



Business Introduction

Presentation of solutions and services



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03

Introduction to SkyToll

COMPLEX SOLUTION PROVIDER

SkyToll designed the complex service of electronic toll collection, including building and integrating system domains and service organisation, defining efficient operational processes and operating the complex service of electronic toll collection in Slovakia, Czech Republic and the electronic vignette system in Slovenia.

■ Design

Build ■

■ Operate

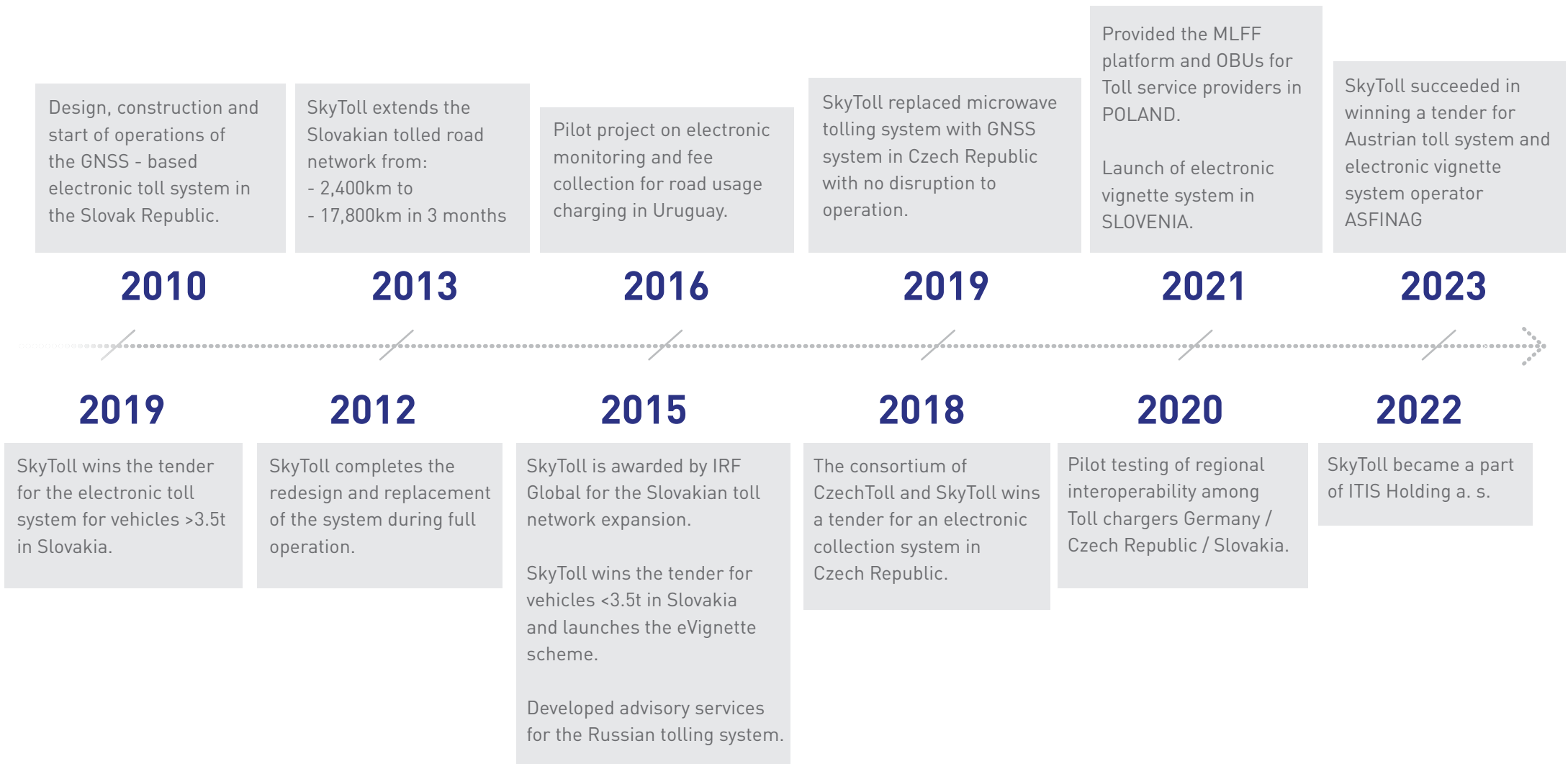
Maintain ■

■ Finance

Innovate ■

04

Key milestone in our 14 year history



05 Project References

		TOLL ROAD CATEGORIES	TOLLNETWORK	PERIOD OF OPERATION
Slovakia Design, development, funding, operation and maintenance of a complex electronic toll collection service	A combination of satellite GNSS/GPS technology, GSM/GPRS technology and microwave (DRSC) technology	Motorways, expressways, first, second, and third class roads	17 611,2 * km	13 Years
Czechia Design, development, funding, operation and maintenance of a complex electronic toll collection service	A combination of satellite GNSS/GPS technology, GSM/GPRS technology and microwave (DRSC) technology	Motorways, expressways and first class roads	2 866 km	10 Years
Slovakia The service of electronic collection and record of payments for motorway vignettes for the use of the specified road sections	Video Tolling / Time based	Motorways and expressways	752 km	5+3 Years
Slovenia Electronic vignettes system delivery and IT operation	Video Tolling / Time based	Motorways and expressways	618 km	5+3 Years
Russia Design of electronic toll collection	Combination of satellite GNSS/GPS, GLONASS, GSM/GPRS technology	Federal roads	50 000 km	
Uruguay Pilot for electronic monitoring and road charging system as a part of consulting services	A combination of satellite GNSS/GPS, GSM/GPRS and microwave (RFID) technology + Video tolling	Primary, secondary, tertiary roads	8 200 km	

