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Metrological Controls for the Prevention and Reduction of Road Accident Trauma and Deaths in Costa Rica

As a first step, the mandatory use of evidential breath analyzers (OIML R 129) and traffic speed meters (OIML R 91) has recently been implemented to decrease excessive speeding and drunk driving

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The Challenge

If the number of deaths and injuries from traffic accidents could be reduced, the income of low- and middle-income countries could increase considerably in the long term. These deaths affect medium- and long-term growth prospects, especially in these countries, where 90 % of traffic fatalities worldwide

“Deaths and Injuries Hold Back Economic Growth in Developing Countries.”

–WBG Press Release, January 2018

occur. Rising incomes in many developing countries have led to rapid motorization, but road safety regulations and enforcement have not kept pace. Therefore, efforts should focus on preventing deaths and injuries by intervening to reduce and enforce speed limits and decrease driving under the influence of alcohol. This requires regulations on the metrological control of evidential measuring instruments.^{1,2}

The Solution

Given that traffic accident injuries are the third leading cause of unnatural death in Costa Rica, metrological control activities for evidential citation instruments (i.e., breathalyzers) began in 2013. This was shortly followed by the installation of traffic speed cameras in 2015. Lacomet is involved in the process because the controls and evidential use of breathalyzers and speed cameras were carried out by Traffic Police Officers, which is a conflict of interest and a lack of transparency, so they request the development and implementation of Legal Metrological Control.

The implementation of these new services required the acquisition of equipment through international cooperation projects with the European Union, as well as technical training and education. During this process, a proposal was made to amend the Traffic Law to make the use of evidential instruments under metrological control mandatory, in accordance with technical regulations based on OIML recommendations³. Lacomet has also provided training to traffic officers and prosecutors on the importance of metrological controls for evidential citation instruments (see **Figure 1**).

¹ World Bank Group, Road Deaths and Injuries Hold Back Economic Growth in Developing Countries, press release, January 9, 2018. <https://www.worldbank.org/en/news/press-release/2018/01/09/road-deaths-and-injuries-hold-back-economic-growth-in-developing-countries>

² World Health Organization (WHO). Road traffic injuries. Fact Sheet 1 May 2026. <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>

³ R 126:2021 Evidential breath analysers and R 91:2025 Traffic speed meters

To ensure the quality of laboratory results for breath alcohol meters (see **Figure 2**), metrological traceability was achieved using dry gases from a commercial supplier that reported SI traceability via NIST Certified Reference Materials (CRMs). However, the cost of these materials exceeded the institution's budget. Therefore, work began on implementing the use of hydroalcoholic solutions (wet process) with metrological traceability for reference materials, aligned with the specifications in ISO/IEC 17034. As part of the improvement process, in-house reference materials with Lacomat metrological traceability are being produced for the magnitudes of mass, volume, and density; magnitudes that have CMCs or are in the process of obtaining CMCs (i.e., density). Work is also underway to optimize the value assignment and certification process to produce CRMs that can provide metrological traceability for both Lacomat and other national metrology institutes.

The metrological verification process for traffic speed meters uses real-world, field-based measurements, with a working standard characterized by its ability to measure distance and time. First, the laser alignment is verified in the laboratory. Then, on the road, the consistency between the camera-generated image and the indicated speed is checked. The speed of the standard is then compared to that of the instrument under test. As a further step, LACOMET is currently developing a Target Speed Simulator⁴ composed of an optical interface, a delay pulse generator, and a computer to perform laboratory measurements as a joint research project with the electrical engineering department of the University of Costa Rica and Lacomat's new optics and photometry laboratory; the objective is to measure the laser frequency to perform laboratory measurements, thereby reducing human error and, consequently, measurement uncertainty.

