Ministerstwo
Finansów

Krajowa Administracja
Skarbowa

Information on the means of conducting integration tests for OBU and ZSL Operators

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Contents

Dictionary of terms

Term	Description
EGNOS	(Eng. European Geostationary Navigation Overlay Service - the European GPS and GLONASS systems and, in the future, the Galileo system.
GNSS	(Eng. Global Navigation Satellite System - a global navigation system covering the whole Earth. For example: GPS.
GPS	(Eng. Global Positioning System - an American radio navigation system based on satellites.
JSON	(Eng. JavaScript Object Notation) - a data exchange format.
JSON Schema	Defines the data structure in JSON.
OBE	(Eng. On Board Equipment) - a toll system component located in a moving vehicle. For example: mobile devices (equipped with free software provided by KAS), a device providing information for an external locating system (ZSL), and on-board units (OBU) using satellite positioning and data transmission technologies.
OBU	(Eng. On Board Unit - a device installed in a vehicle to collect the Electronic Toll, providing information for the OBU operator's system.
OBU operator	The OBU service management company.
SPOE KAS	Electronic Toll Collection System of the National Tax Administration; e-TOLL
Virtual Gantries	A road area delimited by the characteristic points whose geographical coordinates are located in the Central System. Detecting a vehicle drive-through a virtual gantry takes place by checking whether the vehicle trace registered by the OBU and sent to the Central System crosses the virtual gantry area.
ZSL operator	The ZSL service management company.
ZSL	- a system independent of the SPOE KAS that provides information on vehicle location. They are solutions by commercial companies for tracking the location and movement of vehicle fleets.

1   Introduction

This document describes the procedure of technical verification of location data delivery correctness by the OBU Operator or ZSL Operator in SPOE KAS.

The SPOE KAS is used for toll collection based on GNSS techniques. There must be OBE (On-Board Equipment) installed in the vehicle. Data from OBE devices are transferred to the SPOE KAS via the OBU Operator or ZSL Operator. In SPOE KAS it is also possible to transfer location data by means of a mobile application (this document does not cover this aspect), and the mobile application can also be used to display feedback from SPOE KAS to the driver, e.g. account balance. The figure below (Figure 1) shows the main system components related to the transfer of geolocation data.
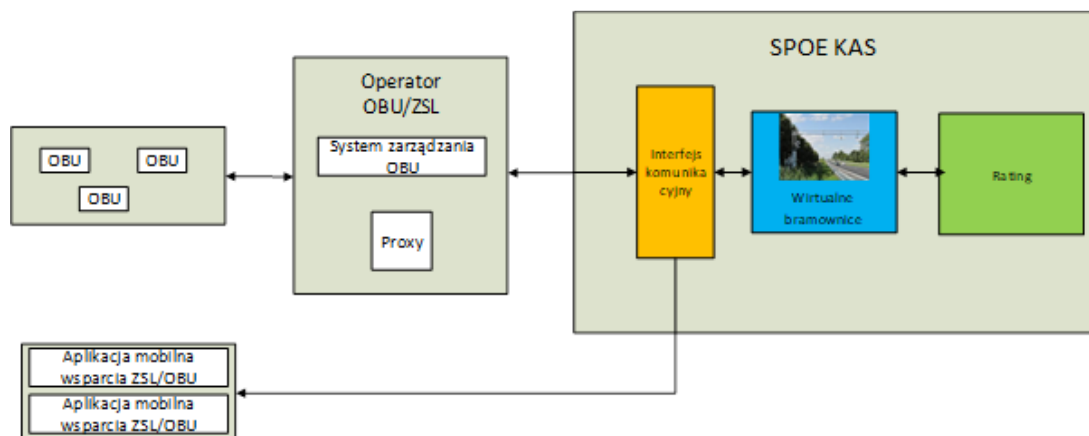

Figure 1 Main system components related to the transfer of geolocation data

2   Verification of technical requirements and the means of transferring geolocation data

Upon registration of the test locating devices in the SPOE KAS, the verification of technical requirements may be commenced. This procedure consists of two stages:
1. Integration: Proxy Server <-> SPOE KAS.
2. *End to end* drive-through tests.

3   Proxy Server <-> SPOE KAS communication

The purpose of the first verification is to check the correctness of data transmission from the Operator's Proxy Server to SPOE KAS in accordance with the technical specification described in *the "Technical requirements for the transfer of geolocation data necessary for the electronic toll collection for OBU and ELS Operators"* document.

This verification is carried out in two stages. The first stage, carried out by the Operator, consists in establishing and checking communication between the Operator's system and SPOE KAS. The second stage, carried out on the part of SPOE KAS, in which the correctness of the messages sent, the interval at which the locations are collected and the interval at which the locations are sent are verified. Stage 2 is carried out during the analysis of data from road tests.

4 Drive-through test

The purpose of the case is to check the correctness of the detection of the events of driving through Virtual Gantries on the basis of the position location sent by the OBU/ZSL device.