*as of 1 January 2023: 8,242,314 km

06 Solution and Services



Advisory services

Using its experience in the field, SkyToll offers advisory services for every key stage throughout the creation of an ETC system:

- **Complex business and integrated design**
- **System development and set up of SLA parameters**
- Organisation development and set up of business processes
- Replacement of the ETC systems without disrupting toll collection
- **ETC and ITS systems integration** (Payment systems, State registers, Enforcement systems, Telematics systems, Accounting systems, Integration with toll service providers)
- Complex test campaigns
- Launch and operational support



Road usage charging

Thanks to strong experience with ITS systems, SkyToll has a solid ETC product portfolio:

- Technology agnostic ETC system back office suitable for GNSS (Satellite-based) ANPR (Video-based) schemes
- eVignette system (electronic time based)
- **Enforcement and monitoring system**
- **Automatic incident detection solutions**
- OBU supply
- OBU Smartphone app with support from DSRC tag
- Business intelligence



ETC scheme operation

SkyToll can manage the commercial and technological operations of an ETC scheme:

- Operational organisation management
- System management
- **Maintenance of the infrastructure and back office**
- Continuous technology innovation
- **Technical support**
- **Customer support**
- **Commercial operations** (Front office, Back Office, Enforcement Back office)
- Service delivery
- Data analysis
- Stakeholder relationship management

07 Business areas

ITS Platform



Toll Collection

- Satellite based toll collection (OBU)
- Video-based toll collection (ANPR)
- DSRC/RFID toll collection

Traffic Monitoring

- Real-Time Monitoring
- Traffic Engineering Monitoring
- Detection of Traffic Rule Violations
- Transport Surveillance
- Automatic Incident Detection
- Data Analysis
- Reporting

Enforcement

- Stationary gantries
- Weigh in motion
- Mobile enforcement vehicles
- Speed enforcement
- Machine learning
- Manual processing

08

Toll collection

Management of all activities starting with collection of information about usage of toll roads and customer care, through to rating and billing, and logistics of On-Board Units.

Toll Collection

Satellite-based toll collection (OBU)

Video-based toll collection (ANPR)

