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**Report on progress in implementing
measures and projects in the priority areas
specified in *Directive 2010/40/EU*
of the European Parliament
and of the Council of 7 July 2010
on the framework for the deployment
of Intelligent Transport Systems in the field
of road transport and for interfaces with
*other modes of transport for 2014-2017***

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1. Introduction

In accordance with the reporting obligation set out in Article 17(3) of *Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport* ('ITS Directive' or 'Directive'), we submit a report on progress in implementing measures and projects in the priority areas specified in the Directive.

Pursuant to *Commission Implementing Decision 2011/453/EU of 13 July 2011 adopting guidelines for reporting by the Member States under Directive 2010/40/EU of the European Parliament and of the Council* and Article 17(3) of the Directive, this report contains information on the current state of implementation of national ITS (intelligent transport systems) measures in the priority areas specified in Article 2 of and Annex I to the Directive.

The report has been prepared in cooperation with central administration offices (Ministry of Internal Affairs and Administration, Ministry of Digital Affairs, General Directorate for National Roads and Motorways, General Inspectorate of Road Transport and National Centre for Research and Development), provincial governments and cities.

In order to ensure the transparency of the information provided, the report has been divided into the following sections:

- Short presentation of the strategic approach to ITS measures;
- Information on measures taken by the ITS community in Poland;
- Description of projects and measures, broken down into undertakings, taking into account plans for the next five years, implemented:
 - across the country,
 - in individual provinces,
 - in cities;
- Information on scientific and research projects;
- List of projects for monitoring purposes.



2. Background

2.1 ITS projects implemented until 2016, co-financed from EU funds allocated for the 2007-2013 financial perspective

2007-2016 was a period of particularly intensive deployment of ITS systems in Poland as local governments and road operators took the opportunity to co-finance deployment from EU funds allocated for the 2007-2013 financial perspective. Projects aimed at achieving the ITS-related objectives of the Transport Development Strategy were financed primarily under the Operational Programme Infrastructure and Environment (OPIE) 2007-2013.

The major ITS undertakings implemented in Poland until the end of 2016 were either independent projects or formed part of larger undertakings aimed at transport modernisation (e.g. traffic control components or passenger information systems supplementing the construction of tram lines or the purchase of rolling stock)¹.

Projects supported under Measure 8.3 Development of Intelligent Transport Systems were of particular importance in the period in question. Most of them were pilot projects. The total amount of EU funds allocated under co-financing agreements was PLN 478 218 329.33. The projects were implemented in the following urban agglomerations: Bydgoszcz, Kraków, Tri-City, Upper Silesian Industrial Region, Gliwice, Wrocław, Poznań, Kalisz, Rzeszów, Szczecin, Jastrzębie Zdrój and Legnica. The support granted under Measure 8.3 has represented the biggest impulse in this field in Poland so far. Nearly all of the above projects concerned urban transport and their value (or the value of ITS components in complex projects) ranged from several to over 100 million zlotys). The vast majority of them were completed and accounted for in 2016. Most of the projects were implemented by the governments of provincial capitals; some were implemented by district capitals, consortia or transport associations of cities or municipalities. Capitals of five Eastern Poland provinces (Olsztyn, Białystok, Lublin, Kielce and Rzeszów) also took advantage of the dedicated support for public transport, including the development of ITS infrastructure under the Operational Programme Development of Eastern Poland 2007-2013.

¹ Funds for the deployment of ITS systems were available mainly under the following measures of the Operational Programme Infrastructure and Environment 2007-2013: 8.3 *Development of Intelligent Transport Systems*, 7.3 *Urban transport in metropolitan areas* and 8.1 *Road safety*.

The location of the ITS systems deployed in the period at issue is shown in Fig. 1 and 2.



Fig. 1. Map of ITS projects implemented in 2007-2016 (source: <http://its-frame.pl/>)

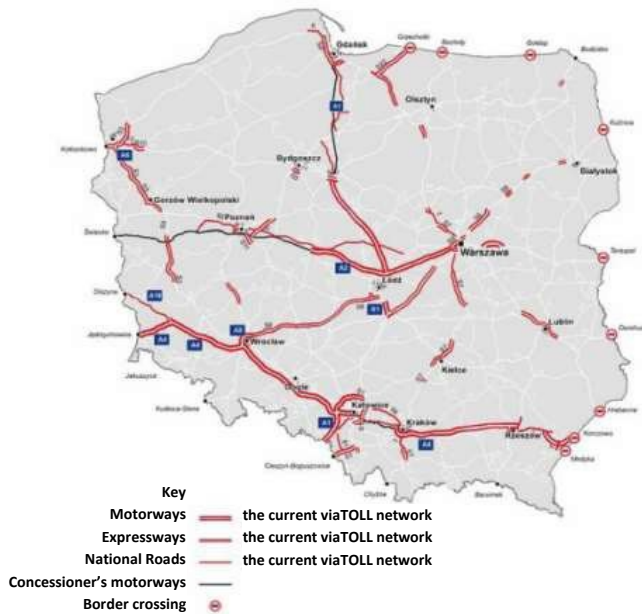


Fig. 2. Map of the network of roads covered by the viaTOLL system. Situation as of 2015 (source: <https://www.viatoll.pl/pl/pojazdy-ciezarowe/mapa>)

2.2 Approach to ITS projects implemented in 2014-2016, co-financed from EU funds allocated for the 2014-2020 financial perspective

The socio-economic development of Poland results in increasing passenger and freight transport needs and necessitates the optimisation of ITS technologies to ensure that the systems are compatible and interoperable. In the current financial perspective, ITS projects are not independent but constitute an integral part of larger infrastructural investments². Funds for implementing such investments are available mainly under the OPIE 2014-2020³ and the financial instrument *Connecting Europe Facility (CEF)*. Support for urban transport in capitals of Eastern Poland provinces under the Operational Programme Eastern Poland (OPEP) 2014-2020 is also continued.

