of those covered by the regulation. The TRUE ratings capture high emissions that could be attributable to any of these potential causes, effectively identifying high-emitter vehicles for follow-up investigation.

- A vehicle's TRUE rating does not reflect its CO_2 emissions. There is no direct link between vehicle NO_X (the only pollutant currently reflected in the TRUE system) and vehicle CO_2. It is possible for a vehicle to emit low levels of NO_X but relatively high levels of CO_2.
- By design, the TRUE rating is difficult if not impossible to cheat. It does not rely on a test with pre-defined driving cycles and test conditions, or on the Real Driving Emissions (RDE) testing protocol. And there is no known method for a manufacturer to cheat remote-sensing measurements, because a vehicle has no way of detecting that it is being sampled by remote-sensing equipment.

BASICS OF REMOTE SENSING

- Remote sensing is a non-intrusive technique that uses spectroscopy to capture a snapshot of a vehicle's emissions—typically, about one second's worth—as it drives by a sampling location.
- When many samples have been collected, from vehicles in many different operating states, at different speeds and engine loads, in different locations (urban, rural) and varying ambient conditions, statistical methods can be used to calculate an accurate picture of the average emissions of a given vehicle model.

Further detail on the TRUE ratings calculation and on the use of remote sensing for on-road emissions measurement can be found in two new papers from the TRUE initiative:

Explanation of the TRUE real-world passenger vehicle emissions rating system
www.trueinitiative.org/data/publications/explanation-of-the-true-rating-scheme
Yoann Bernard, Uwe Tietge, John German, Rachel Muncrief

Determination of real-world emissions from passenger vehicles using remote sensing data
www.trueinitiative.org/data/publications/determination-of-real-world-emissions-from-passenger-vehicles-using-remote-sensing-data
Yoann Bernard, Uwe Tietge, John German, Rachel Muncrief

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TO FIND OUT MORE

For details on the TRUE rating and related questions, contact Rachel Muncrief, **rachel@theicct.org**. For more information on the TRUE project, visit **www.trueinitiative.org**.

The Real Urban Emissions Initiative (TRUE) is a partnership of the FIA Foundation, the International Council on Clean Transportation, Global NCAP, Transport and Environment, and C40 Cities.

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