The test is based on one of 7 test routes performed by vehicles with active devices. The test routes are over 200 km long and are located throughout the country (so that the implementation of test runs does not involve covering long access sections). The location of the routes is shown on the map below.
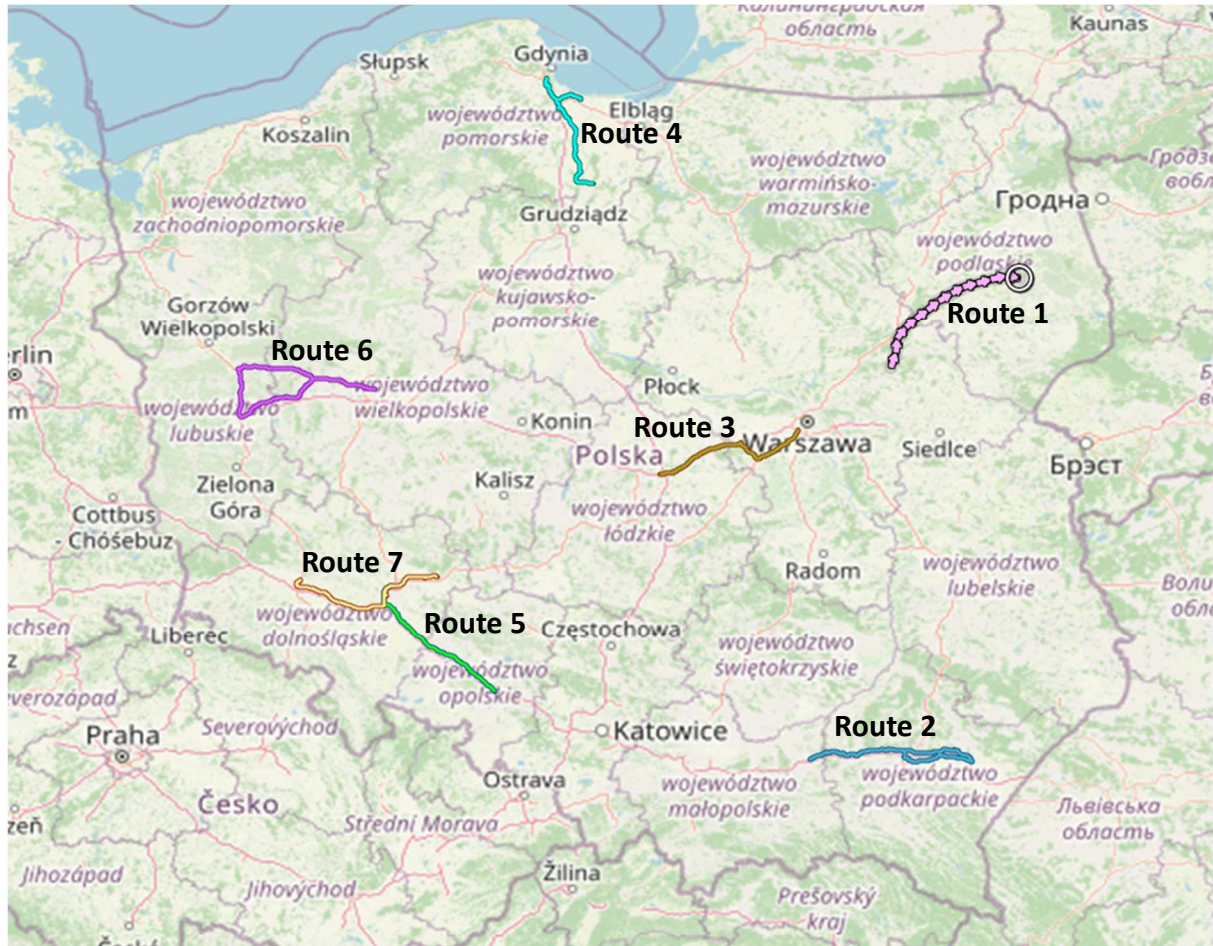
A working, running OBU / ZSL device is a precondition for carrying out the tests in each vehicle. The device should be permanently connected to the power supply during testing. The device should receive GPS signals before the proper test (after the OBU and ZSL are started).

As part of the test runs, the vehicle should additionally perform the following checks:
1. Exiting the route to a Rest Area (device switched on throughout the entire stoppage time for 30 min) (one of 2 rides)
2. Exiting the route to a Rest Area (OBU devices switched off completely throughout the stoppage time for 30 minutes, after stopping; switching on directly prior to returning to the ride) (one of 2 rides)
3. Driving along a route that is parallel to the toll section (no riding events should be detected through the virtual gantry).