Measure 3.1 OPIE Development of the TEN-T road and air network

In the area of road transport infrastructure, projects aimed at improving road traffic management methods are implemented in addition to those aimed at the construction, reconstruction or expansion of the roads in the TEN-T network. Support under this measure is also targeted at investments aimed at improving road safety, which cover infrastructural investments (engineering), and projects relating to the entire national road network, aimed at providing equipment to road traffic monitoring units and rescue services (technical rescue, monitoring and rescue) and organising Poland-wide campaigns and training (education), resulting from, *inter alia*, the National Road Safety Programme 2013-2020⁴.

Measure 4.1 OPIE Improving the transport accessibility of urban centres located on the TEN-T road network and keeping excess road traffic away from cities

² Such projects form part of undertakings aimed at transport modernisation (e.g. traffic control components or passenger information systems supplementing the construction of tram lines or the purchase of rolling stock).

³ As part of the following measures: 3.1 *Development of the TEN-T road and air network*, 4.1 *Improving the transport accessibility of urban centres located on the TEN-T road network and keeping excess road traffic away from cities*, 4.2 *Improving the transport accessibility of urban centres located outside the TEN-T road network and keeping excess road traffic away from cities* and 6.1 *Development of public transport in cities*.

⁴ Cf. Chapter 3.

Support under the measure is granted for investments aimed at connecting urban infrastructure with the extra-urban TEN-T network (national roads in cities constituting urban nodes of the TEN-T core network), keeping excess road traffic away from cities (extra-urban bypasses on national roads and expressways, national roads in cities with district rights) and making cities better accessible (exit routes on national roads, expressway sections next to cities). These projects are supplemented by road safety investments, covering infrastructural investments (engineering).

Measure 4.2 OPIE Improving the transport accessibility of urban centres located outside the TEN-T road network and keeping excess road traffic away from cities

Support under the measure is granted for investments on the national road network outside the TEN-T network, aimed at connecting urban centres with this network (expressways and national roads serving as exit routes), connecting urban road infrastructure with the extra-urban TEN-T network (national roads in urban nodes of the core network) and keeping excess road traffic away from cities (extra-urban bypasses, national roads in cities with district rights). These investments will be supplemented by road safety investments, covering infrastructural investments (engineering).

Measure 6.1 OPIE Development of public transport in cities

Measures implemented in the area of urban transport are aimed at reducing traffic congestion in cities, improving the traffic flow and safety and reducing the adverse impact of transport on the environment in cities and their functional areas. Support is granted for undertakings aimed at developing public transport under low-carbon economy plans for cities with a view to increasing the cities' safety, quality, attractiveness and comfort. In the cities where rail transport (trams) is used, the development of this branch of public transport is preferred, first and foremost through investments in rail infrastructure. Other low-carbon urban transport modes that meet at least the EURO 6 standard are financed in the remaining cities⁵. Projects involving other elements (investments), including ITS, complementary to the basic rail infrastructure and designed to improve the functioning of the entire transport system, thanks to which the existing means of transport will be infrastructurally integrated and the transport system will be adjusted to the needs of persons with reduced mobility, are also implemented.

⁵ Nevertheless, the purchase of vehicles with alternative propulsion systems (electric, hybrid, biofuels, hydrogen, etc.) will be a priority.

Connecting Europe Facility (CEF)

The CEF is a funding instrument aimed at implementing EU transport infrastructure policy. Its aim is to support the construction of new transport infrastructure in Europe or renew and upgrade the existing one. CEF Transport focuses on projects aimed at removing bottlenecks or bridging missing links in various sections of the core network and the comprehensive network (link), as well as on horizontal priorities such as traffic management systems. It supports innovation in the transport system in order to improve the use of infrastructure, reduce the environmental impact of transport, enhance energy efficiency and increase safety⁶.

The 'National Traffic Management System on the TEN-T network – Stage I' project (No 2015-PL-TM-0093-W, grant agreement No INEA/CEF/TRAN/M2015/1143713) of the General Directorate for National Roads and Motorways is to be implemented under the CEF from 2016 to 2020⁷.

Measure 2.1 OPEP 2014-2020 Sustainable urban transport

The aim of the measure is to increase the use of urban transport in provincial capitals of the Eastern Poland macro-region and their functional areas or in the areas where Integrated Territorial Investments (ITIs) are implemented. Support is granted for the creation of new, environmentally friendly and integrated urban transport networks or for the expansion of the existing ones. The supported investments are comprehensive in nature, which means that they include both an infrastructural component and the purchase of environmentally friendly rolling stock or the deployment of telematic systems. The introduction of new ITS and the expansion of the existing systems are elements of the supported undertakings, supplementing investments in urban transport networks and infrastructure necessary for the purposes of sustainable urban mobility, i.e. intermodal stations and interchanges, track layout and overhead contact systems, and infrastructure for supporting and developing public transport, including ecomobility chains. The implemented measures, including ITS development components, will help reduce travel time and improve the flow of traffic in urban transport, provide passenger services in urban areas where public transport services have not been provided until now, integrate different transport modes, adjust the public transport system to the needs of persons with disabilities and environmental protection requirements, and improve road safety.

⁶ <https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/cef-transport-projects>

⁷ Cf. Chapter 5.1.

The investments are implemented as part of plans prepared by local governments, which address the transition to environmentally friendly and sustainable transport systems in cities. Support as part of the measure is granted under a non-competitive procedure, only for complementary projects earmarked for co-financing under the OPEP and included in the ITI strategies of the capitals of Eastern Poland provinces.

2.3 Outputs and results of the implemented ITS projects

Outputs

In most ITS projects implemented to date, ICT infrastructure has been built or expanded: wired and wireless telecommunications networks and data centres. Such infrastructure is crucial for the functioning of the services and represents an important step towards bringing the concept of 'Smart City' into effect.

