IRIS/LCMS

IRIS/LCMS measurement system consists of:

- The base of survey vehicle: Mercedes Sprinter van with 3665mm wheelbase (Vehicle with configuration based on Annex No. 1.)
- LCMS-2 - https://www.pavemetrics.com/applications/road-inspection/lcms2-en
- GPS/INS Positioning System Applanix.

The main characteristics of the system:

- Continuous measurements of road pavement condition, defects and parameters in traffic.
- Ability to import road network into the system and to automatically assign each measurement to separate road network element.
- Assessment of asphalt and concrete pavement.
- Measurement speed from 0 to 100 km/h.
- Measurement width 4,0 m.
- System is equipped with 2 high speed laser scanners above each of the wheel paths (28 000 Hz).
- Each detected defect and parameter are georeferenced in the specified coordinate system (All EPSG coordinate systems).
- Pavement 3D point cloud data collection for set interval.
- Pavement surface image collection for set interval.
- 4-way camera image collection for set interval.
- Ability to set data collection interval to 5 m and 10 m.

Survey system

Detected parameters:

The equipment detect and measure these parameters, objects or defects:

- Pavement type (asphalt, concrete, chipseal, etc.)
- Cracking (width, length, density), both sealed and unsealed.
- Rutting (length, depth, type).
- Pothole (area, depth, volume).
- Patches (area).
- Longitudinal roughness IRI (m/km).
- Longitudinal profile (slope).
- Bleeding.
- Macro texture (MPD, MTD).
- Manholes (cover depth relative to surrounding pavement) and other man-made objects (speed bumps, etc.).
- Pavement markings.
- Curb and edge drop off.
- Slope, Cross Fall and Super Elevation.
- Pick-out, delamination, shoving, ravelling and other.

20 lat
doświadczenia

Standards:
- E950 longitudinal profile and compute IRI with the precision and bias of a Class 1 Profiler.
- ASTM E965 for macro texture and MTD calculation.
- ASTM E1845 for macro texture and MPD calculation.
- ASTM E1703 for rutting.
- AASHTO PP67 for cracking quantification.
- AASHTO PP70 for transverse profiles.

Output and results:
- Can to export each individual measured parameter in a georeferenced SHP (or GDB) and GeoJSON file format.
- Can to export point cloud data in LAS and LAZ format using UTM or Long/Lat of 3D surfaces at user-defined resolutions.
- Can to represent each individual measured and georeferenced parameter in a cloud framework (web-based GIS system for visualization and analysis of measured data) on a map in individual layers with ability to edit, add or delete certain objects.

Lasers:
- Two laser sensors with 3D cameras and IMUs.
- 28000 Hz scanning frequency.
- 1 mm longitudinal scanning interval at speed 100 km/h.
- 1 mm transverse resolution.
- 4,0 m transversal field of view.
- 0,25 mm vertical accuracy, 0,05 mm vertical resolution for IRI measurements at 25 mm (1 inch) intervals (confidence level of ≥95%).
- IP 65 certification.
- Profile spacing 1 mm.

GPS:
- The GPS system calculates the car's position using the signal from 2 DGPS antennas, the DMI ranging system and the inertial system.
- Positioning system uses 3 accelerometers and 3 gyroscopes to measure accelerations and angular velocities that are necessary to calculate all aspects of vehicle's movements, including position, velocity, acceleration, orientation and angular speed.
- Recording time-stamped position and orientation data (event) at a frequency 200 Hz.
- Post processed GPS accuracy for position: 2 cm.
- Post processed GPS accuracy for heading: 0,1 degree.
- Post processed accuracy for Roll and Pitch accuracy: 0,025 degree.
- Ability to perform GPS corrections from base stations during postprocessing.

Odometer:
- Vehicle is equipped with distance measurement instrument (DMI), that makes possibility to record data with speed up to 100 km/h.
- DMI's resolution is 4000 impulses per rotation.
- System have the possibility to run accurate reference calibration. Calibration's procedure is possible to perform without use of specialized tools.
- Distance measurement is synchronized with GPS data and road network system.

Road condition survey camera:
- System is equipped with 4 cameras for road condition survey, directed at each of the 4 sides.
- Colorful photos are taken at set interval (5 and 10 m) with resolution of 1920x1080 px.
- Camera quality is sufficient for all elements of the road will be visible regardless of time of day.

LCMS-2 systems specifications:

Laser Crack Measurement Equipment 2 (LCMS-2) contains:
- Two LCMS-2 3-D laser profiling sensors with built-in IMUs
- Rack-mount controller unit (2U) with DC power supply
- Two cage catching boards
- Software information and installation instructions
- All necessary cables
- One-year full parts and labor warranty (excluding applicable shipping and travel).