DSRC/RFID toll collection

Traffic Monitoring

Real-Time Monitoring

Traffic Engineering Monitoring

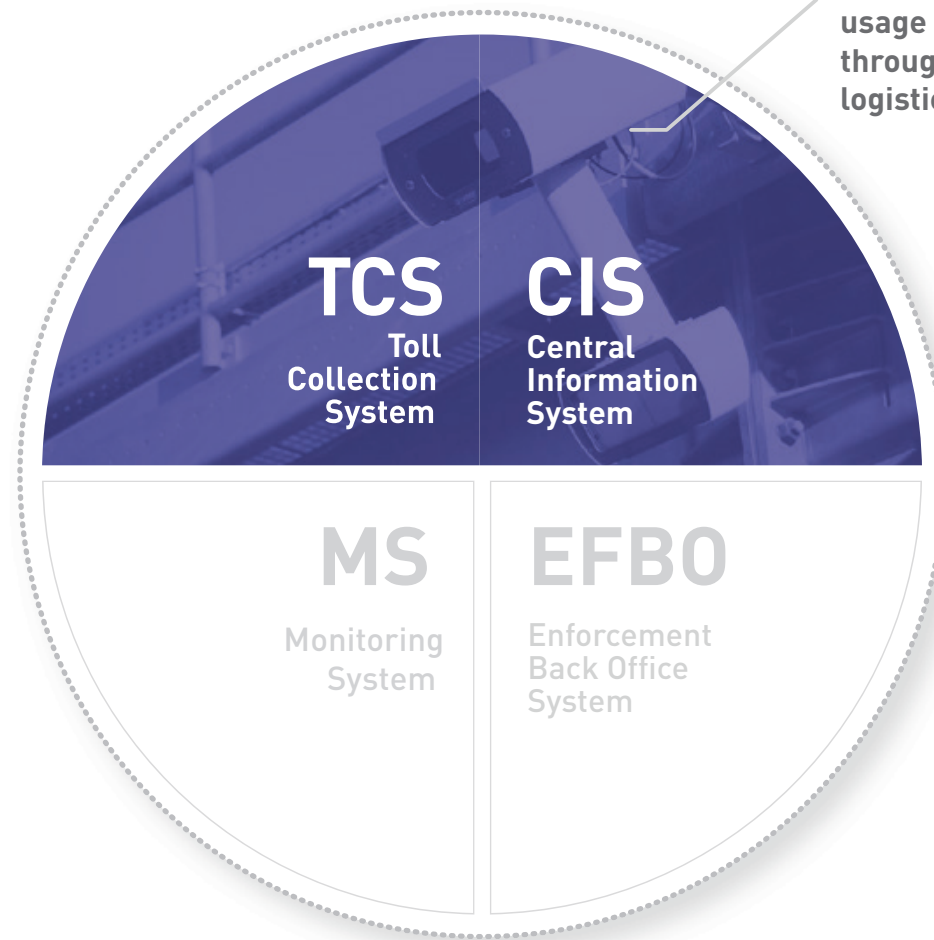
Detection of Traffic Rule Violations

Transport Surveillance

Automatic Incident Detection

Data Analysis

Reporting



Enforcement

Stationary gantries

Weigh in motion

Mobile enforcement vehicles

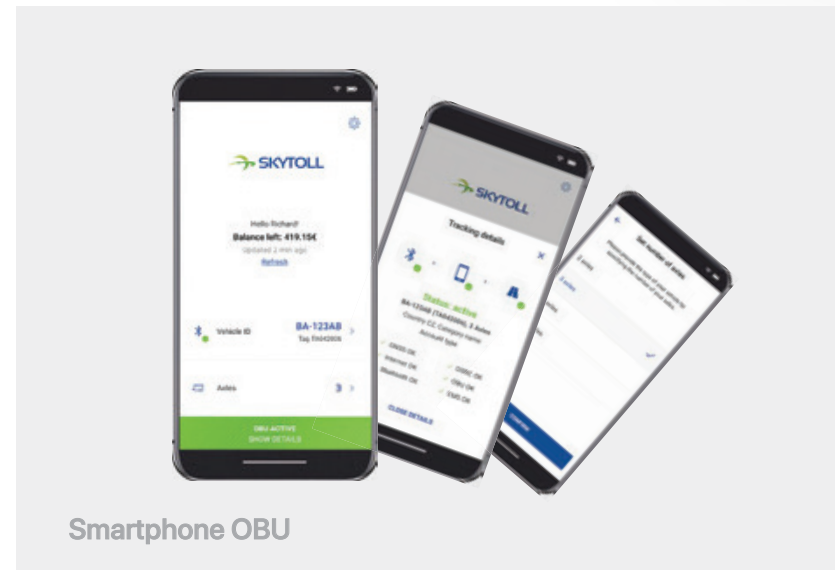
Speed enforcement

Machine learning

Manual processing

Satellite-based Solutions (GNSS)

The MLFF system is based on GNSS technology. Toll collection is **performed using GNSS** with the supplementary use of Route Tickets. Enforcement uses **ANPR technology (in combination with DSRC when required)**.



Smartphone OBU

GNSS technology allows toll collection and enforcement in **free traffic flow in multiple lanes** with no need to change the speed or the direction of traffic.

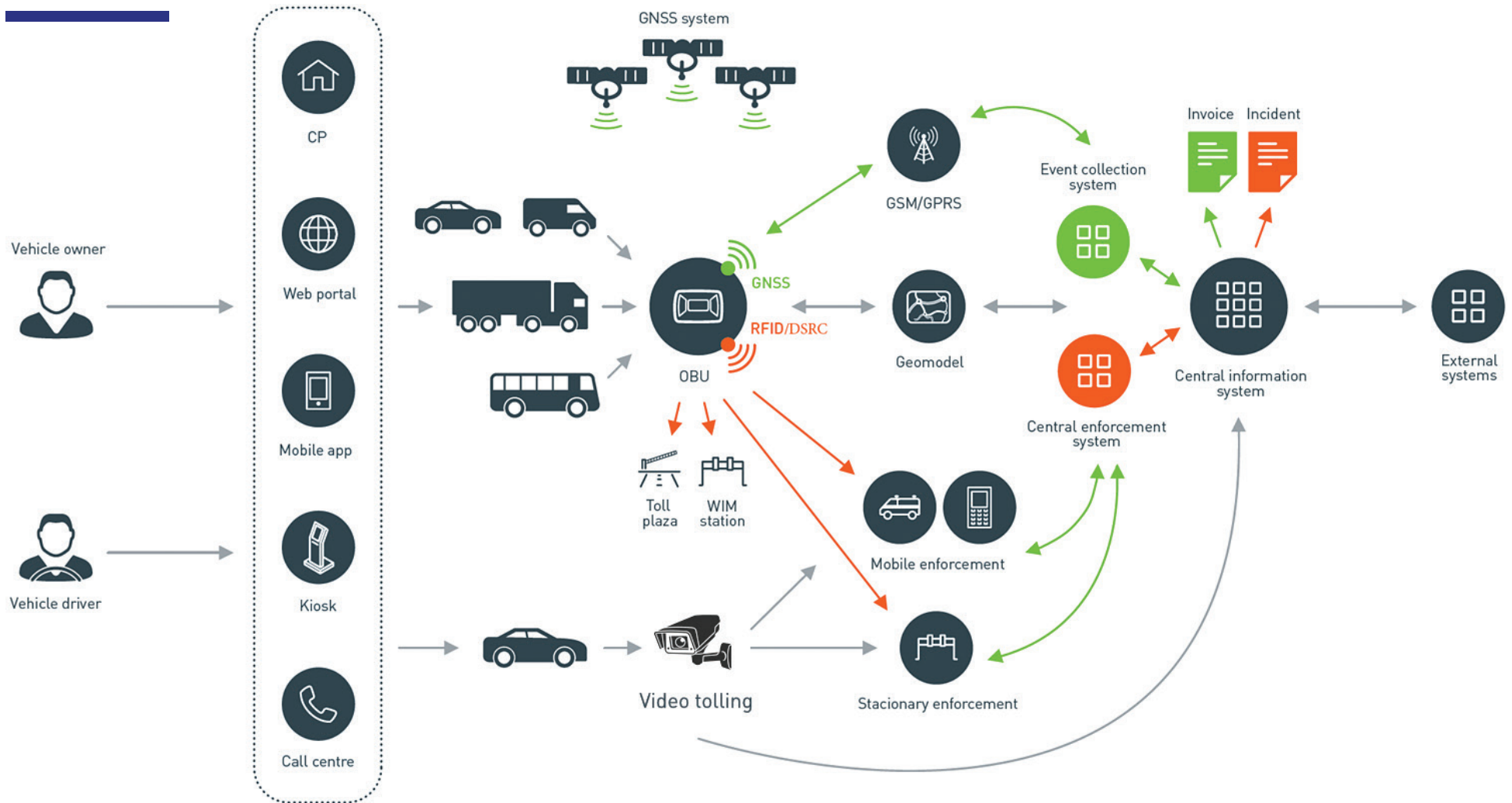
GNSS technology enables system flexibility so upgrades relating to changing requirements in toll collection can be implemented without the costly and time-consuming task of constructing new infrastructure.