A Quantifiable Impact

The main contribution of metrological controls on measuring instruments is to provide confidence in the enforcement of traffic violations and, for evidentiary purposes, thereby serving as a deterrent to excessive speeding and other distracted-driving traffic offenses. To ensure the accuracy of the results from these measuring instruments, procedures for metrological verification of the breath analyzers and speedometers were implemented through the development of the technical regulations *RTCR 468:2014. Metrología. Instrumentos Destinados a Medir la Concentración de alcohol en aliento* and *RTCR 477:2015. Metrología. Instrumentos para la medición de la velocidad de vehículos automotores en carretera. Cinemómetros de tipo doppler y láser*, which are based on OIML Recommendations R 129 and R 91, respectively. These regulations ensure the metrological traceability of standards and validate the methods.

⁴ US National Highway Traffic Safety Administration (NHTSA). LIDAR Speed-Measuring Device Performance Specifications.

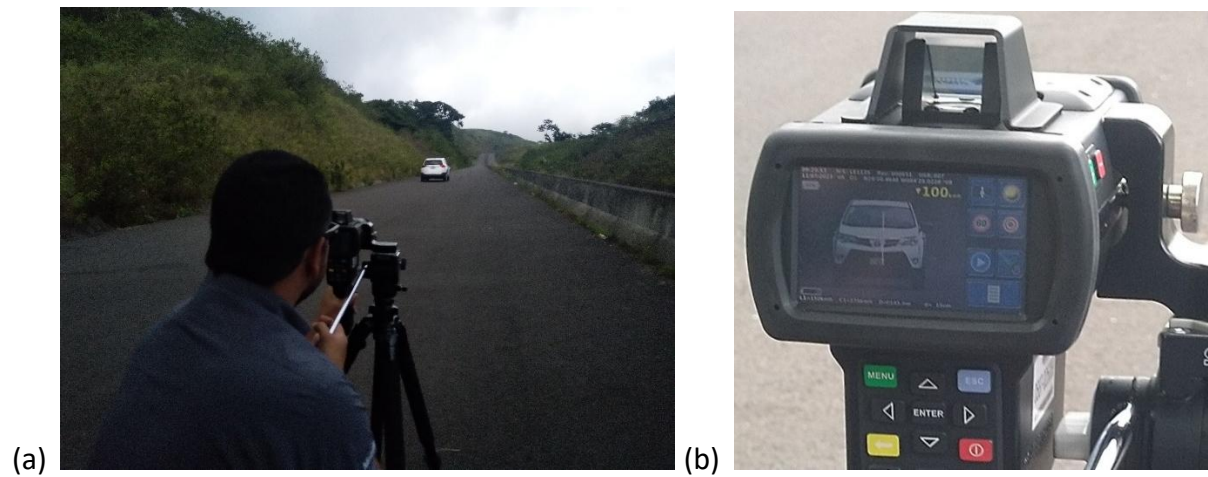


Figure 1. (a) Lacomet personnel operating a speed camera to detect a passing vehicle's speed during device operation training for traffic officers. (b) The results of the measurements taken by the equipment are recorded for potential use as evidentiary proof.



Figure 2. A breathalyzer calibration using Lacomet's Breathalyzer Metrological Bench.

Statistical data on road fatalities, where the main causes are speeding, lane violations, and improper passing, are linked to the increase in the number of drivers. **Figure 3** shows that at the beginning of the metrological control process for breathalyzer and speed-measuring instruments in 2014 and 2015, a relative decrease (fatalities/number of drivers) was observed, with the largest decrease occurring in 2020 due to the 2019 COVID-19 pandemic, during which driving was significantly reduced.^{5,6,7} Afterward, the value increased. Without consideration of the 2020 data, the relationship between the values remains consistent.

In the second phase in 2021, amendments to the Traffic Law were approved, requiring the use of measuring instruments under metrological control. Blood test results were separated from breath test results, with legal metrology authorities responsible for controlling the evidential instruments used for breath alcohol analysis (Lacomet), and the Forensic Science Laboratory of the Judicial Investigation Agency of Costa Rica is responsible for conducting the analysis. A clause was included stipulating that anyone who refuses to take the test will automatically be considered positive.