The outputs of the ITS projects make it possible to put in place advanced traffic control and transport management functions and to increase safety through independent functions, e.g. the recording of traffic incidents and offences, the improvement of the passage of emergency (rescue) vehicles, video monitoring and an integrated real-time road transport management system. In some projects, functionalities have also been specifically adjusted to the needs of persons with disabilities, e.g. through acoustic systems presenting information for blind persons.

The entities implementing these projects most frequently intended for the solutions put in place to be open in character, so that they were compatible with the existing systems and equipment and could be expanded in the future. Due to the deployment of open architecture systems, other contractors are already able to extend the functional scope and extent, using other equipment and software than that initially used.

Results

The success of ITS deployment depends largely on the extent to which the problems that the systems were supposed to address have been resolved. In most projects, specific result indicators were to be achieved. Most frequently, this was a relative reduction in travel time in the area covered by the project, calculated separately for means of public transport and means of individual transport (vehicles).

For the former means, a significant reduction in travel time was to be achieved (preference was given to public transport).

It is too early to assess the results of the deployment according to the indicators achieved. A longer period of time is needed to calibrate and use the systems in order to make an objective assessment. Some of the systems are not yet complete (all important locations are not covered by the systems as other road investments are being carried out in the same area). Nevertheless, according to road operators, a reduction in travel time ranging from several to several dozen per cent, i.e. frequently higher than that expected, has been achieved on selected routes.



3. National strategic approach

In the Polish legal system, entities deploying ITS applications and services are required to comply with the principles listed in Annex II to the ITS Directive under Article 43a of the Public Roads Act of 21 March 1985 (Journal of Laws (*Dziennik Ustaw*) 2016, item 1440, as amended, codified text)⁸.

Solutions based on intelligent transport systems are deployed to achieve the objectives set out in strategic documents. These include, in the first place, the **Transport Development Strategy** (TDS)⁹, which provides for the creation of a *coherent and efficient transport and logistics system, integrated with the European and global systems*. The following measures aimed at implementing modern technological solutions in transport have been set out as part of the specific objective of the TDS of improving the way in which the transport system is organised and managed:

For rail transport, the TDS provides for:

- the deployment of the ERTMS system on the main TEN-T transport corridors;
- the deployment of unified telematic systems for freight and passenger services by implementing a technical specification for interoperability relating to the telematic applications for freight and passenger services of the trans-European conventional rail system on the main TEN-T rail transport corridors.

For road transport, the TDS provides for:

- the implementation of Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of ITS in the field of road transport and for interfaces with other modes of transport into the Polish legal system;

⁸ The principles are as follows: be effective, be cost-efficient, be proportionate, support continuity of ITS services, deliver interoperability, support backward compatibility, respect existing national infrastructure and network characteristics, promote equality of access, support maturity, deliver quality of timing and positioning, facilitate inter-modality and respect coherence.

⁹ Transport Development Strategy until 2020 (with an outlook to 2030). Ministry of Infrastructure and Development, Warsaw 2013.

- the provision of information services for safe and secure parking places for trucks and commercial vehicles;
- the provision of reservation services for safe and secure parking places for trucks and commercial vehicles on selected sections of national roads;
- the provision of multi-modal travel information;
- the provision of real-time information on traffic conditions;
- the determination of the scope of data and the development of procedures for the provision of road safety related traffic information free of charge to users;
- the implementation of the 'Development of Intelligent Transport Systems' measure under the Operational Programme Infrastructure and Environment;
- the gradual introduction of an electronic toll collection system for the use of road infrastructure on a selected network of public roads for vehicles weighing over 3.5 t;
- the construction of the National Traffic Management

System. For air transport, the TDS provides for:

- the upgrading of air traffic management infrastructure (SESAR) for the purpose of implementing the SES (Single European Sky) programme.

For maritime transport, the TDS provides for:

- the construction of the National Maritime Safety System;
- the development of vessel traffic monitoring and information systems (SSN and VTS/VTMS).

For inland waterway transport, the TDS provides for:

- the launch of a system of harmonised river information services (RIS).

The TDS reflects the objectives specified in the [Strategy for Responsible Development \(SRD\)](#), which is the main strategic document setting out the development objectives of the country. One of these objectives is

*Improving transport accessibility and conditions for the provision of freight and passenger services*¹⁰. In accordance with the above document, by 2020 measures aimed at improving the safety of road and rail traffic as well as of other modes of transport are to be implemented, traffic management systems, including ITS, ERTMS and an air navigation system (SESAR), are to be deployed and a programme for implementing river information services (RIS) is to be continued. Furthermore, in accordance with the SRD, by 2030 IT and telecommunications (transport telematics) systems are to be deployed in all modes of transport, taking into account the costs and potential profits (different for individual modes of transport). This applies in particular to the deployment of ITS in cities and functional areas, the River Information Services (RIS) in the area of the Lower Oder, and the European Rail Traffic Management System (ERTMS) on the main routes.

The need to develop and deploy ITS is taken into account also in other strategic documents on tasks in the area of transport, ICT technologies, computerisation and space technologies. Noteworthy documents are:

- the Efficient State Strategy, in accordance with which *Making the country more efficient requires making extensive use of modern ITC technologies, while public administration authorities should closely cooperate to, inter alia, improve the functioning of the transport system by taking advantage of the opportunities offered by innovative and intelligent solutions called intelligent transport systems (ITS)*¹¹;
- the National Urban Policy, in which ITS are indicated as being *crucial to the development of the transport layout of the city and its functional area*¹²;
- the National Reform Programme for the implementation of the Europe 2020 Strategy, in accordance with which *urban mobility should be optimised through the development of freight transport and intelligent transport systems (ITS)*¹³.