The on-board unit is a key component of the Electronic Toll Collection system (Smartphone OBU are also available). The OBU are easy to install and can be fitted by the vehicle's driver.



On-Board Unit

10 ETC Components



11 Aim of the Pilot Project

The purpose of electronic toll collection is to generate revenue to compensate for damage caused by commercial vehicles on highways and trunk roads and to monitor primary and – eventually – secondary roads. It involves complex systems and operation so we believe that early sharing of knowledge is one of the most important factors in a project (<https://youtu.be/ngU7pB84tFA>).



Scan me!



¡Escanéame!

As the technology for satellite-based Electronic Toll Collection Systems is unique and the final system will affect many road users over a long period of time, we offer a Pilot project to allow stakeholders to evaluate the benefits of our system at minimal cost.

The goal of the Pilot project is to demonstrate the flexibility of the satellite-based Electronic Toll Collection System and the speed at which it can be built, before decisions about future technology have to be taken.

12 Video Tolling (ANPR)

This is a form of electronic toll collection, which uses video or still images of a vehicle's license plate to identify if it is liable to pay a road toll.

Instead of road-side cash or payment card methods the system is used in conjunction with "all electronic" open road tolling to allow drivers without an electronic device to use the toll road.

Provision of a charging service according to identified LPN.

Provision of Customer and Billing services.

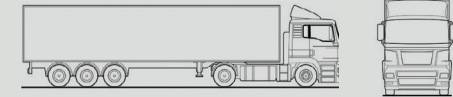
Video Tolling technology can be used for time-based tolling as well (sol called Electronic vignettes where ANPR is used only for the purpose of enforcement)



CA 7890 BT

Front number plate
CA 7890 BT

Country code
EU-BULGARIA



Length	Height	Width
1400 cm	430 cm	250 cm



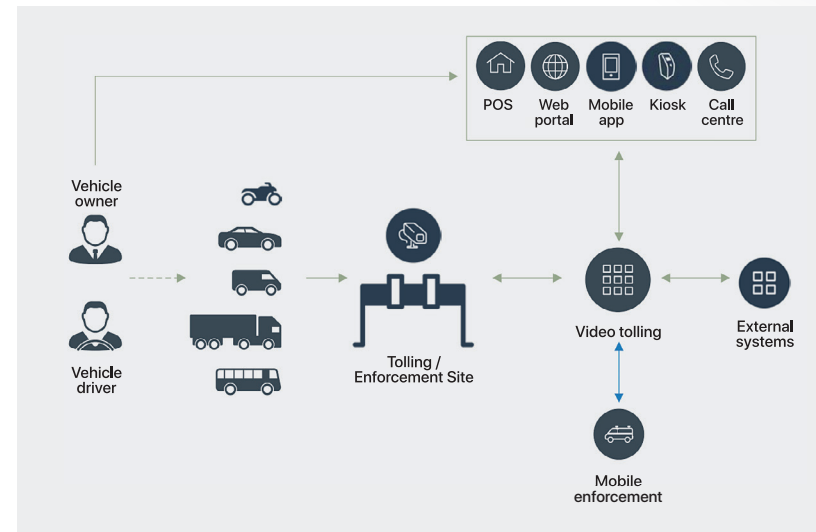
13 Video Tolling Variations

Road tolling/ Tunnel charging has multiple variations of charging:

- Single Journey
- Multiple Journeys
- Distance / Sections
- Time (Day, Week, 10 days, 1 month, 365 Days and others which are subject to configuration)

Sales Channels

- Point Of Sales
- Web Self Service
- Mobile Application
- Kiosk Device
- Integration with 3rd parties (Petrol stations, Post...)
- Purchase by QR code



Open mode

Gantries are located at the entry to toll sections. Each type of gantry takes into account the technical parameters of the road, including the number of lanes needed to record vehicle passages.

