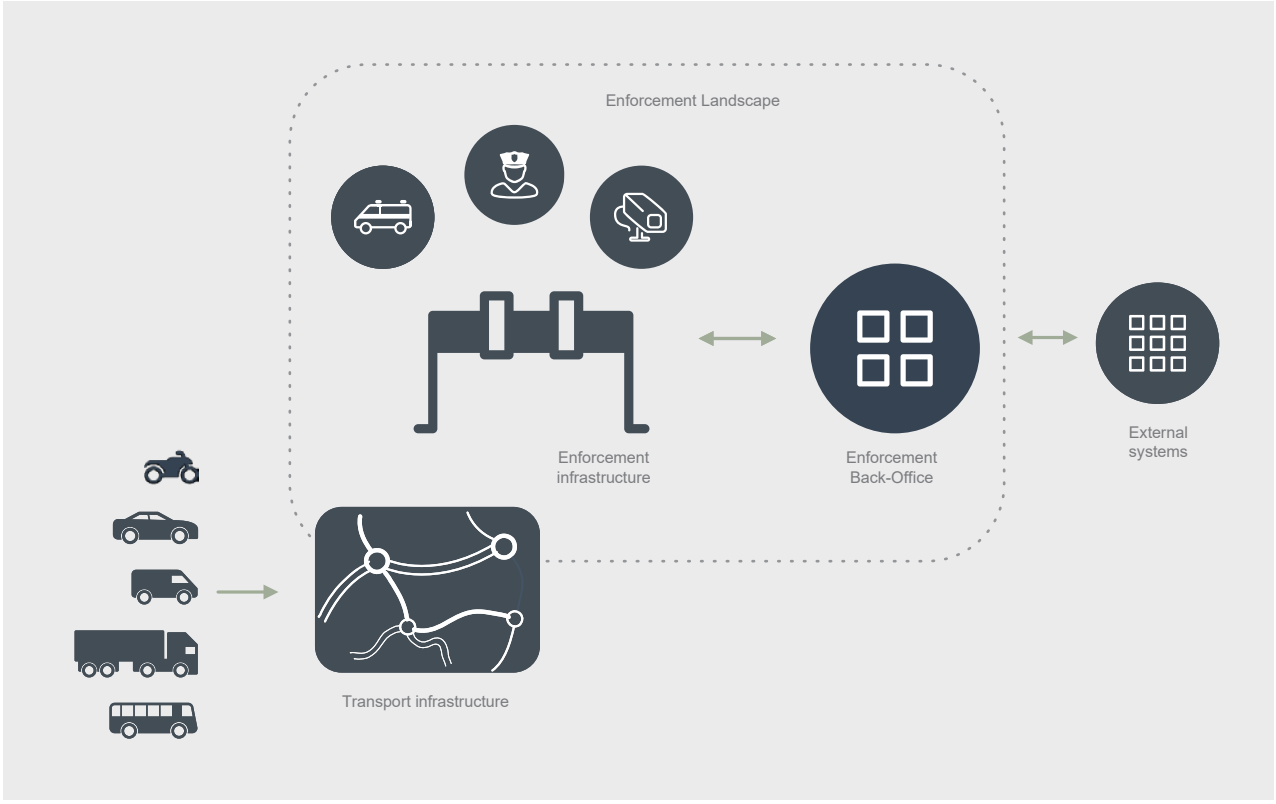
Platform

Toll Enforcement (ENF)

SKYTOLL

Enforcement is central to maintaining the integrity of primary operating systems, such as tolling, as well as interrelated systems, and is key to guaranteeing fair road usage and revenue optimisation.



We have developed and continue to 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 localised road infrastructure, such as tolled road networks.

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

The Enforcement infrastructure is integral to the Enforcement system. It includes various types of enforcement equipment that are tailored to specific needs, and for which we have developed individual products.

Enforcement infrastructure

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

Stationary enforcement gantry as a hub for Roadside Equipment **(RSE)** consists of a smart camera-set housed in a rugged weather-proof casing that is installed on the gantry portal (construction) above the road. It includes an ANPR camera, a context camera, an illuminator (e.g., infrared) and a computer module with AI functionality. Some installations also include a DSRC transceiver for reading on-board units. RSE may also be equipped with dynamic weights that provides weight-in-motion functionality. Even though the RSE is considered primarily as a stationary enforcement gantry, it can be configured as a movable system that can be easily relocated since the main RSE unit can be installed on the portal (construction) in under 30 minutes with no need for tools.

Portable enforcement set was designed as lightweight, highly portable equipment which is optimised for daily operation and can be used on or near the road. The portable enforcement set includes a smart-camera unit that is placed in a protective casing. It takes just 15 minutes to mount the camera on a foldable and fully adjustable lightweight tripod. The smart camera unit includes in each set a power connection box that supplies sufficient power for autonomous operations and includes additional components for e.g., power management, data communication etc.

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

Handheld enforcement equipment is installed in a rugged mobile device, that is equipped with an application that can perform vehicle checks based on ANPR functionality. The installed software allows correct identification of vehicle registration numbers and countries of registration either while the vehicle is stationary or driving slowly at a speed of up to 30km/h. Handheld enforcement equipment may also be used with a dedicated ToolBox application that enables set up, configuration and status confirmation of other enforcement components using a wireless connection.

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 legal obligations (e.g., toll payment) and to generate **official evidence** for each confirmed incident that can be sent automatically to the relevant authorities.

Main modules:

- Data pre-processing
- Automatic data processing
- Manual data processing
- Enforcement infrastructure management
- Incident management
- Configuration

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

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

The enforcement process begins with vehicle passage detection by enforcement infrastructure that is then transferred in real-time to EFBO, where it is recorded as an **enforcement event**. The vast majority of enforcement events are processed completely automatically with no need for manual intervention. The number of enforcement events processed automatically usually increases thanks to **integration with national vehicle registers and/or Eucaris**. This provides 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 users, typically with higher permissions might also have to input be additional data, perform quality checks and approve or reject the enforcement event processing outcome that was originally set automatically by the system.

AI-based algorithms are used in EFBO data processing to significantly reduce manual load processing such as by applying the Levenshtein distance method to reduce common mistakes from vehicle identification, or by applying automatic incident classification.

If no incident or breach of legislation is found after evaluation, any detected or recognised attributes like licence plate numbers, human faces, etc. would undergo anonymisation and/or retention process, or would simply be made unidentifiable.