For this purpose, sections parallel to the toll road and designated parking areas were designated on each of the test routes. On the maps with test routes attached below, these places are marked as follows:

∞   sections parallel to the toll road

P   designated parking areas

Route description

Route No. 1

Route No. 1 Białystok – Łochów – Białystok, via roads: S8 and DK50 with a parallel section to the toll road, beyond the Rzędziany intersection and stop at Prosienica Rest Area.
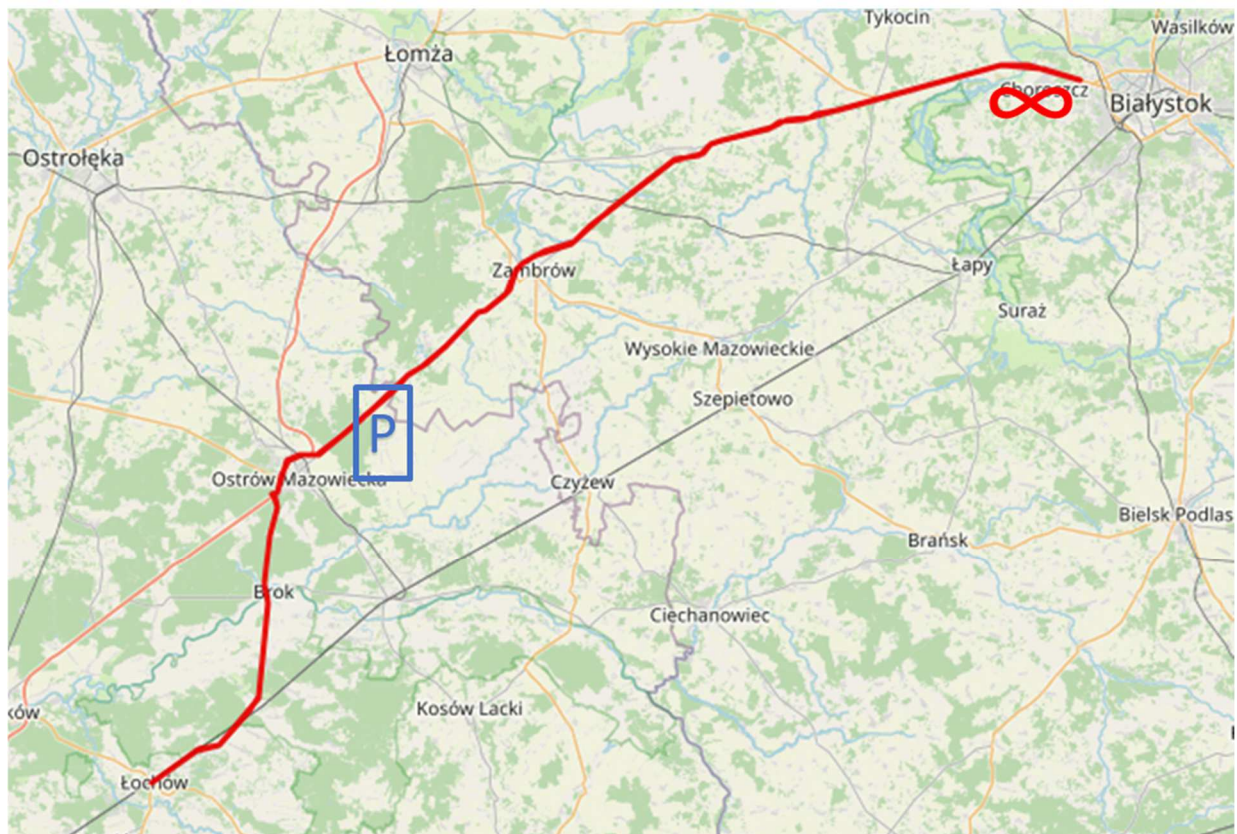

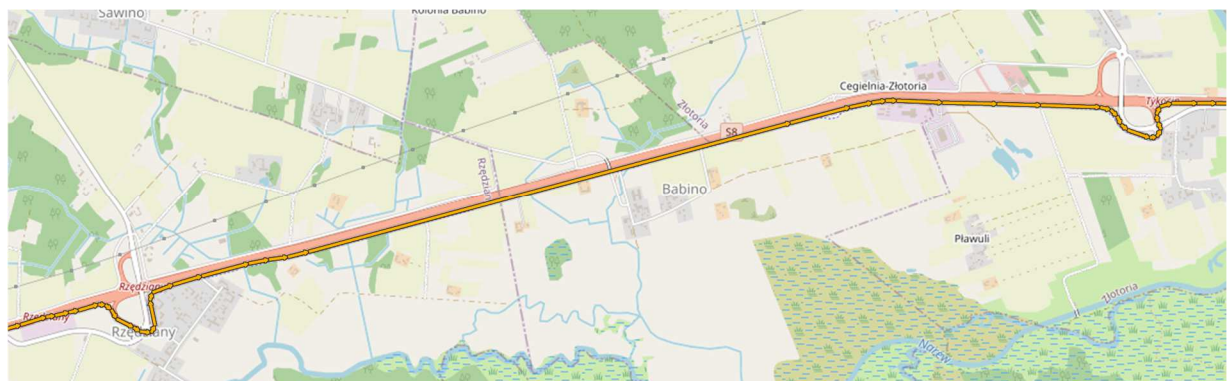Figure 2 Route No. 1 (Białystok – Łochów – Białystok)