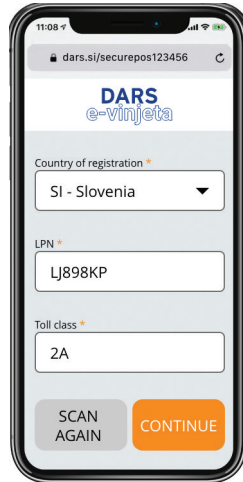
Closed mode

Gantries are located at all entry and exit points (roads, intersections) of a toll area. After recording the entry and exit points, the system evaluates the route and creates a vehicle passage with the appropriate parameters needed for further processing.

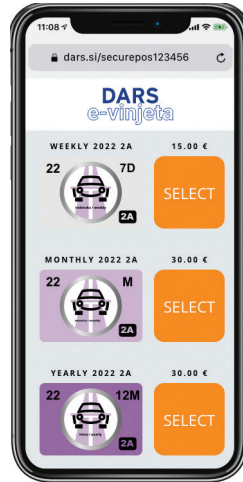
14 Purchase by QR



Vehicle



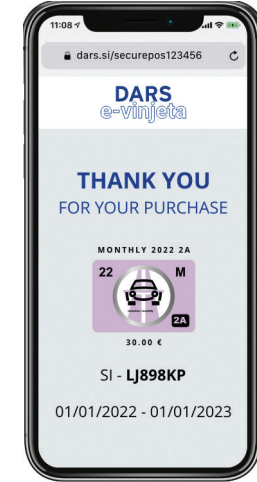
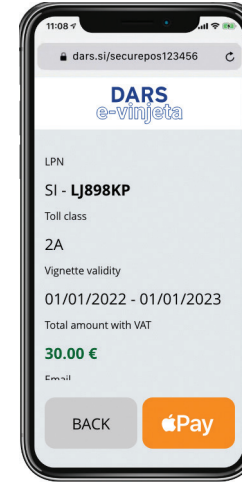
Vignette



Contact



Payment

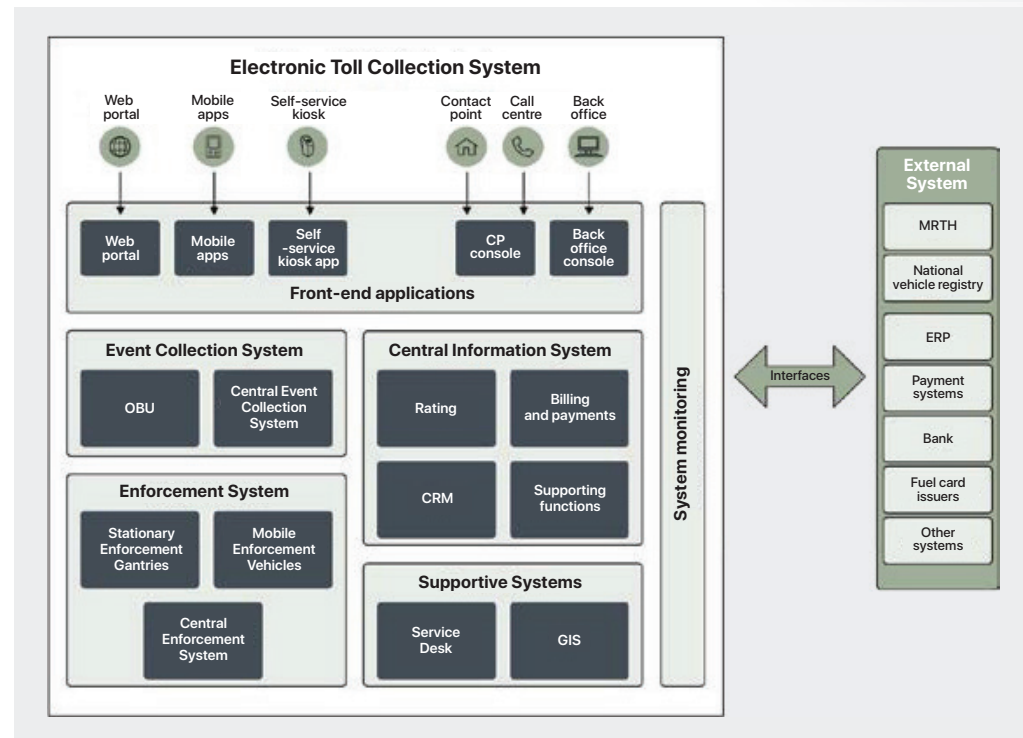


15 The Central Information System

The Central Information System supports all business activities (Business Support System – BSS) and is optimised for companies specialising in road tolling.