Data acquisition workstation (example specification):
- Processor Dual 8-core Xeon for a total of 16 cores. (32 threads.)
- 8 TB SSD Hard disk.
- The PCI slot interface for the two (2) frame grabber boards - PCIe x8.
- Windows 11 64bit operating system.

Data processing workstation (example specification):
- Processor with 18 cores (36 threads) and 3.0GHz clock
- 32GB of RAM
- Dedicated graphics card which supports necessary software and two monitors in 2K resolution
- RAID controller (RAID 0/1/5)
- Storage consisting of 8 SATA HDDs (16TB each), configured as RAID5 (capacity 100TB)
- Backplane with 3 hot-swap slots for HDDs/SSDs (same like in computer in vehicle)
- LED monitor with 16 x 9'' format, 24'' full HD resolution
- Keyboard and mouse
- Windows 11 64bit operating system.

Processing software:
Data processing software provides easy and repetitive step-by-step process from the beginning. Software complex includes an organized pictures database along with data about road damages and aggregated tabulation of data. Full complex of data processing software consists of:
- Raw data processing software with a variety of built-in tools for batch processing.
- Software used for automatic analysis of pavement condition and calculating various parameters.
- Software to view and synchronize pictures from cameras with pavement pictures generated from point cloud data.
- Software to view and edit point cloud data: pan, zoom, export with different coordinate system and other parameters.
- Software to visually edit results of automatic analysis, including patches.
- Software to edit information about survey length, to input road information: road number, roadway number, lane number, road direction, starting mileage, and other measurement header information.
- Software for creation of data base which unite and include all measured road parameters.
- Data acquisition and processing applications have graphical user interface (GUI) and contains C/C++ acquisition and processing DLL library for custom user applications.
- Pavement defect algorithms are optimized for use on asphalt, hotmix, chipseal, porous pavement, concrete.
- Automated correction of 3D pavement scans to compensate for vehicle motion.
- The ability to import post-processed, corrected GPS data in order to increase the accuracy of reported elevations.
- Automated merging of overlapping passes in order to map multi-lane highways, airport runways and other large surfaces.

Support and repairs:

- The Supplier ensures the functioning and maintenance of technically sound equipment by providing updates for all used software up to for 5 years from the Transfer and Acceptance Act signing date. All subscription fees for this period are included in the price.
- Free of charge support online or via telephone for the period of minimum 12 months from the Transfer and Acceptance Act signing date.
- Ability to correct software related issues via remote support.
- Ability to conduct necessary repairs on the Equipment at the Clients premises or within a 1000 km radius from Vilnius, Lithuania.
- Supplier provides availability of any spare parts for the device assuring functionality for 5 years from the Transfer and Acceptance Act signing date.
- Supplier provides technical support related to data processing in the office.
- The Supplier during the warranty period of the Equipment carry out calibration and inspection of the entire system (the first time - no later than 12 months from the Transfer and Acceptance Act signing date; the second time - no later than 24 months from the Transfer and Acceptance Act signing date).

Annex No 1. Vehicle adaptation

1.1.   Electrical installation

230V AC power supply system

Vehicle is equipped with power supply with given parameters:
- Input voltage: 230V AC +/- 2%, 50Hz
- Input power: 230V AC 2000 VA

Used solution have option to connect external source of power that is 230V AC, which provides:
- Power to computer system and survey units
- Automatic charging of starter battery and additional battery
- Protection to batteries against overcharging and discharging on their own.
- Protection against starting of engine when using external source of power (230V AC)

Additional features:
- Uninterruptible power supply (UPS). In case of 230V network malfunction or break, inverter in vehicle will turn on automatically and provide power to all computer units etc., which leads to uninterrupted work.
- Control panel which gives the possibility to control and monitor the power system. Displaying informations about UPS system uptime.
- Charging additional batteries with vehicle's alternator, which leads to uninterrupted work of computers and survey units when vehicle's engine is running.
- Possibility to monitor charge level of additional batteries in vehicle thanks to intelligent battery controller with measuring shunt.

