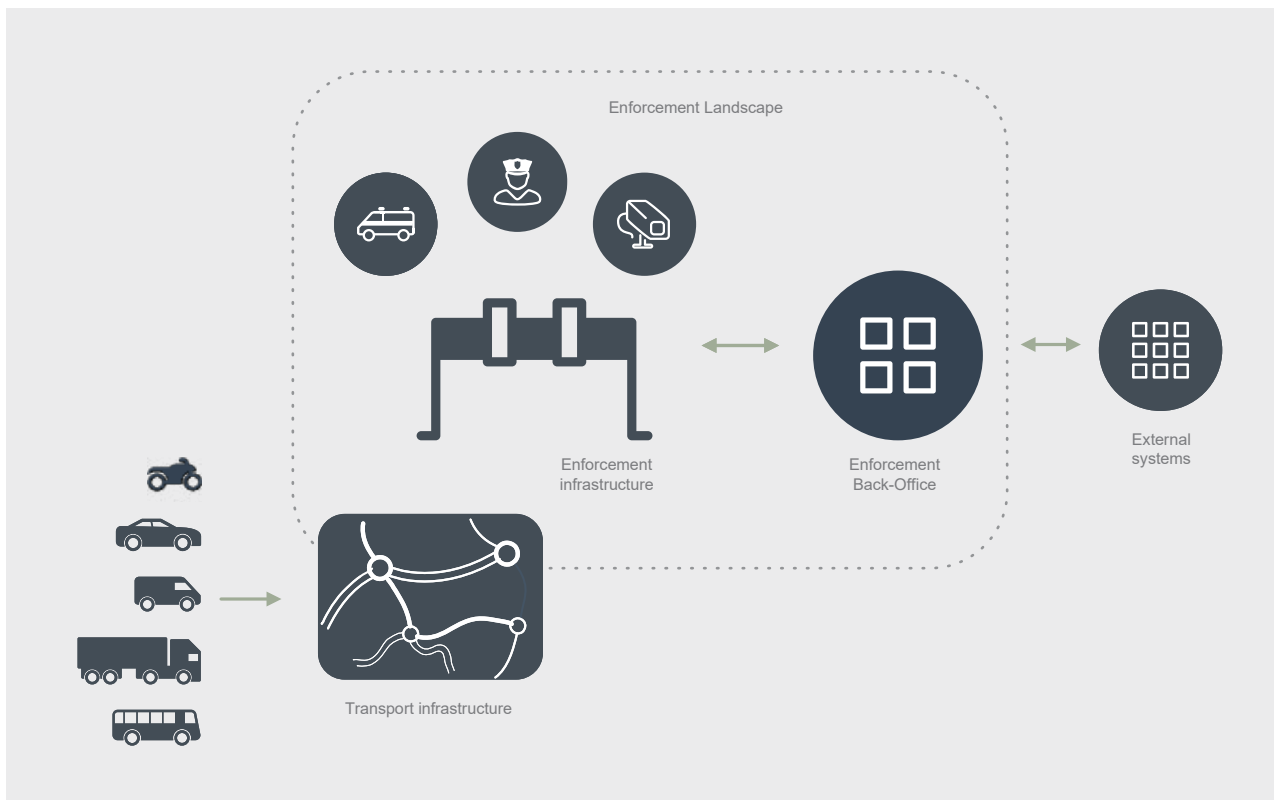# Platform
Toll Enforcement (ENF)

The enforcement plays a central role in maintaining the integrity of other related but usually parallelly, yet primarily operated systems (such as tolling systems) and as a key element it is guaranteeing equitable road usage and ensuring the optimized revenue generation.

We have developed and continuously enhance an exceptionally versatile solution that combines **Enforcement infrastructure** and the **Enforcement Back-office system.**

SCAN ME

More information:
qrfy.com/p/2023_enf

- **Enforcement infrastructure**
  Its elements are integrated and operated within the localized road infrastructure, such as tolled road networks.

- **Enforcement Back-office**
  A centralized enforcement system, that handles the majority of data processing and provides supplementary support functions for the enforcement infrastructure.