¹⁰ Strategy for Responsible Development until 2020, with an outlook to 2030, Warsaw 2017, p. 301.

¹¹ Efficient State Strategy 2020, Warsaw 2013, p. 33 and 60.

¹² National Urban Policy 2023, Warsaw 2015.

¹³ National Reform Programme Europe 2020, Warsaw 2011.

Recommendations on which specific ITS services should be developed by the state and local authorities are included in programmes aimed at bringing the strategic assumptions into practice. Noteworthy in this area are:

- the Integrated State Computerisation Programme, in which the need to develop ITS in areas such as information on road conditions, tolls or travel planning is indicated as a recommendation for basic public e-services at the central level¹⁴;
- the Programme for the development of space technologies and the use of satellite systems in Poland, in which ITS are indicated as an area to be supported¹⁵;
- the National Road Safety Programme 2013-2020, in which it is indicated that priority should be given to ITS with a view to ensuring road safety¹⁶.

¹⁴ <https://mc.gov.pl/z21-rekomendacje-do-katalogu-podstawowych-e-uslug-publicznych-do-wdrozenia-na-poziomie-centralnym> – Chapter 13.

¹⁵ Programme for the development of space technologies and the use of satellite systems in Poland, Warsaw 2012.

¹⁶ National Road Safety Programme 2013-2020, Warsaw 2013.

4. ITS promotion in Poland

4.1 Polish Association of Transport Telematics and International Transport Systems Telematics Conference

The Polish Association of Transport Telematics¹⁷ was established by employees of technical colleges, research institutes and transport and telecommunications companies.

The association aims to:

1. popularise achievements in the fields of science, technique and economy as well as persons contributing to the development of these fields,
2. promote science and technique,
3. raise its members' professional qualifications,
4. create a forum for exchanging information in the fields of science and technology,
5. ensure that engineers and technicians adhere to professional ethics,
6. represent and defend the professional and personal interests of its members,
7. propagate the idea of the humanisation of technique and association activity.

While the association was formally registered in 2007, it had been active much earlier than that, as evidenced by the annual *Transport Systems Telematics* conference, which provides the opportunity to exchange experience and become acquainted with the latest technologies and developments in the field of intelligent transport systems for all modes of transport.

The 17th edition of the conference was held in 2017 under the auspices of the Minister for Infrastructure and Construction, the Marshal of Śląskie Province and the Committee of Transport at the Polish Academy of Sciences as well as under the media patronage of 11 scientific journals and the Springer and Wykładnia publishing houses.

¹⁷ <http://www.pstt.eu/index.php>

As every year, the aim of the conference was to acquaint the participants with the latest improvements in transport resulting from the global achievements in telematics. Nearly 100 lectures on infrastructure for all modes of transport¹⁸ were entered in 2017 and presented during a plenary session, six scientific sessions, two poster sessions and two short presentation sessions. Conference papers will be published (as in previous years) in the Communications in Computer and Information Science series by the Springer Verlag publishing house and in the Archives of Transport System Telematics journal published by the Polish Association of Transport Telematics.

4.2 ITS POLAND Association and Polish ITS Congress

The Intelligent Transport Systems ITS POLAND Association has been operating since 2007 as a knowledge partnership in the field of intelligent transport systems. It constitutes a platform bringing together the industry, services, central and local government organisations, research and implementation institutes and academic centres. ITS POLAND is a member of ERTICO – ITS Europe and ITS Nationals.

As part of its activities, ITS POLAND organises the ITS LEADER competition, the Polish ITS Congress and branch meetings, seminars and conferences relating to ITS. It also publishes the List of ITS Branches in Poland and the Code of Good Practices for effective deployment of ITS, and maintains the www.przegląd-its.pl website.

The Polish ITS Congress¹⁹, organised by ITS POLAND for 10 years now, provides a platform for exchanging information on the application of systems and services in Poland and abroad. During the congress, specific investment plans of ITS companies are presented and modern telematic solutions are promoted and discussed. During the sessions in 2017, the focus was on, *inter alia*, technologies used in public transport, including new ways of managing demand for transport in towns using ITS. Railways were also discussed, as in previous years.

As every year, the companies participating in the congress had the opportunity to present their latest solutions not only during speeches and discussion panels but also in a specially created exhibition space, which the participants in the congress greatly enjoyed.

¹⁸ The lectures concerned in particular: ITS architecture, strategies for introducing transport telematics solutions, telematic services, control and management systems in transport and the safety of transport telematics systems.

¹⁹ <http://itspolska.pl/index.php?lang=pl>

The congress also provides an opportunity to present the winners of the ITS LEADER competition. Awards are granted in the following categories: product, scientific and research paper, and dissertation.



5. National projects

5.1 Implementation of the ‘National Traffic Management System on the TEN-T network – stage I’ project²⁰

Implementation period: 2016-2020 – the main project and 2019-2023 – system integration.

The agreement for a grant from CEF funds for the project was concluded with the European Commission in November 2016 (INEA/CEF/TRAN/M2015/1143713). Co-financing: 85 % of the eligible costs. Project No: 2015-PL-TM-0093-W. Project value: EUR 144 954 797 (PLN 645 541 693). Co-financing: EUR 123 211 577. The material scope of the project is to be implemented in the following stages in 2017-2020: preparing tender documentation for implementation work, selecting contractors for the implementation work and executing the work.

The project is crucial for the development of a coherent traffic management system on national roads²¹ and provides for the implementation of a number of ITS services identified by the GDDKiA as having the highest priority for road users and for traffic management purposes. The most important of these services are information on traffic conditions and travel time, information on incidents, weather information, area and corridor traffic management, dynamic designation of diversions, information on the road network, and intelligent and safe parking places.