Example block diagram with VictronEnergy components that monitor power parameters:
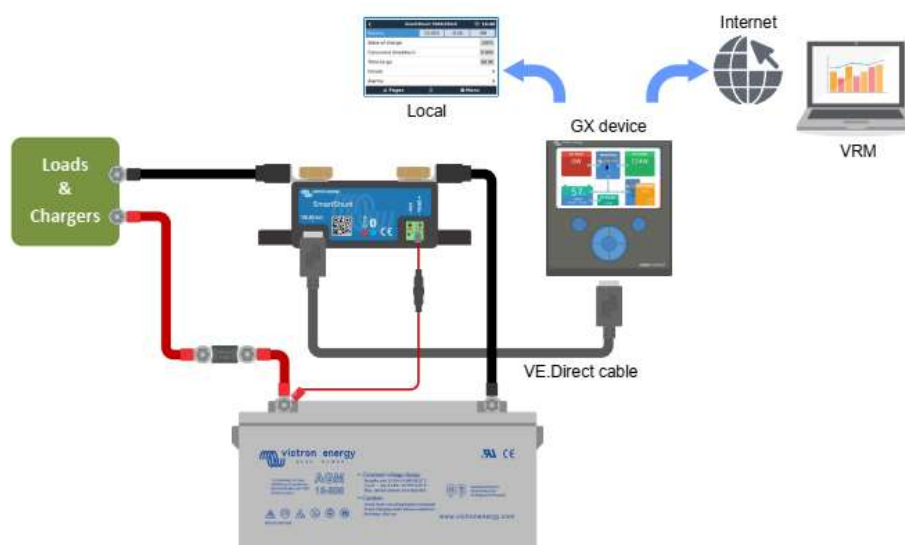
Inverter is installed at the back of the vehicle and batteries are placed under 19'' rack cabinet, which makes it easier to access them during controls and services.

Example of equipment in Mercedes Sprinter van:

Warning lights

Ready installation of warning lights consists of:
- Warning lightbar installed on the roof in front of vehicle (orange light color)
- Two LED beacons installed on the roof at the back of vehicle (orange light color)
- Two LED grill lamps installed on grill in the front of vehicle (orange light color)
- Traffic advisor installed at the back of vehicle with changeable modes (orange light color)

Marker lights

Additional marker lights are installed on elements that stick out of vehicle's outline to improve safety on the roads.

Interior lights

Interior lights are installed in office and technical section of the vehicle. Given interior lights are made in LED technology and installed in vehicle's ceiling lining. Interior lights switches are installed near main door's entrance (office section) and at the back near rear door (technical section).

Example solution used:

1.2.   Built in furniture

Special purpose furnishing

Vehicle is remade to mobile road condition survey laboratory. Special furnishing have construction that make it possible to install computer devices in 19'' rack cabinet in two sections as can be seen on pictures below, with depth of 60cm. All computers and devices in rack cabinet is protected from shakes during driving by installed anti-vibration mounts.

Example of 19'' rack cabinet can be seen on pictures below.

View from main entrance (right side):

View from rear door:

Additional chair and desk between driver's seat and rack cabinet

Desk are installed in driving direction, so operator can work while vehicle is riding. Chair is permanently assembled to vehicle's floor. Rotation range of chair is 0-90° degrees.

Example of chair and desk installation can be seen on pictures below:

Floor

Existing wooden floor are covered with non-slip material (underfelt glued to waterproof surface) that is very resistant, which eliminates risk of walls waterlogging when washing up office section.

Thermo-acoustic insulation of vehicle

Empty space in car body is filled with soundproof mat that also eliminates condensation inside vehicle.

Additionally, walls are covered with washable board that doesn't absorb humidity and improves visual effect of interior.