Its functions cover all essential activities starting with customer care, through charging for toll road usage, payment processing, issuing route tickets and finishing with clearing and settlement.

The Central Information System conducts quality assurance procedures and data consistency verification for toll collection and settlement during both data reception and data processing.



In terms of business processes, the Central Information System covers business and operational activities for operating and administering toll services, including the functions of a toll charger.

The system is regularly divided into following functional domains

- **CRM**
- **Toll Collection (Rating)**
- **Payments and Clearing**
- **(Billing) Supportive Domain**

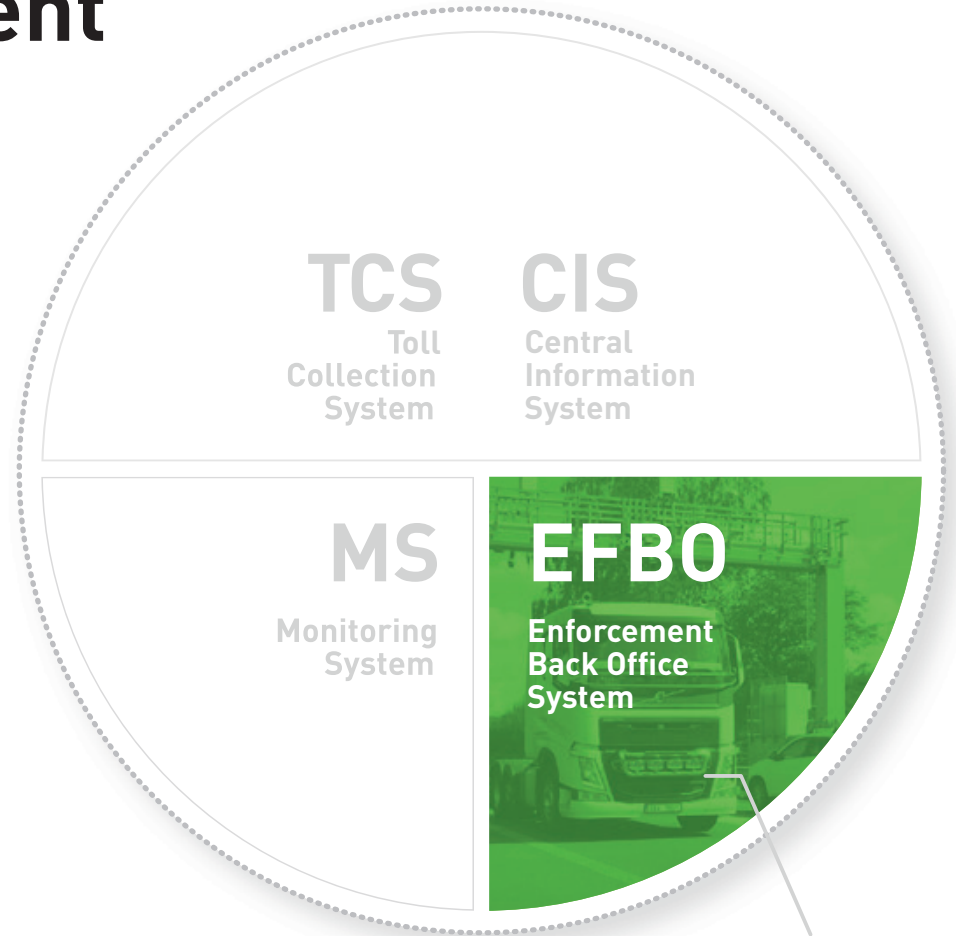
16 Enforcement System

Toll Collection

- Satellite-based toll collection (OBU)
- Video-based toll collection (ANPR)
- DSRC/RFID toll collection

Traffic Monitoring

- Real-Time Monitoring
- Traffic Engineering Monitoring
- Detection of Traffic Rule Violations
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- Reporting



Enforcement

- Stationary gantries
- Weigh in motion
- Mobile enforcement vehicles
- Speed enforcement
- Machine learning
- Manual processing

The Enforcement Back Office (EFBO) receives records from all control gantries and MEVs and automatically processes them using several processes. Records where automatic evaluation was not completed are forwarded to manual processing.

17 Enforcement System

The Enforcement System ensures data collection and data checks relating to usage comply with obligations linked with toll collection. Usage data relates to real usage of the toll road network captured by enforcement equipment, i.e. pictures and classification data about all vehicles that pass by the enforcement gantries and mobile enforcement vehicles.



The Enforcement System is composed of the following devices and systems:

Enforcement gantries

Stationary devices that are permanently placed at one checkpoint. They are used at places with highest traffic concentration. Gantries use cameras and components for vehicle categorisation and for verifying the technical parameters of a vehicle (licence plate, vehicle category and the number of axles).

Mobile enforcement vehicles

Mobile enforcement vehicles are equipped with mobile enforcement devices, which are designed to function regardless of the environmental and technical conditions of the vehicle. Supporting hardware includes ANPR cameras with integrated illumination installed as a roof unit mounted on a roof rack.

Central Enforcement System

The Central Enforcement System gathers, processes and assesses data from enforcement gantries and mobile enforcement vehicles and the enforcement parts of the MLFF System. It is one of the main elements of violators' identification and is also used for reporting violators to the competent bodies.