The material scope of the project will be implemented by, *inter alia*, installing equipment in the right-of-way (variable-message signs, prismatic signs, cameras, traffic parameter measuring devices, weather stations), developing central system-management software, and creating a communication network and system operation stations (traffic management centres). Existing independent traffic management systems are to be integrated with the central modules of the National Traffic Management System and other traffic management systems, which will be put in place as part of the construction of national roads.

²⁰ Stage I of the overall task indicated in the report for 2011-2014 as the National Traffic Management System – a set of related projects and measures leading to the deployment of an integrated ICT system for dynamic traffic management on the national road network and for the support of road infrastructure maintenance processes.

²¹ It was included in the Implementation Document for the Transport Development Strategy until 2020 (with an outlook to 2030).

The territorial scope of the project (Fig. 3) is connected mainly to the Baltic-Adriatic TEN-T core network corridor and covers approx. 1 100 km of roads, i.e. approx. 28 % of the length of the TEN-T core network in Poland.

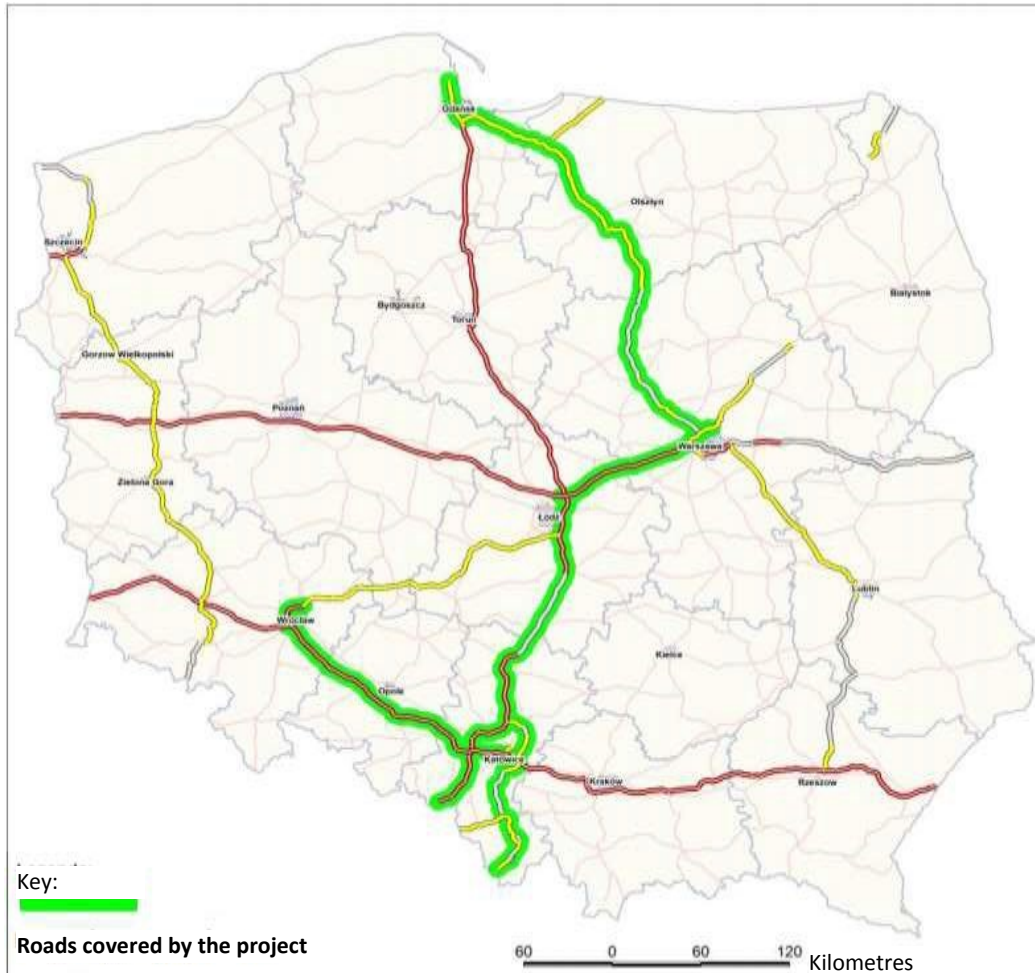


Fig. 3. Map of the territorial scope of the 'National Traffic Management System – stage I' project

5.2 Creation of the National Access Point – CROCODILE and CROCODILE 2

Implementation period: 2014-2018

Projects co-financed from EU funds as part of the TEN-T and CEF funds.

Assumptions for the creation of the National Access Point to information on traffic conditions were prepared as part of the CROCODILE project implemented in 2014-2015. Since 2016, work on the National Access Point to information on traffic conditions has been continued under the CROCODILE 2 project. The requirements for the National Access Point (Single Point of Access) are set out in the Commission's delegated acts issued under the ITS Directive (2010/40/EU of 7 July 2010).

In accordance with the grant agreement (INEA/CEF/TRAN/M2104/1058107), the eligible value of the CROCODILE 2 project for Poland is EUR 3 238 000. The co-financing constitutes 20 % of the eligible costs. Project No: 2014-EU-TM-0563-W.

The procedure for selecting the contractor for the first stage of the project, containing the functionalities specified in Commission Delegated Regulation (EU) No 886/2013 of 15 May 2013 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users, and No 885/2013 of 15 May 2013 supplementing the above Directive with regard to the provision of information services for safe and secure parking places for trucks and commercial vehicles, was announced in February 2016.

The National Access Point will constitute a source of data on the traffic situation across the country, ensuring consistent and reliable information on traffic conditions. A uniform communication interface will allow the interested parties to easily install it in their systems. The source of information will be the operators of all categories of roads (and in the future other entities), who will provide data by means of a dedicated communication interface or an application available via an internet browser.

