

Overview of GNSS-Based Tolling Deployments in Europe



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ITS UK Road User Charging Forum

Photo by Anton Shkaplerov, courtesy of ROSCOSMOS

Multi-Lane Free Flow Tolling with DSRC in Austria

Since 2004, Limited to Motorways and Expressways



Multi-Lane Free Flow Tolling with GNSS

Vehicles are tolled on any road category



Multi-Lane Free Flow Tolling with GNSS

Overview of Toll Data Collection

FRONT-END

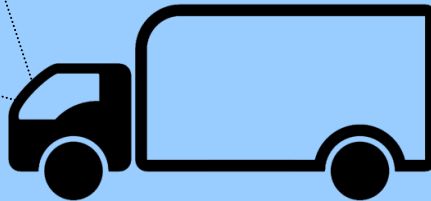
GNSS



OBU



Tolled Vehicle



Cellular
Network



OBU
Proxy



BACK-END

Tolling Data
Back Office



GNSS
Signals

Vehicle Position
(via OBU)

GSM /
GPRS

Server
Hardware



Multi-Lane Free Flow Tolling with GNSS

Overview of Toll Data Collection

Switzerland 2001

Germany 2005

Slovakia 2010

Hungary 2013

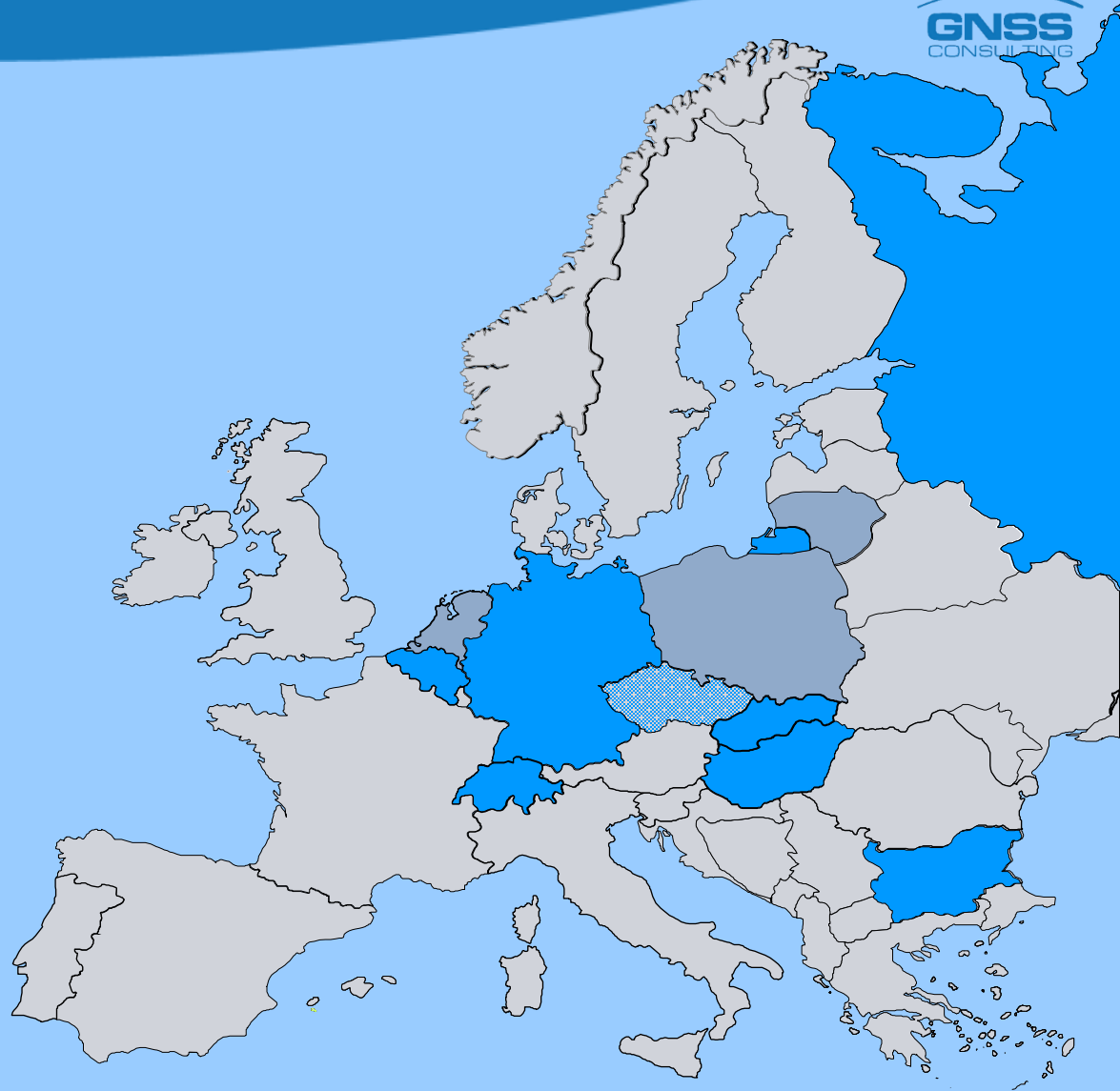
Russia 2015

Belgium 2016

Bulgaria 2020

Czech Republic 2019

Current Tenders



Germany: Introduced Toll on 12,000 km in 2005

Annual Toll Revenue from €4 billion to €7.5 billion!

In 2018, the network expanded from 15,000 km to 52,000 km



Slovakia: First Country to Toll ALL Major Roads

Also the first to have “plug & play OBU” (mandatory)

Approximately 2,500 kilometers, of which 1,800 were 1st class roads



Slovakia: First Domain with Major Network Extension

Toll Road Network Expansion in 2014

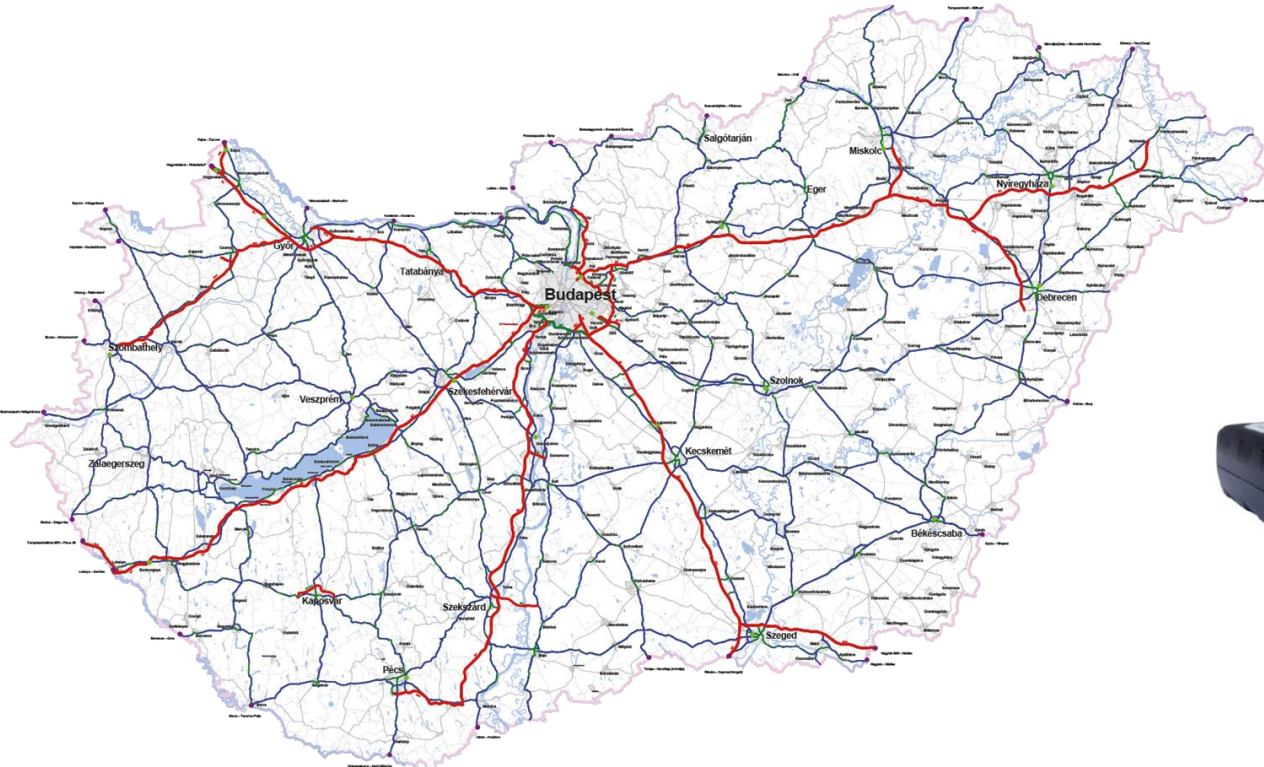
From 2,500 kilometers to 17,000 kilometers in just 3 months