Figure 3 Route No. 1, section parallel to toll road

Route No. 2

Route No. 2 Tarnów – Jarosław – Tarnów, via roads: A4 and DK94 with a parallel section to the toll road in the area of Głuchów and stop at Budy Rest Area.
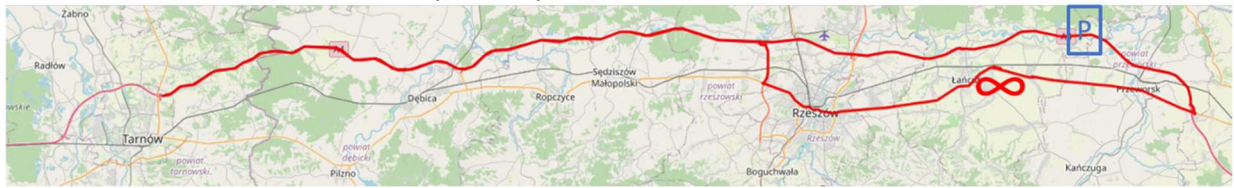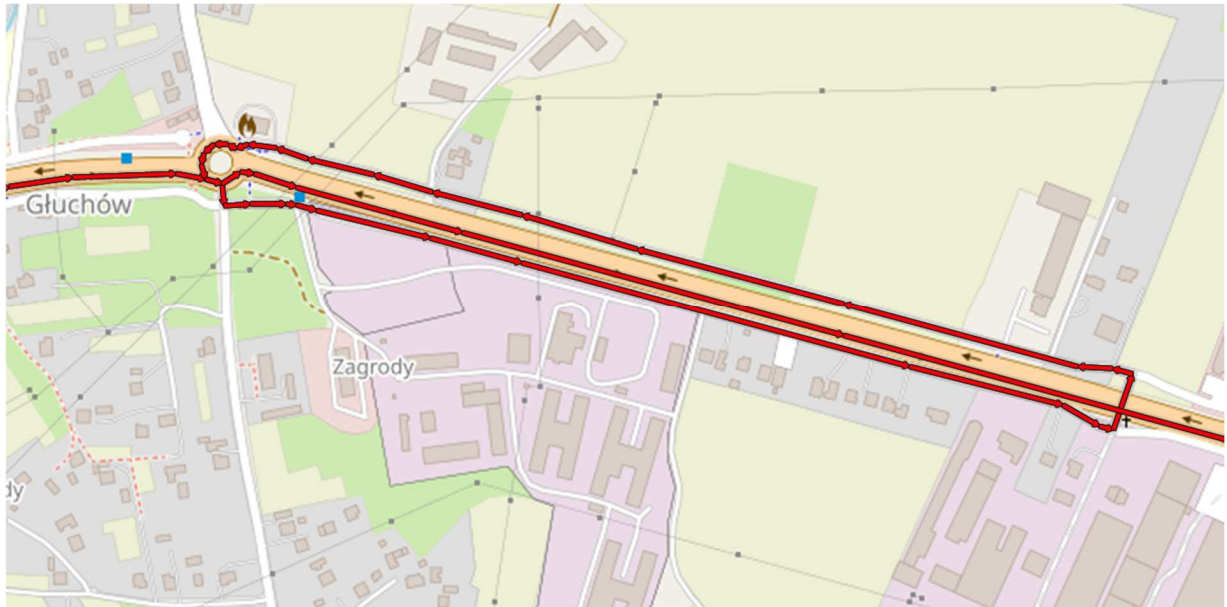

Figure 4 Route No. 2 (Tarnów – Jarosław – Tarnów)

Figure 5 Route No. 2, section parallel to toll road

Route No. 3

Route No. 3 Warsaw – Stryków – Warsaw, via roads: A2, S8 and DK50 with a parallel section to the toll road, beyond the Mszczonów Północ intersection and stop at Niesułków Rest Area.
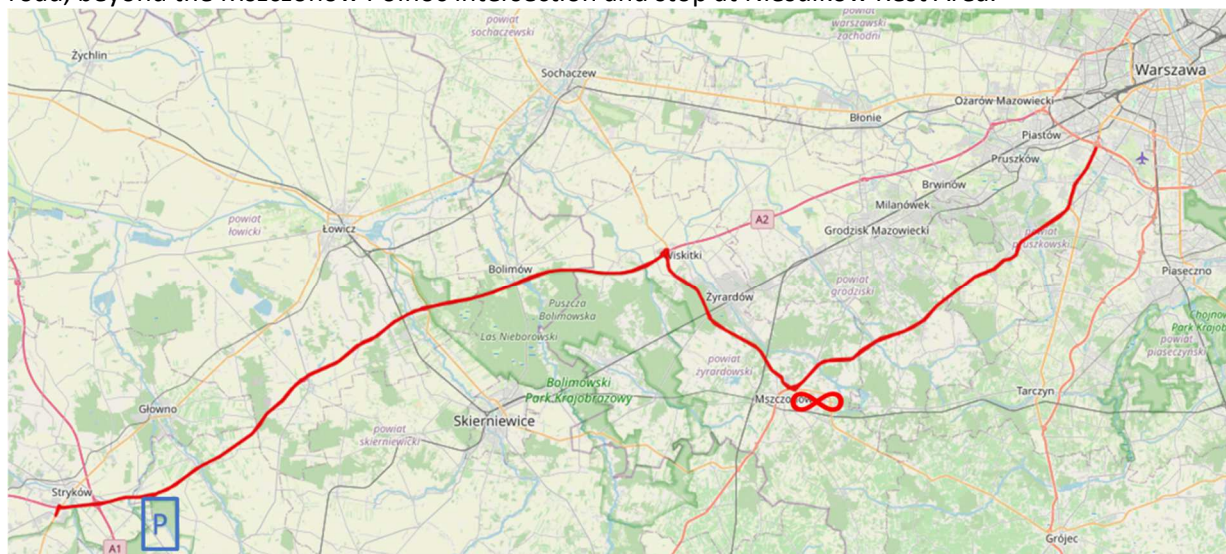