The first stage of the project is scheduled for completion in 2017. Work to extend the functionalities of the National Access Point to meet the requirements indicated in the remaining delegated regulations issued under Directive 2010/40/EU is planned for 2018. The created solution will be complementary to the 'National Traffic Management System on the TEN-T network – stage I' project and will supplement its functionalities.

5.3 Traffic management systems put in place under road projects included in the National Roads Construction Programme 2014-2023

Implementation period: in accordance with the plans for the implementation of the National Roads Construction Programme, i.e. until 2023.

Components of traffic management systems are included in road contracts for road sections located outside the network covered by the 'National Traffic Management System on the TEN-T network – stage I' project. These systems are put in place on the basis of concepts and design documentation which take into account the assumptions for the National Traffic Management System and will subsequently be integrated with its central modules.

Requirements for the traffic management systems are set out on an ongoing basis in functional and utility programmes for the purposes of next road projects. Concepts and elements of design documentation prepared for the systems are also being verified. Components of the systems will be installed at the final stages of investments. The costs of the traffic management systems are included in the value of road construction contracts.

5.4 Road traffic monitoring

The *Construction of a central system for automatic traffic monitoring* project, co-financed by the EU from the European Regional Development Fund under the Operational Programme Infrastructure and Environment, was implemented in 2011-2015. The total eligible cost of the project was PLN 183 263 384.95, of which the co-financing from the European Regional Development Fund was PLN 155 773 877.20. The beneficiary of the project was the General Inspectorate of Road Transport.

As part of the project, speed camera infrastructure for stationary and mobile traffic monitoring was purchased, the Automatic Traffic Monitoring Centre (Centrum Automatycznego Nadzoru nad Ruchem Drogowym, CANARD) was set up and system software for automatic processing of data from recording devices was purchased. On 1 July 2011, the CANARD began disclosing cases where the speed limits were exceeded: initially, using existing speed camera infrastructure taken over from the Police and the General Directorate of National Roads and Motorways. 29 mobile recording devices were installed in vehicles in November 2013, and the final version of the ICT system was launched at the CANARD's Data Processing Centre in May 2014.

A total of 400 stationary recording devices, 29 average speed measuring devices and 20 sets of devices for monitoring red-light running were installed by the end of 2015²².

Two indicators were adopted to assess the implementation of the project, i.e. the number of kilometres of roads covered by the CANARD's system and the number of violations detected by the CANARD. For both indicators, the target values were specified in the project co-financing agreement.

The *Increasing the effectiveness and efficiency of the automatic traffic monitoring system* project is to be implemented under the OPIE 2014-2020 until 2023²³. This undertaking is a development and continuation of the completed project. Its main aim is to further improve road safety by extending the monitoring to all categories of public roads. Recording devices for all road categories are to be purchased or replaced/upgraded under the project: initially approx. 600 recording devices of various types, including speed cameras, speed measuring devices and devices for monitoring red-light running. ICT solutions are also to be developed. The total cost of the project is estimated at PLN 162 million²⁴.

The following performance indicators were specified in documents relating to the project:

- the number of newly purchased or upgraded recording devices,
- the number of times the CANARD's Data Processing Centre system was integrated with external systems,
- a decrease in the accident rate in places where the new stationary recording devices of various types were installed.

²² As of 26 April 2017, the CANARD monitors road traffic in Poland using 469 stationary devices and 29 mobile devices installed in vehicles.

²³ The agreement for the preparation of the project under a non-competitive procedure (pre-agreement) was concluded on 30 June 2016.

²⁴ This project will help to meet, *inter alia*, the objectives of the White Paper, i.e. the European Commission's paper laying down a strategy for the future of the EU transport system, and the National Road Safety Programme for 2013-2020 (one of the transport policy objectives set out in these documents is a 50 % decrease in the number of road fatalities by 2020)

5.5 Emergency call system

A system comprising 17 emergency call centres is currently in place in Poland (since 1 January 2014). Under that system, emergency calls to 112 are handled in a uniform manner on the basis of standards and procedures developed by the Ministry of Internal Affairs and Administration²⁵.

eCall infrastructure required for the proper receipt and handling of all calls will be put in place by 1 October 2017²⁶. The system will operate based on the current communication infrastructure, but MSD (minimum set of data) messages, containing the vehicle identification number, the exact location of the incident (determined using GPS) and information about whether the call has been activated manually or automatically, will also be transmitted along with voice calls.

The emergency call centres currently handle eCalls from vehicles covered by commercial services by contacting companies providing such services by phone.

²⁵ Electronic communication between the emergency call centres and control rooms of the Police and State Fire Services is now possible through the electronic transmission of data on the incident collected by the emergency number operator while talking to the person reporting that incident.

²⁶ In accordance with Decision No 585/2014/EU of the European Parliament and of the Council of 15 May 2014 *on the deployment of the interoperable EU-wide eCall service* (OJ L 164, 3.6.2014).

6. Selected provincial projects²⁷

6.1 Kujawsko-Pomorskie Province

Implementation period: 2014-2015:

Provincial Roads Registration and Management System for Kujawsko-Pomorskie Province. The direct objective of the project is to improve the management of the provincial roads by deploying modern ICT systems capable of acquiring, processing and transmitting data, with a view to ensuring better access to information on road infrastructure and traffic conditions for the inhabitants, undertakings and provincial road users. Effects:

- ensuring access to information on the road infrastructure used in the everyday management of the provincial roads, and reducing the operating costs of the Provincial Roads Authority,
- ensuring reasonable management of public funds by deploying a process-oriented system for managing ongoing maintenance, repairs and investments, taking into account the integration of the system for recording failures, defects and guarantees,
- increasing the efficiency of field work by deploying a mobile system for acquiring and transmitting data and, at the same time, increasing the transparency of the Provincial Roads Authority's operations by publishing information on the ongoing and planned activities on a public traffic geoportal,
- ensuring access for citizens, undertakings and road users to the services provided by the Provincial Roads Authority as part of its public tasks in electronic form by launching a public traffic geoportal.