Hungary: First Country to Use Fleet Management

Existing Telematic Devices used on > 6,000 km

Entire Motorway and First Class Network tolled from the beginning
20 Fleet Management Operators became “Toll Declaration Operators”
2462 Toll Sections (“virtual gantries”)



**Basic GPS Tracking
Devices Used**

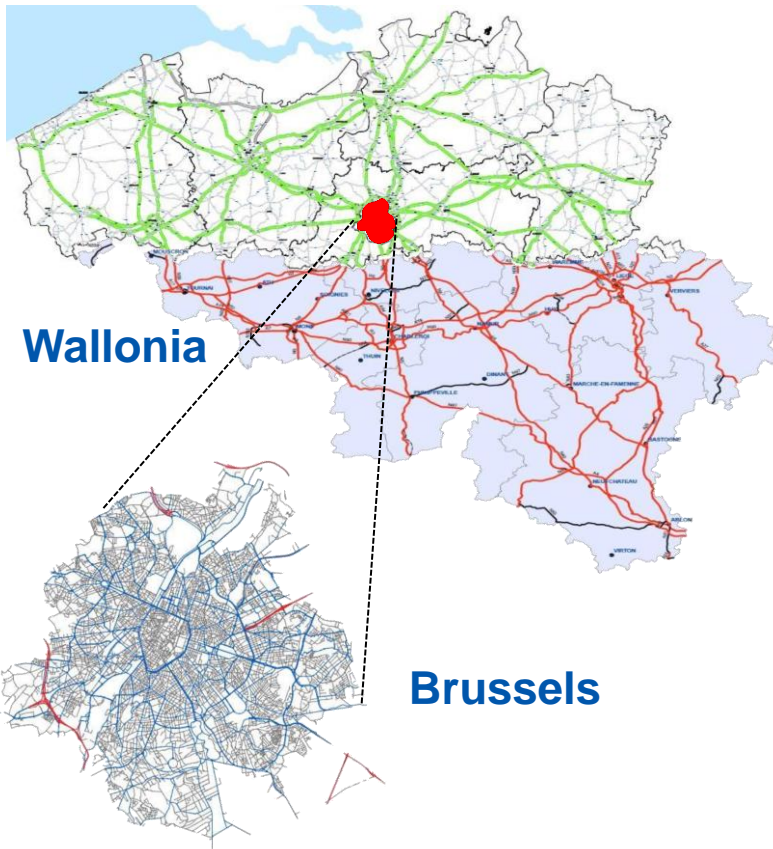
Belgium – Three Different Tolling Systems in One

The First Country to Implement EETS

Three Regions having separate rules, adding to the system complexity.