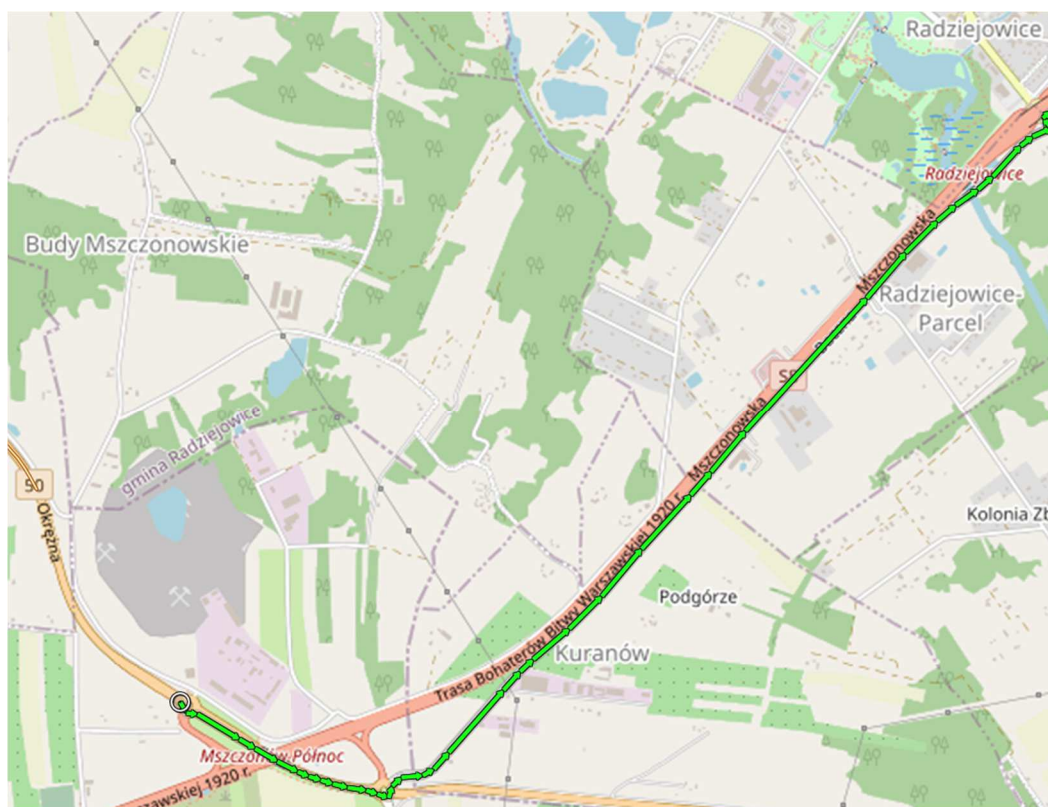Figure 6 Route No. 3 (Warsaw – Stryków – Warsaw)

Figure 7 Route No. 3, section parallel to toll road

Route No. 4

Route No. 4 Gdańsk – Kwidzyn – Gdańsk, via: S6, S7, DK90 and DK91 with a parallel section to the toll road beyond the Gdańsk Owczarnia intersection with stop at the car park beside Żuławy Wschód intersection.

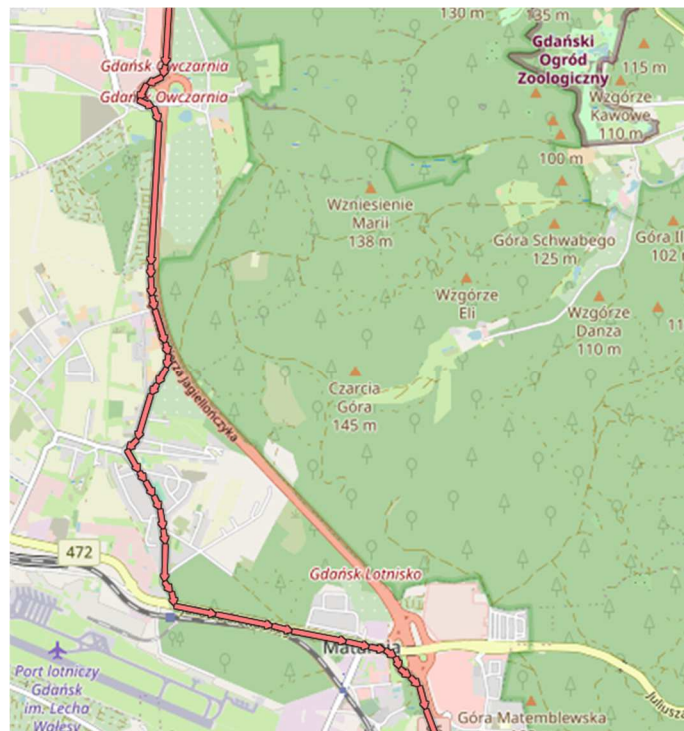Figure 8 Route No. 4 (Gdańsk – Kwidzyn – Gdańsk)