1.3.   Complete survey system with software tools

Installation of LCMS-2 and IRIS survey systems

In order to install LCMS-2 survey system with additional CMOS camera (IRIS system), a new construction is assembled on the roof of vehicle. Given construction fulfills requirements set by Pavemetrics regarding LCMS-2 sensors installation.
Construction consists of aluminum profiles, installed on vehicle's dedicated roof rack.
Chassis made of aluminum profiles are designed in a way to use and ride vehicle safely with max speed of 140 km/h.
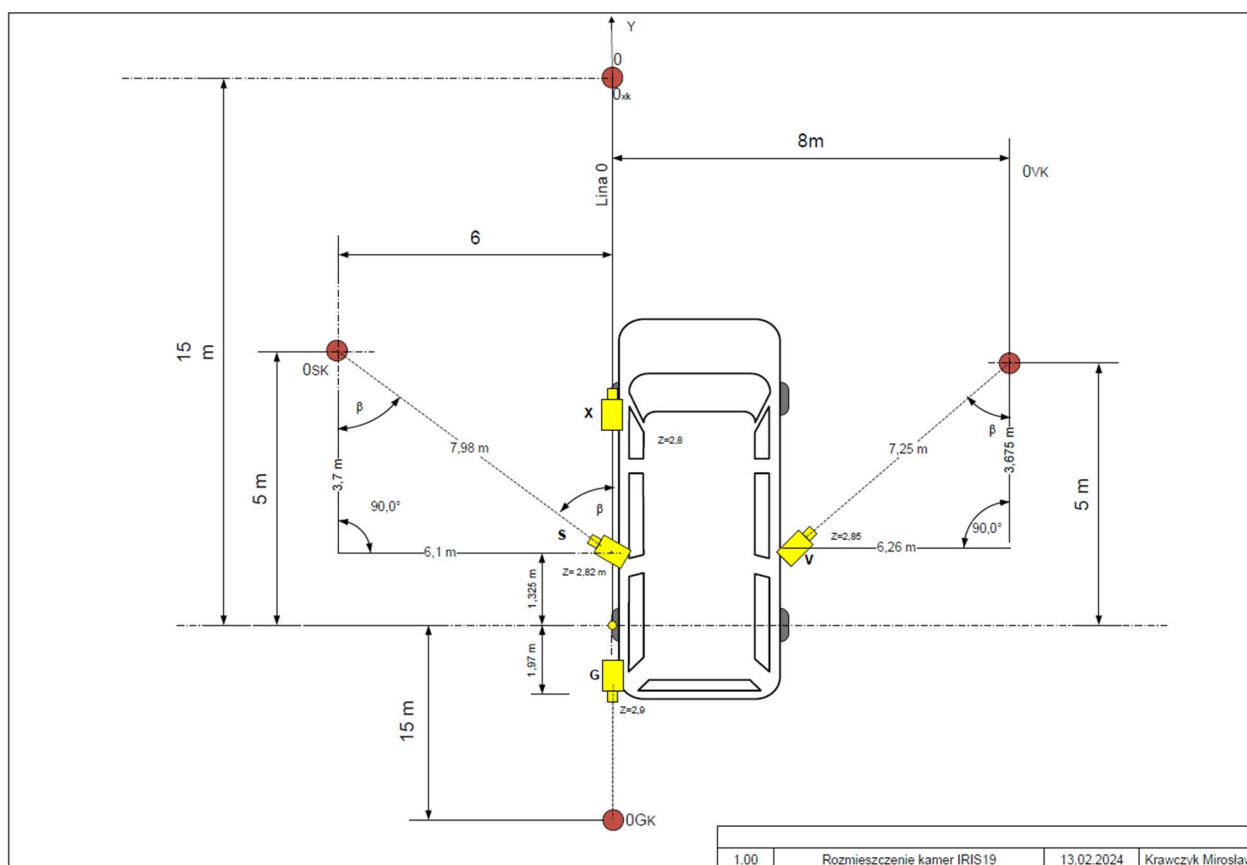
Integrated Road Information Scanner (IRIS)

Road condition survey camera

System is equipped with 4 cameras for road condition survey (front camera). Colorful photos are taken every 5 meters with min. resolution of 1920x1080px.
All elements of the road are visible due to good photos quality.

Camera installation – example

Camera view – example

Time synchronization system

Vehicle is equipped with time synchronisation system integrated with all survey systems units. All events (data) recorded by all survey systems are synchronized with an accuracy up to 50 ms which allows this data to be correlated with GPS coordinates.

Distance measurement instrument (DMI)

Vehicle is equipped with distance measurement instrument, that makes it possible to record data with speed up to 100 km/h. DMI's resolution is at least 4000 impulses per rotation.
System have the possibility to run accurate reference calibration. Calibration's procedure is possible to perform without use of specialised tools.
Distance measurement is synchronized with GPS data and road network system.