Flanders

Various EETS OBUs used in Belgium



Default OBU for Belgium (Satellic)



Axxès OBU
(first EETS OBU in operation)



Telepass OBU (Italy)



AS24 OBU
(Total, France)



Tribox OBU
(Eurotoll, France)



"Toll4Europe"
(white label for many brands)

new in 2021:



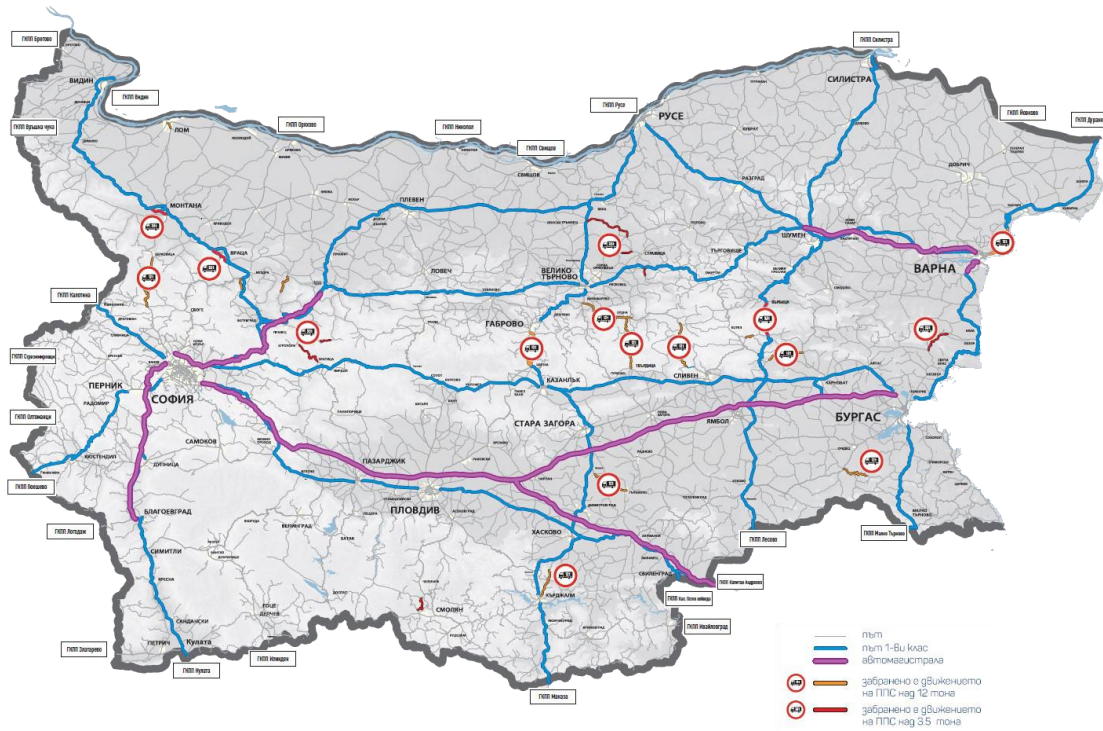
MSTS OBU
(Netherlands)

Bulgaria: Attempted the Hungarian Model (sort of)

The “No Free Lunch” Principle was not overcome

Initially 10,800 km were to be tolled. In the end only 3,111 km are charged.

Only the central components were tendered, service providers were to bring their own OBU – both local fleet management and EETS providers.



The contractor supplied its own OBU and provides for the operations as well.