Figure 9 Route No. 4, section parallel to toll road

Route No. 5

Route No. 5 Wrocław – Krapkowice – Wrocław, via: A4 and A8 with a parallel section to the toll road beyond the Wrocław Airport intersection and stop at the Młyński Staw Rest Area.
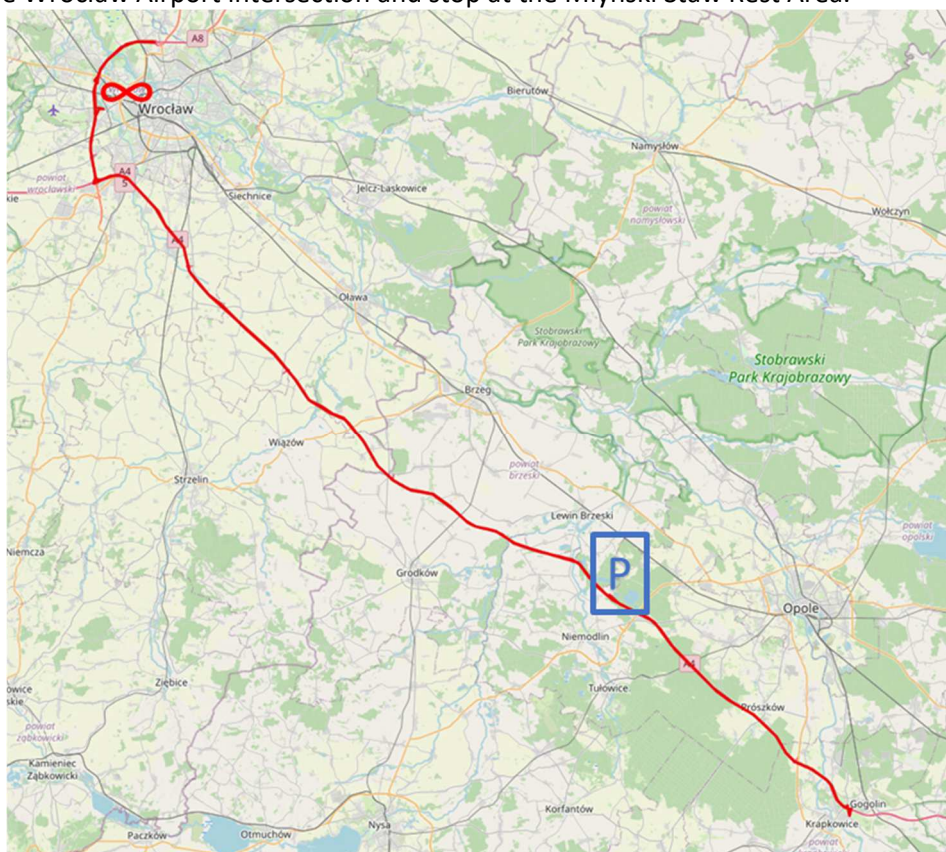

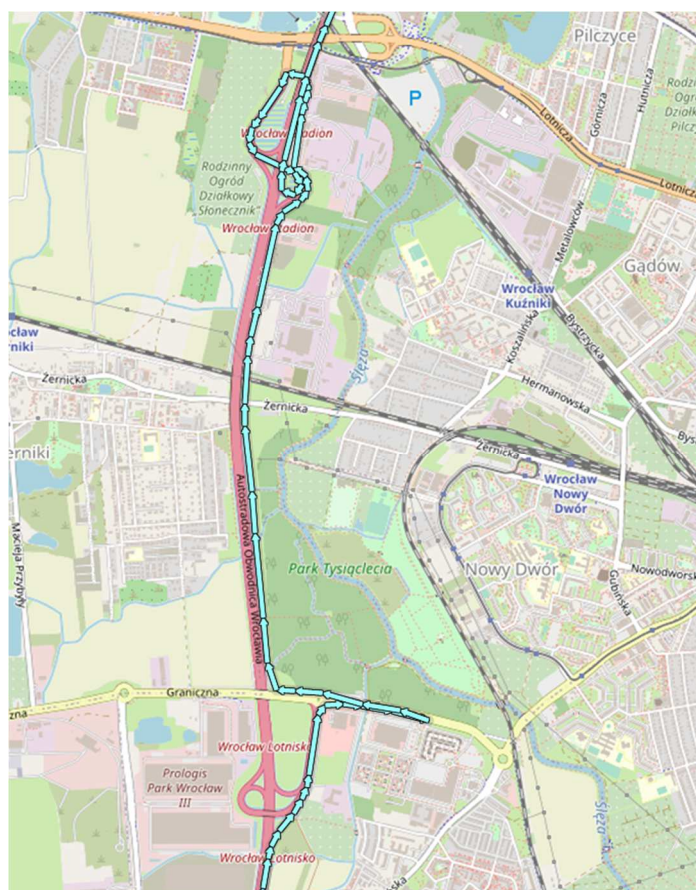Figure 10 Route No. 5 (Wrocław – Krapkowice – Wrocław)