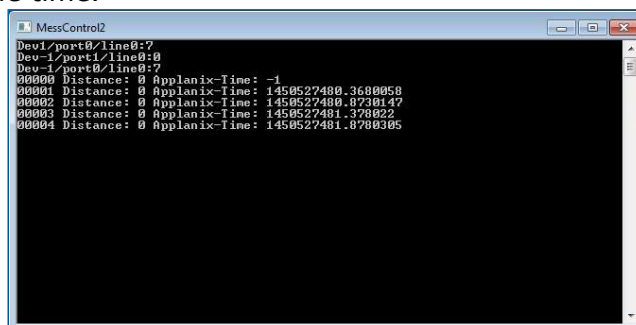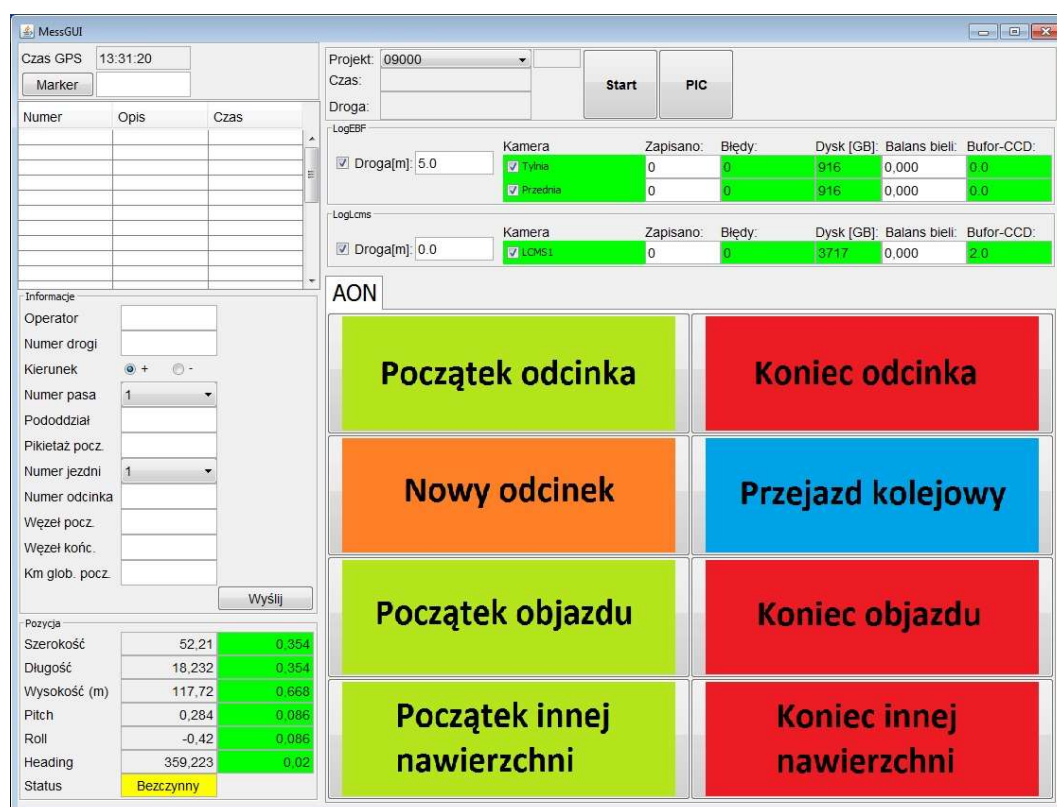Software used to calibrate DMI sensor:
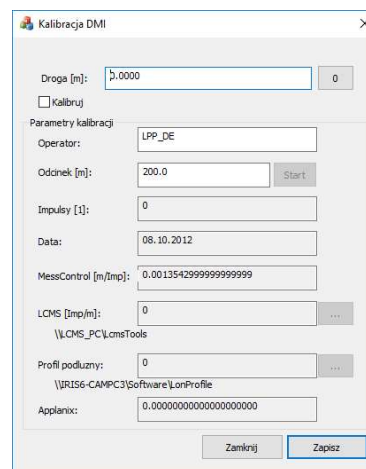
Software used to record pictures data

It is possible to control the system from every screen that is available in vehicle. All operator has to do during survey is click START/STOP button. Graphical user interface display given subsystems' informations and statuses during survey. In case of error, appropriate message are shown on the operator's screen. A real time view of LCMS and IRIS systems is displayed in the interface as well.

Special program to connect all software components also are used in survey vehicle. Thanks to it, all pictures data, GPS coordinates acquired and distance measured by DMI are saved in the same time.

Example of graphical user interface software to record survey data - MessGUI

Data processing software

Data processing software provides easy and repetitive step-by-step process from the beginning. Ready product consists of organized pictures database along with data about road damages and aggregated tabulation of data.

Data processing software, that allows to process survey data, consists of:

a. ProcessingGUI
Graphical user interface (GUI) which has variety of built-in tools for batch processing. Software automatically searches folders structure and creates list of tasks to do, which in next step start the tasks and control them. A user can define number of tasks to run simultaneously to maximise available hardware capabilities.
The following tools are supported:
- Messpictures   - unpacks pictures taken by IRIS camera to JPG format
- CreateEBFMdb   - creates pictures database
- LCMSRoadInspect - creates text file used for batch processing in Pavemetrics' LCMSRoadInspect

b. Pavemetrics' LCMSRoadInspect
Pavemetrics' software used for automatic analysis of pavement condition. Enormous capabilities of mentioned software is described in manual from Pavemetrics.

c. LCMSSynchronizer
Software used to synchronise IRIS pictures with LCMS pavement pictures. Data from LCMS and IRIS systems are recorded independently, therefore they need to be connected with each other using timestamps that are recorded for each event.

d. LPViewer+LCMSEditor
Software used to edit results of automatic analysis, including patches. A user has ability of reviewing pictures data and adding changes regarding pavement damage, which are visualised on pictures.

e. MarkerEditor
Software used to edit information about survey length. During survey, operator has ability to input information about: road number, roadway number, lane number, road direction, starting mileage, etc. With the help of MarkerEditor, user can edit this data to make corrections reviewing pictures from IRIS and LCMS systems. This data is used to sort folders accordingly.