Plans for the next five years:

²⁷ All investments implemented by the provinces in the period at issue and plans for the next five years are included in the list attached as Annex 2 to the Report.

As part of future investments aimed at reconstructing and modernising roads, the Provincial Roads Authority intends to commission the setting up of new image acquisition points, vehicle pre-selection points and weather monitoring, which will be incorporated into the existing system.

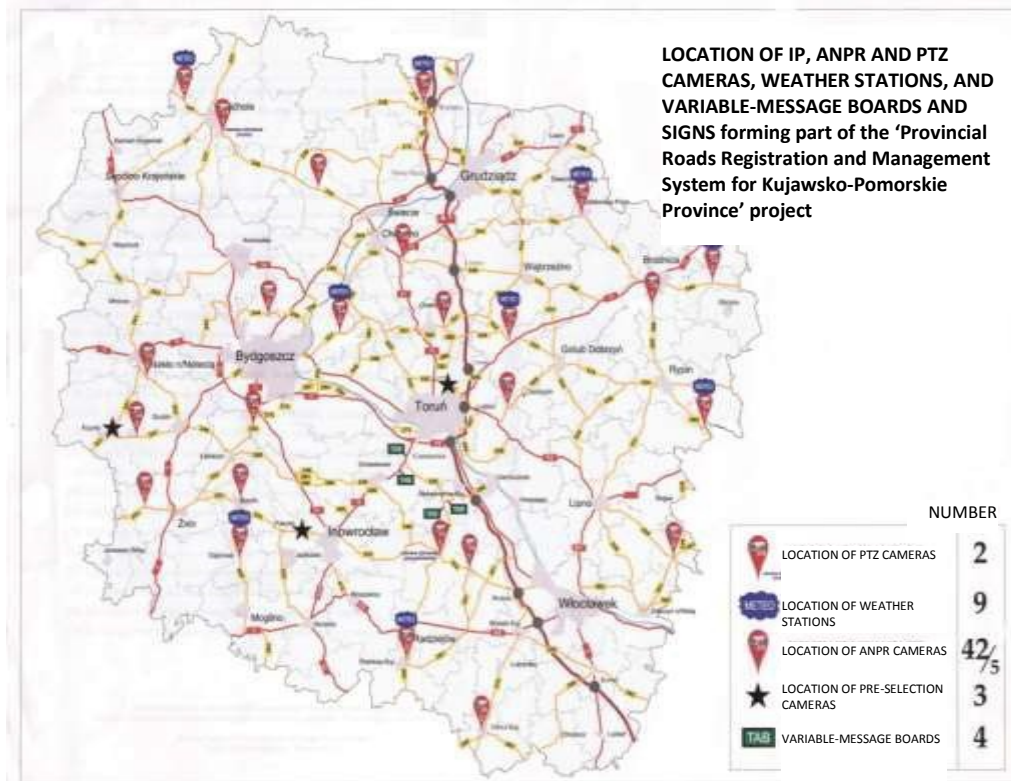


Fig. 4 Location of devices forming part of the 'Provincial Roads Registration and Management System for Kujawsko-Pomorskie Province' project.

6.2 Mazowieckie Province

Implementation period: 2013-2016:

ITS projects introduced by Koleje Mazowieckie – KM Sp. z o.o.

1. A rolling stock failure detection system (DSAT) deployed by PKP PLK S.A. and made available to rail operators. In addition, in 122 new and upgraded vehicles the company installed systems that make it possible to view and track the vehicle status online on an ongoing basis. The company also plans to deploy similar systems in 71 electric multiple units which are to be purchased.

2. A train positioning system using GPS terminals, installed practically in the company's entire rolling stock, used mainly by the dispatching unit. It is one of the IT tools facilitating the work of dispatchers, used mainly to organise rail traffic.
3. Regardless of the above, data on the position of vehicles are fed into the following IT systems:
 - *Crisis Management Centre's Interactive Map for Rail Operators*, which is used to organise operations in the event of a crisis.
 - *Your travel portal*, containing full information about whether the train timetable is adhered to, including the information about disturbances, if any²⁸. In addition, train movements can be tracked on an interactive map updated in real-time²⁹.
4. In 2015, Koleje Mazowieckie introduced, as a pilot project, the *Masovian Card*. It is a modern type of carrier for recording Koleje Mazowieckie's tickets in electronic form on contactless cards. Tickets issued in accordance with Koleje Mazowieckie's Transportation Tariff and season tickets of the Urban Transport Authority in Warsaw can be recorded on such cards.

ITS projects introduced by the Provincial Roads Authority for Mazowieckie Province.

Implementation period: 2014-2016:

Acyclic traffic control adjusting control parameters to existing traffic has been put in place in seven locations to date on the roads in Mazowieckie Province managed by the Provincial Roads Authority for Mazowieckie Province as part of measures aimed at deploying intelligent transport systems.

²⁸ If a train is delayed, the length and cause of that delay are indicated. The delay on the next stations is also projected. If a train is cancelled or its route is changed, information on the type of substitute vehicle is provided.

²⁹ Information is available on Koleje Mazowieckie's website, in the section *Current train movements*.

Plans for the next five years:

Deploying in 14 locations acyclic traffic control systems adjusting control parameters to existing traffic in isolated traffic lights not covered by centralised area traffic control and management systems.

6.3 Świętokrzyskie Province

Implementation period: 2014-2017:

16 weather warning systems, together with cameras, and variable-message signs were installed on provincial roads under various projects in the above period. The weather stations were set up on the network of G category provincial roads and their setting up is linked to the following priority areas:

- Article 2, indent III: ITS road safety and security applications,
- Article 3(b): the provision of EU-wide real-time traffic information services,
- Article 3(c): data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users.