Figure 11 Route No. 5, section parallel to toll road

Route No. 6

Route No. 6 Poznań – Międzyrzec – Poznań, via: S3, DK24 and DK92 with a parallel section to the toll road in Poznań (travel via Świętego Antoniego Street) and stop at Popowo Zachód Rest Area.
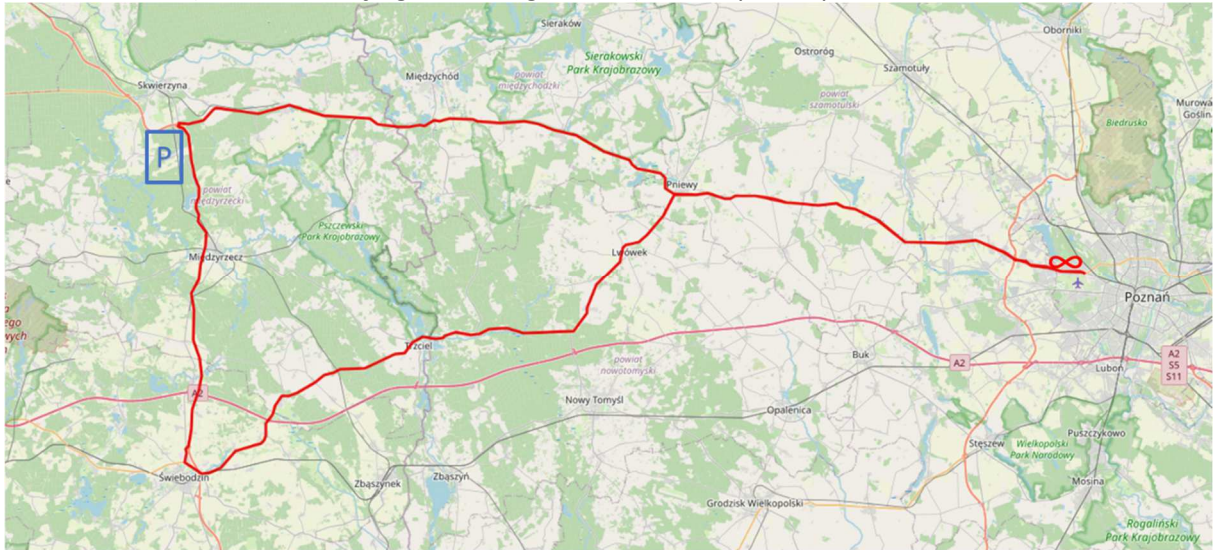

Figure 12 Route No. 6 (Poznań – Międzyrzec – Poznań)

Figure 13 Route No. 6, section parallel to toll road

Route No. 7 Legnica – Oleśnica – Legnica, via: A4, A8 and S8 with a parallel section to the toll road beyond the Wrocław Airport intersection and stop at a car park near Kostomłoty
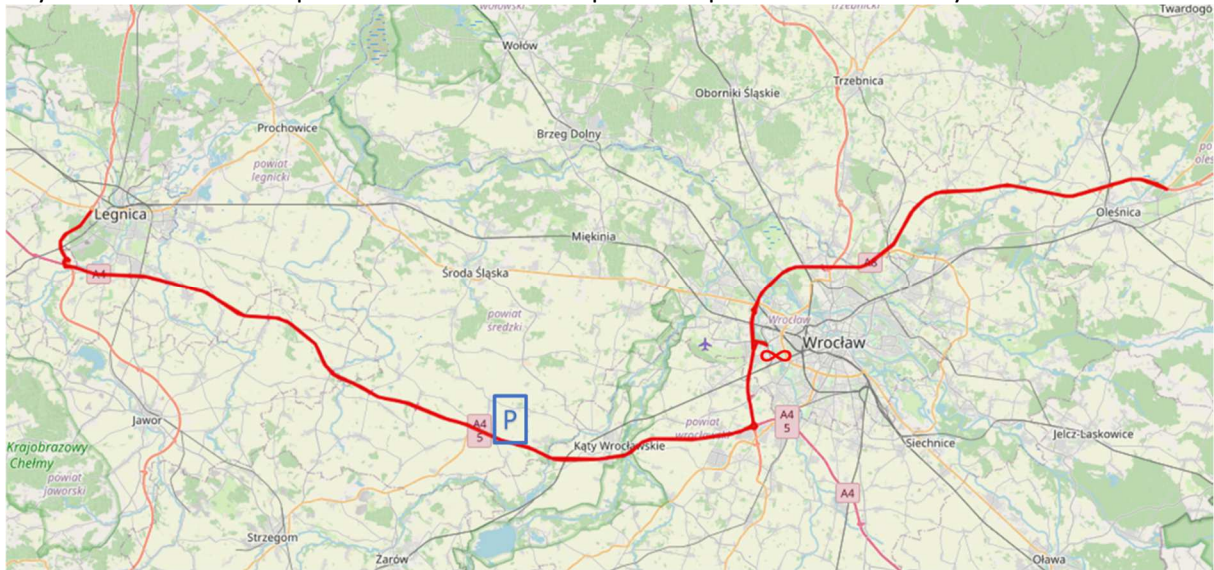