f. LP-Viewer

Software, as name suggests, is for viewing pictures from IRIS and LCMS systems. Features are listed below:
- no license restrictions
- viewing list of surveys that are available in database
- simultaneous presentation of pictures from all available cameras from IRIS and LCMS systems
- display information about local and global mileage of the road
- length measurement and area measurement on the pictures
- ability to read longitudinal and latitudinal geographical coordinates in any coordinate system in place where pictures were taken
- display of road or satellite map with geographical position of viewed picture

Example screenshot of LP-Viewer:
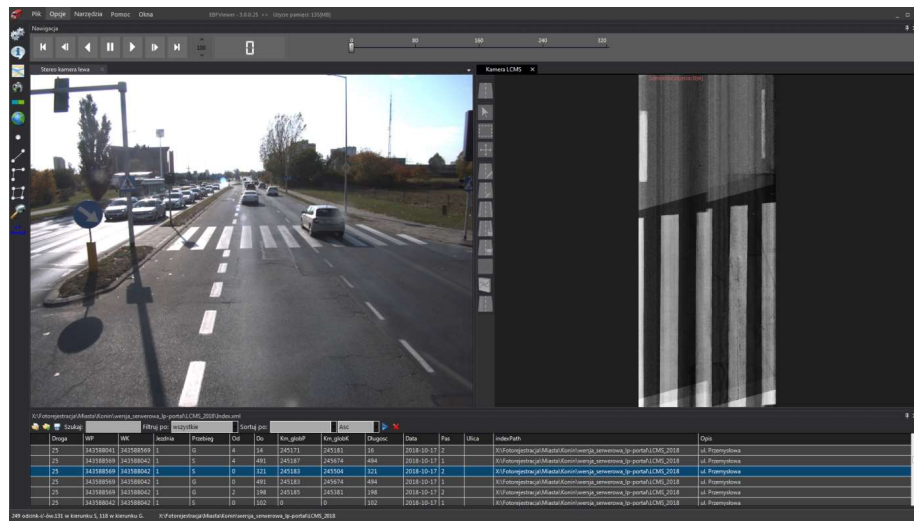
g. LDTM Processing tools (additional LCMS module required)
- creation of data base for storage of LCMS/LDTM detection results of Cracking, Rutting, IRI, Patches, Potholes, Bleeding and Macrotexture,
- import function of all distresses,
- import function of section boundaries (10m),
- projection of section boundaries to road network using definitions of beginning and ending markers for each measurement,
- export of data to geoJSON in chosen coordinate system separately for each distress type.

1.4.   System GPS Applanix

Vehicle is equipped with Applanix GPS positioning system which uses the highest quality receivers in industry which ensure full flexibility and optimal accuracy in conjunction with the newest technology of high performance dual-frequency receivers. Positioning system uses three accelerometers and three gyroscopes to measure accelerations and angular velocities that are necessary to calculate all aspects of vehicle's movements, including position, velocity, acceleration, orientation and angular speed. Strictly conjugated inertial GPS system, continually verifies available GPS raw data, to make sure that only correct signals are being saved. System ensures consistent and reliable data capture with 200Hz frequency and timestamps, integrated with all other systems that are present in survey vehicle.

Thanks to EGNOS services, system provide variety of levels of GPS performance, even below decimeter without the use of base station.

GPS system receiver is equipped with GPS azimuth subsystem (GAMS), which consist of two GPS receivers and two antennas, assembled at the roof of vehicle with over 2 meters distance between each other.

This approach helps eliminating drift error of GPS signal that usually appears in systems with single antenna when vehicle stops.

GAMS provides very accurate heading of vehicle, independently of velocity, which ensures the best possible accuracy and performance in every environment. GPS system ensures full performance and smooth operation with 100 km/h velocity.

Table below presents accuracies of our GPS system.

GPS corrections data from base stations can be used during postprocessing. For example http://www.asgeupos.pl/, http://litpos.geoportal.lt/, etc…

Position accuracies are at centimeters level - table below shows GPS system accuracies in postprocessing stage.

GNSS-inertial solution

PERFORMANCE SPECIFICATIONS[3] (RMS ERROR) NO GNSS OUTAGES, STANDARD ROAD VEHICLE DYNAMICS				
	SPS	SBAS	RTK	POST-PROCESSED[7]
X, Y Position (m)	1.5 H	0.5 H	0.02 H	0.02 H
Z Position (m)	3.0 V	0.85 V	0.03 V	0.03 V
Velocity	0.01	0.01	0.01	0.005
Roll & Pitch (deg)	0.04	0.03	0.03	0.025
True Heading[4] (deg)	0.12	0.09	0.09	0.06

1 KM OR 1 MINUTE GNSS OUTAGE, STANDARD ROAD VEHICLE DYNAMICS[5]				
	SPS	SBAS	RTK	POST-PROCESSED[7]
X, Y Position (m)	2.0 H	2.0 H	1.0 H	0.80 H
Z Position (m)	5.0 V	3.0 V	2.0 V	0.20 V
Roll & Pitch (deg)	0.09	0.09	0.09	0.05
True Heading[4] (deg)	0.35	0.35	0.30	0.20

Applanix POSPac MMS for Land is powerful post-mission software that processes data from your Applanix integrated GNSS/Inertial system to perform highly accurate Direct Georeferencing of your land-based mapping sensor.