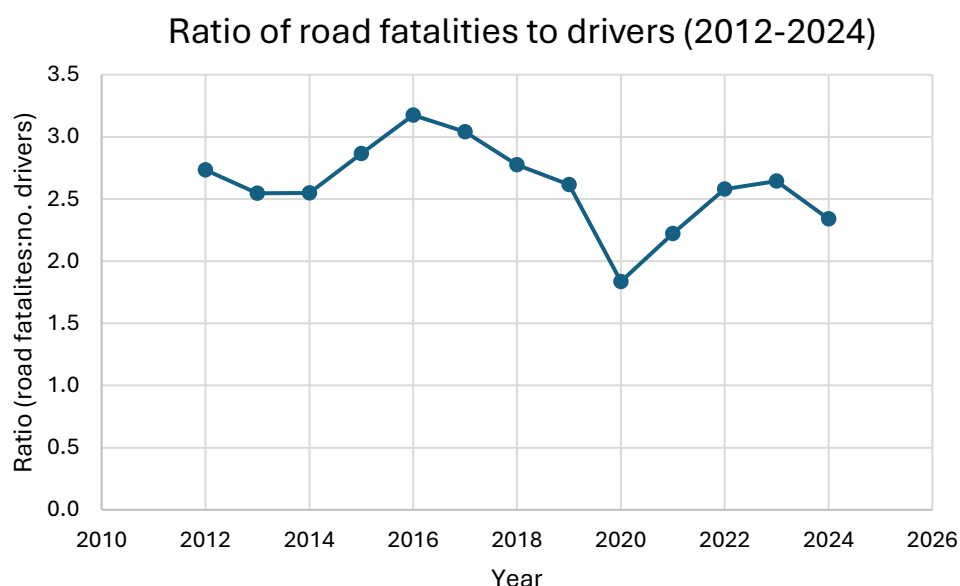


Figure 3. The ratio of road fatalities to the number of drivers over a 13-year period (2012-2024).

⁵ Tasas de mortalidad y fallecidos por accidentes de tránsito. Periodo 2004-2023
<https://datosabiertos.csv.go.cr/dataviews/234877/tasas-de-mortalidad-y-fallecidos-por-accidentes-de-transito-periodo-2004-2023/>

⁶ Consejo de Seguridad Vial. Number of drivers with at least one license by gender, by year.
<https://datosabiertos.csv.go.cr/dataviews/247118/cantidad-de-conductores-con-al-menos-una-licencia-por-sexo-segun-ano/>

⁷ Consejo de Seguridad Vial. Categories of infractions. <https://datosabiertos.csv.go.cr/dashboards/19787/infracciones/> (accessed 2026-07-03)

By 2024, the General Directorate of Traffic Police reported that every 2.5 hours, a driver was penalized for speeding,⁸ while in the same period, a person lost their life in a speeding-related road accident. This correlation is based on the 3 482 speeding tickets issued last year and the 175 fatalities related to this behavior on the road.⁹

The decrease in road deaths is not immediately evident because government data does not account for increases in the vehicle fleet or the deterioration of public roads. However, it is evident in the increase in the number of traffic fines issued, which is related to the confidence in the results obtained by instruments used for evidentiary purposes under metrological control, and the decrease in appeals in the courts.¹⁰

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⁸ Ministerio de Obras Públicas y Transportes. Every 2.5 hours a driver was penalized for speeding in 2024.

<https://www.mopt.go.cr/noticias/2025/cada-25-horas-un-conductor-fue-sancionado-por-exceso-de-velocidad-en-el-2024>

⁹ Consejo de Seguridad Vial. Number of drivers with at least one license by gender, by year.

<https://datosabiertos.csv.go.cr/dataviews/247118/cantidad-de-conductores-con-al-menos-una-licencia-por-sexo-segun-ano/>

¹⁰ Consejo de Seguridad Vial. Categories of infractions. <https://datosabiertos.csv.go.cr/dashboards/19787/infracciones/> (accessed 2026-07-03)