Figure 14 Route No. 7 (Legnica – Oleśnica – Legnica)
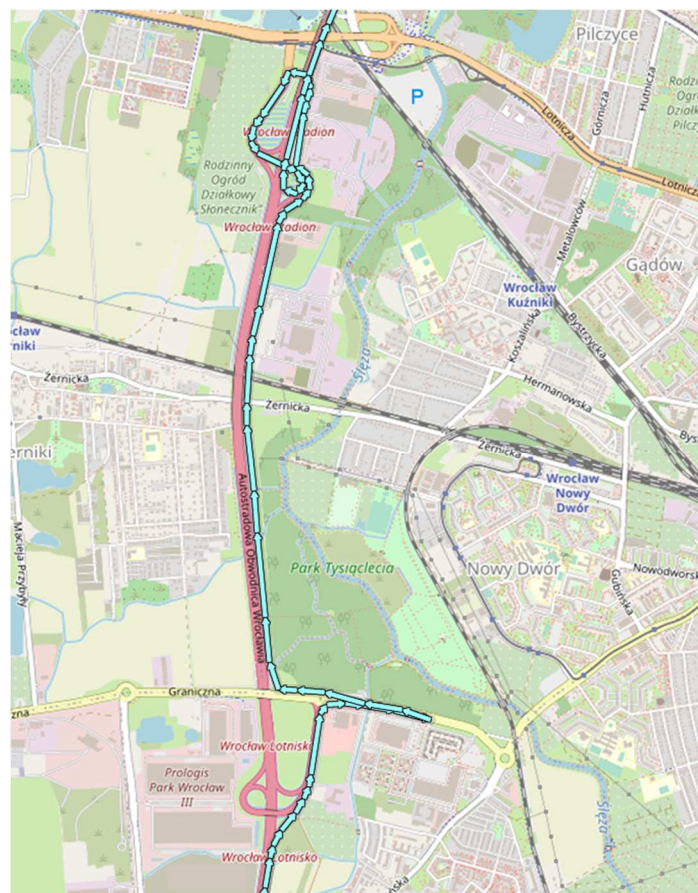
Figure 15 Route No. 7, section parallel to toll road

All test routes are "loops", therefore, test runs can start anywhere on the route, provided that the entire route is completed. If necessary, the suggested stopping places may be replaced with other ones, but in this case, the report on the implementation of test runs should include information on where the stops were made.

Files in *.gpx and *.kml formats have been prepared for each route, which can be imaged on map backgrounds. A sample tool for handling the above-mentioned files is available at: https://www.gpsvisualizer.com/ .

After completing test routes, the Operator should send "**Information on test route process**" to the following address: operatorzyOBUZSL@mf.gov.pl

5 Procedures related to the implementation of drive-through-tests

For test purposes, the ZSL Operator / OBU Operator will have to notify the test start date. The drive-through test is performed following the principles given below:

- **one vehicle** equipped with a **maximum** (recommendation, not requirement) of **2 different test types** of OBU/ZSL **devices**; **each type** of device **must be represented by 3 units**, providing a **maximum of 6 devices** in the vehicle; during the test, the vehicle drives along one of the designated routes twice in both directions or,
- **two vehicles**, **each** equipped with a **maximum** (recommendation, not requirement) of **2 different test types** of OBU/ZSL **devices**; **each type** of device **must be represented by 3 units**, providing a **maximum of 6 devices** in the vehicle; during the test, each vehicle drives along one of the designated routes in both directions,
- the drives should take place at intervals of not more than 2 working days,
- it is recommended to start the route at one of the end points, however, it is possible to start it at any point on the route and end the **full drive at the same point where it began**,
- the drive will be monitored by SPOE KAS,
- the result will be positive after detecting, **for each tested device**, all events from the gantries located on the designated routes in SPOE KAS,
- the result will be negative if data collection at intervals other than 5 seconds and sending at intervals other than 1 minute (60 seconds) are detected.

The SPOE KAS operator in special cases (e.g. long-term road exclusion from traffic on a long section due to renovation) allows the possibility of changing the route (before the change, consent of the SPOE KAS operator must be obtained.

6 Short tests of devices after modification

In the event that the ZSL Operator / OBU Operator introduces changes for the OBE types approved by SPOE KAS, consisting in extending the existing features, which do not affect the positioning accuracy or the way in which data is transferred to SPOE KAS (e.g. extension consisting in introducing handling transmission in 5G networks), then as part of obtaining approval for the use of modified OBEs in SPOE KAS, the Operator will be able to use a shortened test procedure. The shortened test procedure includes Proxy Server <-> SPOE KAS communication tests and covering any route (not only those indicated in the case of full tests) with a toll section no shorter than 50 km. Conducting tests in the shortened procedure requires the consent of the Ministry of Finance, for which the ZSL Operator / OBU Operator should submit an application, which also indicates the scope of modifications that the OBE has been subject to since the last admission tests.
Changing the firmware in OBU/ZSL devices requires the Operator to carry out full re-tests.