The Enforcement infrastructure is an integral platform of the Enforcement system, that encompasses various types of enforcement equipment tailored to specific needs, for which we have developed specific individual products.

Enforcement infrastructure

- Stationary enforcement gantry
- Portable enforcement set
- Mobile enforcement vehicle
- Handheld enforcement equipment

Stationary enforcement gantry usually as a Roadside Equipment **(RSE)** consists of a smart cameraset installed in a ruggedized all weather-proof housing, installed on the gantry portal (construction) above the road. It includes an ANPR camera and a context camera, an illuminator (e.g., infrared or other suitable), and a computer module with AI functions. For some installations it includes also the DSRC transceiver for reading on-board units. RSE may be also equipped with dynamic weights that provides weight-in-motion functionality. Even though that the RSE is considered primarily as a Stationary enforcement gantry, it might be configured as a movable system that fully supports the relocation, since the main RSE unit could be installed on the portal (construction) without any tools in maximum 30 minutes.

Portable enforcement set was designed as lightweight, highly portable type of equipment, with optimised possibility to be effectively used for daily work in the field with focus to operate no limitation on the terrain either on or near the road. The portable enforcement set includes the smartcamera unit placed in a special protective enclosure, that is during the operation mounted in not more than 15 minutes on a foldable and fully adjustable lightweight tripod. Except smart camera unit, includes each set a power connection box

that, except sufficient power for autonomous operations, includes also other components e.g., for power management, data communication etc.

Mobile enforcement vehicle (MEV) is an enforcement technology built into the vehicle and except ANPR cameras and/or DSCR transceivers it includes the power management, communication equipment and antennas and usually the mobile office equipment.

Handheld enforcement equipment is built in a ruggedized mobile device, that is equipped with an installed application, capable of performing the vehicle checking based on the ANPR functionality. The installed software allows to perform correct identification of vehicle registration numbers and vehicle's countries of registration either while stationary or slowly driving in a speed up to 30km/h. Furthermore, the Handheld enforcement equipment may be also used through the dedicated ToolBox application that allows through the wireless connection, to set up and configure or simply check the status of other enforcement components.

Enforcement Back-office

(EFBO) acts as the central system responsible for **automated collection, processing, and evaluation of data** from the enforcement infrastructure. One of its primary functions is to identify individuals who fail to meet the legal obligations (e.g., toll payment) and generate **official evidence** for each confirmed incident, which can then be automatically sent to the relevant authorities.

Main modules:

• Data pre-processing

• Automatic data processing

• Manual data processing

• Enforcement infrastructure management

• Incident management

• Configuration

Furthermore, the EFBO is used as a second layer of AI algorithms (in addition to those used in enforcement infrastructure), either to enhance input data, such as identification of further vehicle attributes like vehicle manufacturer, model and colour,

or to detect fastened seatbelts, mobile phone usage or detection of biometric data or simply perform additional analysis of data identified directly by the enforcement infrastructure such as additional vehicle classification.

The overall enforcement process begins with the vehicle passage detection by an enforcement infrastructure and its processing into the compiled uniform output, that is transferred in real-time to EFBO, where is further processed as an **enforcement event**. The vast majority of the enforcement events are processed completely automatically with no need to process them anyhow manually further. The ratio of automatically processed enforcement events is usually increased thanks to the **integration to national vehicle registers and/or Eucaris**, that provide an additional set of data, that are used by the evaluation algorithm within the Automatic data processing module.

For any enforcement event, that requires **manual intervention**, the user needs to either correct and/or approve the input data (e.g. vehicle LPN, category, number of axles where applicable, etc.). Other user, typically with different/higher user role, might be afterwards responsible for additional input data quality check and for approval or rejection of the enforcement event processing result, that was preliminary set by the system automatically.

Moreover, **AI based algorithms** are used in EFBO data processing, to significantly reduce the manual processing load, such as by application of Levenshtein distance method to decrease the most common mistakes from the vehicle identification or also the application of the automatic incident classification.

For any of the detected/recognized attributes (licence plate numbers, human faces, etc.) it could be, immediately after the evaluation, especially if no incident or legislation breach has been detected, applied the anonymization and/or retention process, or simply made those data unidentifiable.