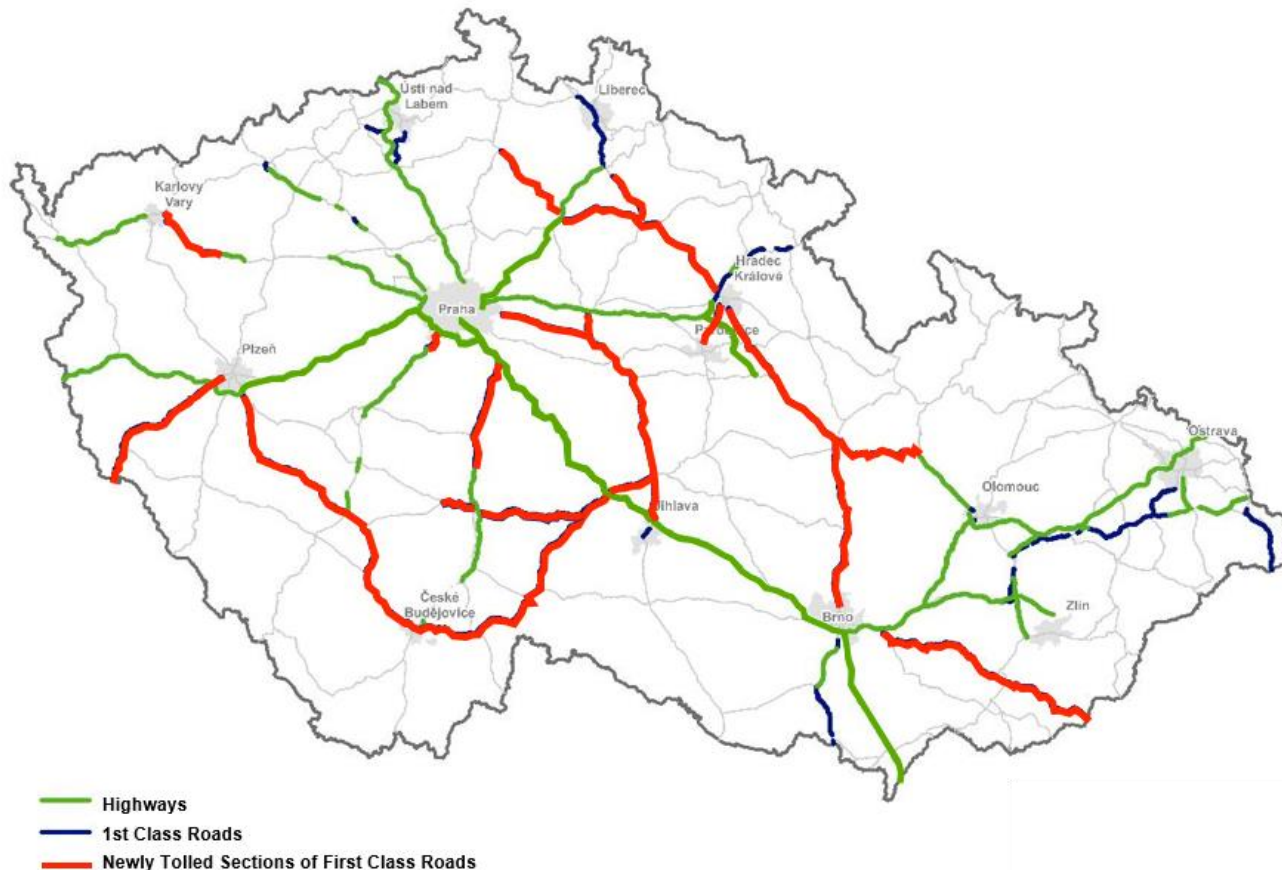
The standard Bulgarian OBU

Czech Republic: Replacing DSRC with GNSS

Much Larger Toll Road Network

Extended from 1,505 km to 2,409 km.

Cost of replacement € 75 million.



OLD DSRC OBU



NEW GNSS OBU



600,000 new OBUs
were delivered

Czech Republic: Replacing DSRC with GNSS

Operation Costs Reduced

Operation costs reduced by €38 million.

Higher toll revenue (+5%) after 1 year (2020), despite the effects of the pandemic.



11 small gantries installed on the first-class roads.

49 existing enforcement gantries were upgraded.

All DSRC gantries were removed.



Lithuania: Tender has been Issued on March 4th, 2021

Deadline for Submission is April 12th, 2021

The tolled road network includes all major highways, having a total of 1,700km.