18 Enforcement system

- Automatic Number Plate Recognition including country of registration
- Images from cameras including date and time stamp
- Identification of vehicle category
- Identification of vehicle manufacturer, model and colour
- Identification of the number of axles
- Identification of the vehicle dimensions and 3D model using laser scanners
- Identification of the direction of driving
- Weight measurements using dynamic weight in motion
- Certified speed measurement using certified radars



19 Weigh in Motion

Weigh in motion for direct penalties improves road safety and protects against premature degradation of road infrastructure caused by overloading heavy commercial vehicles.



Weigh-in-Motion (WIM) requires installation of several inductive loops and weighing sensors directly into the road surface (the more the better for accuracy). There are also requirements on road surface quality, and regular checks and recalibrations (can be automated) that are needed.

The interface shows a truck on a road with a 'WEIGHT' warning icon. Below it is a 'FILL WEIGHING FORM' button and a 'FOLLOW' button. The form contains the following data:

- WIM system: @ 80012 11001 68000
- Vehicle: J 316
- ID: 3307987
- Type: 01000001 0101
- Date: 1
- Direction: 01 (A-D)
- Invoice vehicle number: K983429 (07384)
- Quantity: 801 452 (kg/axle)
- Speed: 45.00 (km/h)
- Class: 010010
- Class: 010010 (kg)
- Class: 010010 (kg)

The weight breakdown diagram shows the following axle weights:

- 250 cm axle: 0 900 kg
- 300 cm axle: 16 960 kg
- 500 cm axle: 7 100 kg
- 300 cm axle: 7 100 kg
- 300 cm axle: 7 100 kg

Although the cost of the system, including installation and maintenance expenses, is relatively high there is proof that the payback period is less than one year. There are basically two principles – the widely used piezoelectric and minor optoelectric, which exploits the measurable deformation of optical fibers installed in the road surface. Skytoll's AID exploits the mature piezoelectric principle based on best-in-class technology. There can be various configurations installed depending on the target application.

The measurement of weight load can be done per wheel, axle and overall vehicle (gross) without any disturbance to traffic flow (i.e. at normal travelling speeds).

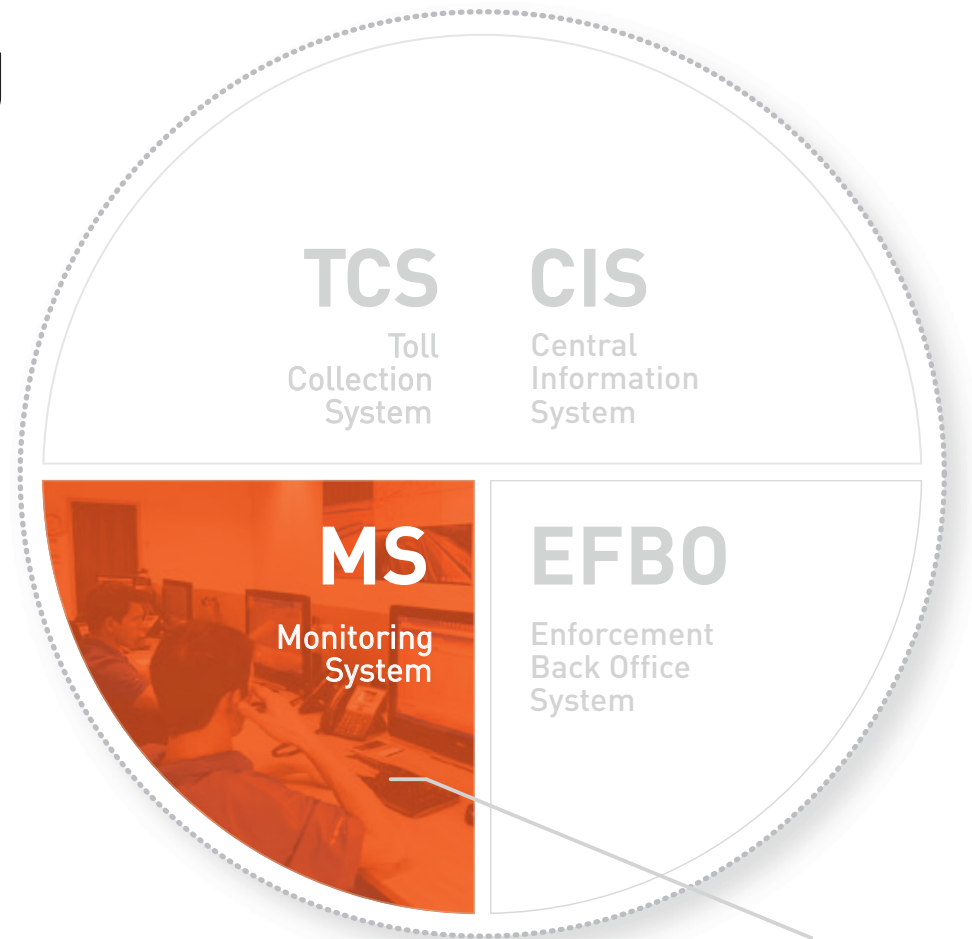
20 Traffic monitoring

Toll Collection

- Satellite-based toll collection (OBU)
- Video-based toll collection (ANPR)
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Traffic Monitoring

- Real-Time Monitoring
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Proactive monitoring system that helps to control traffic infractions, avoid traffic accidents, detect potentially dangerous drivers, and predict or estimate traffic conditions based on historical data.