This software provides the ability to process data from the measurement vehicle with the accuracy from the table above (values given in the Post-Processed column), which are necessary to obtain correct LDTM data.

More information on site: https://www.applanix.com/products/pospac-mms.htm

1.5.　Mercedes-Benz Sprinter 319 CDI Van 3665 mm

Model:　　　　　　　Mercedes-Benz Sprinter

Type:	Sprinter 319 CDI Van 3665 mm
Axle configuration:	RWD
Baumuster:	90763313
Engine power:	140 kW (190 KM)
Wheelbase:	3665 mm
Gross vehicle weight rating:	3500 kg

Configuration

Code	Designation	Code type
054	AEJ X3/2	sales
559L	Poland	partsIdent
804	AEJ X3/1	sales
9147	Paint, arctic white MB 9147	partsIdent
A50	Front axle with increased load capacity	sales
AR2	Axle ratio i = 3,923	sales
BH1	HOLD function	sales

Code	Designation	Code type
BH6	Control code for hydraulic assembly variant 5	sales
BK2	Control code for wheel brake configuration 2	sales
C6L	Multifunction steering wheel	sales
C907	BAUREIHE 907 TRANSPORTER VS30	partsIdent
CB8	Stabilisation level II	sales
CL1	Height and rake adjustable steering wheel	sales
CW2	Deletion, vehicle lowering	sales
D03	High roof	sales
D13	Mounting rails for roof rack	sales
D93	Omission partition	sales
E07	Hill-Start Assist	sales
E1D	Digital radio (DAB)	sales
E1U	5 V USB socket	sales
E2A	Tapping of body manufacturer special signals in cockpit	sales
E2I	Auxiliary battery for retrofitted consumers, interior	sales
E2N	Control by scopes in NTG6	sales
E30	Battery main switch single-pole	sales
E36	Disconnecting relais if auxiliary battery	sales
E3J	Preinstallation for switch panel	sales

Code	Designation	Code type
E43	Trailer socket, 13-pin	sales
E4M	MBUX multimedia system with 10.25-inch touchscreen	sales
ED4	AGM battery 12 V 92 Ah	sales
ED8	Preinstallations electrical system, PSM	sales
EE5	ULTRACAP - Automatic transmission lock	sales
EK1	Terminal strip for electrical connection	sales
ES0	Starting aid contact	sales
ES5	Charging package, dashboard	sales
EW6	Vorrüstung Remote Services Plus	sales
EX9	3 years of free map updates	sales
EY2	Vorrüstung für Live Traffic Information	sales
EY5	Mercedes-Benz emergency call system	sales
EY6	Breakdown management	sales
F64	Electrically folding exterior mirrors	sales
F68	Exterior mirror heated and electr. adjustable	sales
F907	BAUREIHE 907 TRANSPORTER VS30	partsIdent
FF5	Shelf above windscreen	sales
FF8	Single-size slot at front under roof liner	sales
FG8	Cup holders front	sales

Code	Designation	Code type
FKA	Panel van	partsIdent
FR8	Rear view camera	sales
FZ5	Anti-theft alarm system	sales
G43	9G-TRONIC	sales
H00	Hot-air duct to passenger compartment	sales
H11	Auxiliary hot-air heater	sales
H20	Heat-insulating glass all round	sales
HH2	Electrically powered hot-air auxiliary heater	sales
HH7	Roof-mounted air conditioning system, basic	sales
HH9	Air con., semi-autom. controlled, TEMPMATIC	sales
HI1	Climate zone 1 (cold/comfort)	sales
IC1	Model series C907/C910 Sprinter	sales
IE0	Model series C907 VS30 RWD	sales
IG4	Standard	sales
IG5	Basic	sales
IH6	Headunit ECE/RoW	sales
IK0	Complete vehicle	sales
IL2	Export code	sales
IL5	Left-hand drive	sales