Relies on the full interoperability with EETS from the very beginning.

Tender focuses on OBU software requirements rather than on OBU hardware.



Smartphones

(and tablets) will play a central role in detecting and declaring the use of the tolled road network. This could be the first nationwide tolling system that relies on smartphones as On Board Equipment.



More details here: <http://www.gnss-consulting.com/preparations-for-gnss-tolling-in-lithuania/>

Smartphones for GNSS-based tolling

Are they a realistic alternative to On Board Units?

There are good reasons for having standardized OBUs in each vehicle:

- OBUs are specially designed for tolling (e.g. “automotive“)
- Hardware is thoroughly tested to guarantee service levels
- OBUs are relatively inexpensive (€100 and falling)
- Secure storage and transmission of tolling data
- Much higher position accuracy (mounted on windshield)
- No risk of other “apps” interfering with tolling application
- No risk of a virus attacking the hardware
- No excuses, such as “my battery power ran out”
- Automated Toll Enforcement with DSRC interface
- Smartphones are not interoperable, not compliant to EETS
- Simple and straight-forward user interface (think about call center issues!)



GALILEO – the European GNSS

First Operational Satellites Launched in 2011

Full Operational Capacity (FOC) in 2019



Galileo is the Only Civilian-Operated GNSS

The European Commission is in charge!



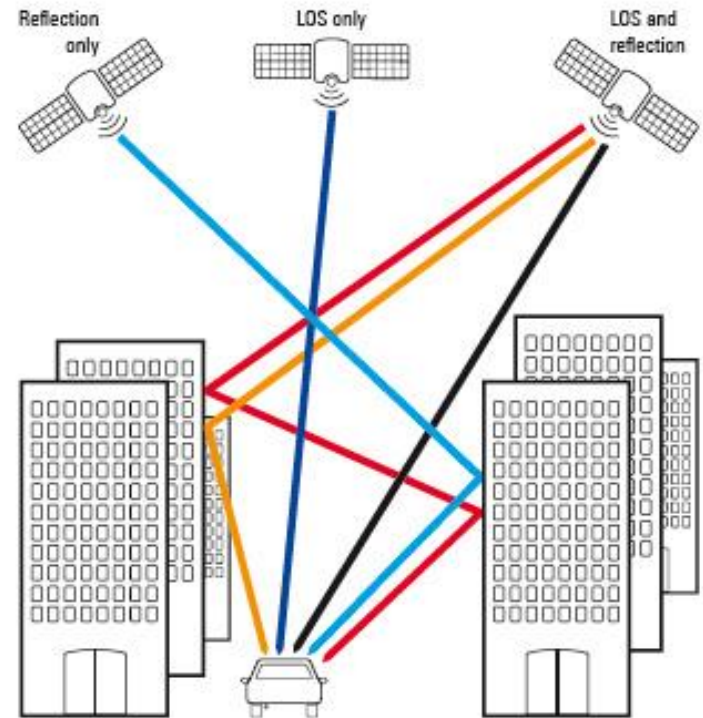
Operator is the European GNSS Agency (EUSPA), based in Prague

Advantages of Multi-Constellation GNSS

Galileo, GPS, BeiDou, Glonass



Multiple GNSS: more satellites visible in harsh environment (urban canyons, tree canopy,...)



Multiple frequencies remove ionospheric errors and mitigate multipath reflections

Advantages of Galileo

especially multi-constellation, multi-frequency GNSS



- No risk of losing positioning service in the case of military intervention
- Signal authentication (OSNMA) will eliminate the risk of spoofing
- Already in the market: virtually all new smartphones are Galileo-enabled
- 19 brands of chipsets use Galileo, representing 95 percent of the market
- European legislation has made Galileo mandatory for tolling
- Most EETS providers already deploy Galileo-enabled OBUs
- Higher position accuracy with multi-constellation receivers
- Sub-meter accuracy with dual-frequency Galileo receivers



**Position yourself on the road
with our expertise**

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