Enforcement

- Stationary gantries
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21 Traffic Monitoring Areas

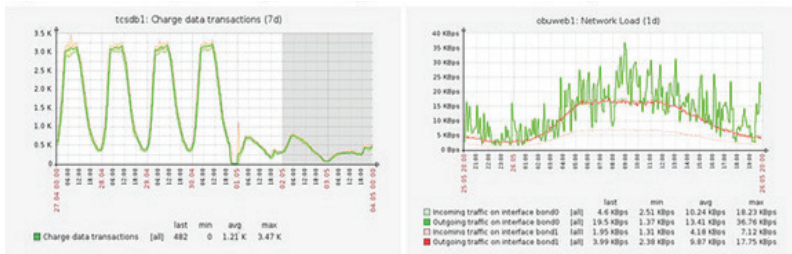
An overall system is a valuable source of data, not only for customer data, but particularly for engineering data that can be collected and evaluated from various areas using the latest technology:

Traffic monitoring using all ITS platform data

- Real-time monitoring of the road network
- Providing data for traffic engineering
- Identifying traffic rule violations
- Transport surveillance
- **Automatic traffic incident detection**



22 Traffic Monitoring Areas



Detection of Traffic Rule Violations

- Speed / weight limit violations
- Driving time / rest periods
- Road user restrictions
- VAT fraud identification / Cabotage rule violations

Traffic Engineering Data

- Predict traffic flow
- Effective inputs for construction of new roads
- Effective incident response and traffic management
- Provision of evidence to support incident investigation

Real-Time Monitoring

- Traffic counting and traffic intensity, passenger counting
- Traffic jams caused by accidents
- Reduced visibility, detours, alternate routes
- Lane closure caused by road construction

Transport Surveillance

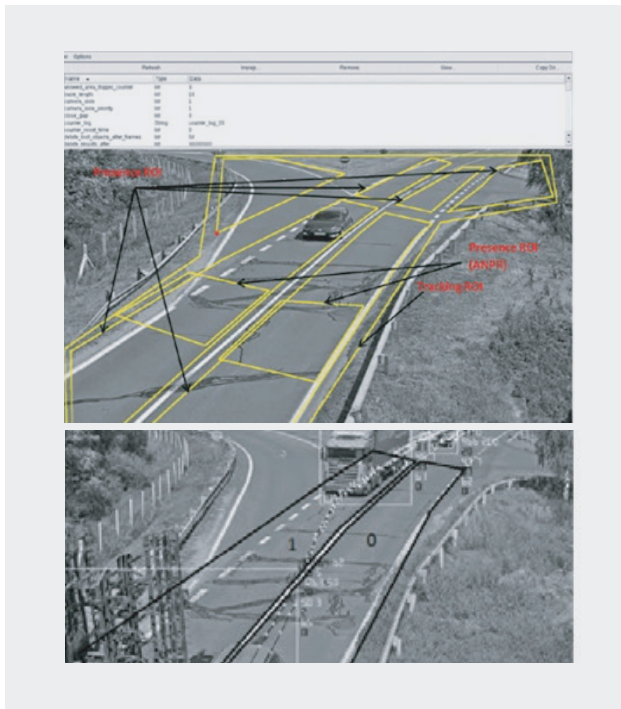
- Monitoring of oversized and dangerous goods vehicles
- Identification of illegal forms of transport
- Identification of illegal carousel transport
- Identification traffic incidents

23 Automatic Incident Detection

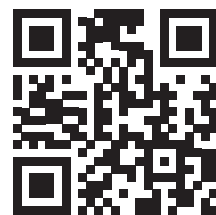
Technology used for traffic monitoring became mature enough and cost-effective enough that wide deployment has been possible in recent years. The core capability of the Automatic Incident Detection (AID) System is to combine information from installed equipment to produce evidence of a detected incident.

The system recognises laws in the target country so is able to substantially reduce dangerous traffic rules violations.

Traffic rules infringements made by drivers are fined using the automated system, which produces and sends printed (hard copy) documentation of the driving offence to car owner.



- | | |
|--|---|
| <ul style="list-style-type: none"> • MOTION TRACKING & ANALYSIS • SPEED MEASUREMENT • OVERWEIGHT • STOP SIGN CROSSING • RED LIGHT VIOLATION • WRONG WAY OR REVERSING • NO STOPPING SIGN CHECK • WRONG WAY OR REVERSING | <ul style="list-style-type: none"> • U TURN AND FORBIDDEN TURN CROSSING • SOLID LINE CROSSING • RAILROAD CROSSING • FORBIDDEN HEAVY WEIGHT VEHICLES SIGN CROSSING • HIGH AND LOW SPEED MONITORING • LOW EMISSION ZONE |
|--|---|



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