Code	Designation	Code type
IR4	Wheelbase 3665 mm (BM-forming code)	sales
IT4	3,5 Tonner	sales
J10	Speedometer, km/h	sales
J55	Seat belt warning system for front passenger seat	sales
J58	Seat belt warning for driver's seat	sales
J65	Outside temperature gauge	sales
JA8	Crosswind Assist	sales
JH3	Communication module (LTE) for digital services	sales
JI7	Startlaufstrecke Wartungsintervall 60.000 km	sales
JK5	Instrument cluster with color display	sales
JV7	Pre-fittings for multi-tone horn unit	sales
KB7	Main tank, 93 litres	sales
KL5	Fuel filter with water separator	sales
KP7	SCR Generation 4 exhaust gas cleaning	sales
L	LINKS-LENKUNG	partsIdent
L94	Omission parking lamp	sales
LA2	Headlamp Assist	sales
LB1	Side marker lights	sales
LB5	3rd Brake light	sales

Code	Designation	Code type
LC4	Comfort overhead control panel	sales
LE1	Adaptive brake lights	sales
LV1	Preinstallation for rotating beacon lamp	sales
LX5	Europe	sales
M60	Alternator 14 V / 250 A	sales
M72	Fahrzeug HVO fähig	sales
MI9	omission of eco start/stop function	sales
MP6	Engine version, Euro VI	sales
MR0	Emissions level E (for heavy commercial vehicles)	sales
MS1	Cruise control	sales
MU6	OM 654 DE 20 LA 140 kW (190 hp) 3800 rpm	sales
P47	Front mud flaps	sales
P48	Mud flaps, rear	sales
Q11	Longitudinal member reinforcement	sales
Q22	Trailer coupling, rigid coupling head	sales
R65	Spare wheel bracket below frame end	sales
R87	Spare wheel	sales
RF1	Make of tyres Continental (10)	sales
RH2	Tyres 235/65 R16 C	sales

Code	Designation	Code type
RM0	All-season tires	sales
RS3	Steel rims 6.5 J x 16	sales
RZ2	Wheel make Magnetto Wheels	sales
S04	Adjustable co-driver's seat	sales
S22	Armrest for driver's seat	sales
S87	Driver's seat frame, low	sales
SA5	Airbag, front driver's seat	sales
SB3	Suspension seat, comfort version, driver's seat	sales
SK2	Sitzbelegungserkennung Fahrersitz	sales
T12	Intermediate detent for load comp. sliding door	sales
T16	Sliding door right	sales
T74	Handle for entrance	sales
V36	Panelling under roof	sales
V43	Wood flooring	sales
V85	Package SMOKER	sales
VF7	Fabric Maturin black	sales
W16	Window front left, fixed, in sidewall/sliding door	sales
W17	Window front right, fixed, in sidew./sliding door	sales
W70	Black-tinted rear windows	sales

Code	Designation	Code type
WB9	Control code plant	sales
WD8	Control code plant	sales
WM4	Control code plant	sales
WZ7	Control code plant	sales
X99	Mercedes-Benz AG manufacturer	sales
XC9	COC papers	sales
XG7	without load uprating/derating 3500 kg	sales
XM1	Noise reduction	sales
XM4	Acoustic package	sales
XN3	Modification year G3-II	sales
XO5	Digital Owner's Manual	sales
XO9	Mercedes-Benz MobiloVan with DSB and GGD	sales
XQ1	VIN encoded vehicle data with check digit	sales
XU5	Signs / printed documents, Polish	sales
XV0	Control code – Reference mass check	sales
XV1	Reference mass of at least 2381 kg required	sales
XW9	Steuercode Umstellung WLTP	sales
XY4	Model year 4	sales
XZ0	Model generation 0	sales

Code	Designation	Code type
Y43	Hydraulic Jack	sales
Z0Z	Abdämpfungen Motorraum	sales
Z11	Poor-road version	sales
Z1N	Qualification N1	sales
Z2E	National version for EU – EFTA	sales
Z4V	Production in Düsseldorf	sales
Z52	ECE-Ausführung	sales
Z74	Rohbaumaßnahmen zusätzlich 2	sales
Z75	Additional body-in-white measures	sales
ZM0	Panel van	sales
914U	ARKTIKWEISS	sales

Dane techniczne

Masy i wymiary

Typ	
Konfiguracja osi	RWD
Rozstaw osi	3665 mm

Masy	
Masa własna:	
Masa na 1. oś przednią	1416 kg
Masa na 1. oś tylną	1085 kg
Masa poj. gotowego do jazdy	2501 kg
Maksymalnie dop. masy:	
Masa na 1. oś przednią	1860 kg
Masa na 1. oś tylną	2250 kg
Ładowność:	999 kg
Dop. masa całkowita pojazdu:	3500 kg
Dop. masa całkowita zestawu:	5500 kg

Masa pojazdu z kierowcą (75 kg) i 90% napełnienia paliwem.

Silnik	MU3
Pojemność cm3	1950
Moc w kW / KM	110 / 150
Maks. moment obrotowy w Nm przy	340 Nm przy 1500 obroty/min

Skrzynia biegów	
Kod	G43
Opis	Automatyczna skrzynia biegów 9G-TRONIC