Plans for the next five years:

Further weather stations, together with cameras, are to be expanded on the network of provincial roads as part of future investments.

Fig. 5 Location of weather stations, together with cameras.



7. Selected projects in urban areas³⁰

7.1 Bydgoszcz

Implementation period: 2014-2016:

Intelligent Transport Systems in Bydgoszcz and their expansion. The following tasks were performed as part of the expansion of the ITS system (in 2015-2016):

- the introduction of a traffic control functionality into the central traffic control system (SCATS), together with the installation of CCTV cameras at intersections built as part of the construction of a tram line to Fordon district – 12 intersections;
- the purchase, assembly and commissioning of traffic light controllers, together with their integration into the ITS system and the central traffic control system (SCATS) – nine intersections;
- the purchase, assembly and commissioning of automatic number-plate recognition cameras, together with wiring and their integration into the subsystem for directing vehicles onto alternative routes of the ITS system – two ANPR cameras;
- the purchase, assembly and commissioning of CCTV video monitoring cameras, together with wiring and their integration into the video monitoring subsystem of the ITS system – four CCTV cameras;
- the preparation of design documentation for traffic lights at ul. Wojska Polskiego – Trasa Uniwersytecka and ul. Grunwaldzka – commercial facility, taking into account the assumptions for the ITS system;
- the expansion of the disk space of the EG system server, which is a component of the parking information subsystem of the ITS system.

Categories of roads on which ITS projects are implemented:

municipal, district, provincial and national.

³⁰ All investments implemented by the provinces in the period at issue and plans for the next five years are included in the list attached as Annex 3 to the Report.

Information on performance indicators for ITS projects:

Efficiency:

- the average travel time by tram on selected transport corridors was expected to be reduced by 8 %: a 12.88 % reduction in the average travel time by public transport was achieved directly after the task was performed,
- the average travel time by car on selected transport corridors was expected to be reduced by 6 %: a 31.26 % reduction in the average travel time by individual transport was achieved directly after the task was performed.

Plans for the next five years:

Currently, the expansion of individual ITS subsystems is planned for each new road investment, in particular for traffic control and video monitoring, taking into account the right of way for public transport.

7.2 Gliwice

Implementation period: 2014-2016:

Gliwice did not implement direct investments relating to ITS in the reporting period. There are plans to launch new projects in the coming years.

Categories of roads on which ITS projects are implemented:

municipal, district, provincial and national.

Information on performance indicators for ITS projects:

- the number of ITS systems installed (1);
- the length of roads covered by ITS systems (420 km).

Plans for the next five years:

The second stage of the expansion of the detection system in the city, together with the upgrading of selected traffic lights, is planned in 2017-2018. The aim of the project is to make public transport more attractive by:

- increasing the functionality of the existing system, in particular by giving the right of way to urban transport vehicles in the entire area of the city of Gliwice;
- increasing the number of persons using public transport;
- increasing the efficiency of transferring information on the current traffic situation in the city;
- ensuring that rescue services can arrive at the scene of an emergency faster, and coordinating and managing activities aimed at quickly and safely resolving problems resulting from sudden and unexpected events;
- improving the transport accessibility of Gliwice agglomeration and the entire region;
- reducing traffic volume on roads covered by the system;
- optimising such traffic control indicators as minimising the amount of time lost, increasing travelling speed and minimising the number of times vehicles must come to a halt;
- reducing travel time through the city (in particular by rolling stock in public passenger transport);
- increasing the safety of all road users;
- improving the conditions of urban roads (reducing surface degradation caused by traffic volume);
- reducing road transport costs.

7.3 Upper Silesian Industrial Region

Implementation period: 2014-2016:

The *Dynamic Passenger Information System within the area of competence of the Municipal Transport Union of the Upper Silesian Industrial Region (Komunikacyjny Związek Komunalny Górnośląskiego Okręgu Przemysłowego, KZK GOP)* was launched in 2014. The main aim of the project was to improve the management of public road transport through the use of ITS solutions.

The project covered:

- the design, supply and deployment of the Dynamic Passenger Information System and the supply of a professional IT tool to support traffic modelling and analysis;
- the supply of computers and software for traffic modelling;
- ensuring GSM data transfer between the infrastructure created under the project (the Dynamic Passenger Information System was deployed in six among the 27 municipalities that formed the KZK GOP at the time);
- the construction of the Dynamic Passenger Information System Management Centre and the purchase of application software for the system, together with licences;
- the purchase of deployment and commissioning services for the system; the costs of monitoring the installation and staff training;
- the creation of communication infrastructure for bi-directional data and signal transmission – equipping 177 vehicles with general-purpose on-board computers with GPRS/EDGE communication modules;
- the assembly of information boards – equipping 72 stops with LED boards.

The Dynamic Passenger Information System was deployed in six municipalities forming part of the KZK GOP (i.e. in Będzin, Dąbrowa Górnicza, Gliwice, Katowice, Sosnowiec and Zabrze). The total cost of project implementation was PLN 5.5 million, of which PLN 3.5 million was refunded as part of ERDF co-financing (the funds were granted under Measure 8.3. of the Operational Programme Infrastructure and Environment 2007-2013).

The second project covering ITS components was the *Silesian Public Services Card* (implemented in 2010-2015). The idea behind the project is to allow holders to pay for, *inter alia*, using means of public transport or parking with an electronic money instrument. Apart from being electronic money instruments, the cards can be used to identify the holders and are electronic signature certificate carriers. The cards were placed on the market to improve the quality of life of the inhabitants of the entire region and to make it easier to analyse the flow of passengers using the public transport organised by the KZK GOP. The project received co-financing from the ERDF under the Regional Operational Programme of Śląskie Province for 2007-2013. The cost of creating the system was PLN 142.6 million, of which the EU co-financing was PLN 77.8 million.

The system consists of:

- a Customer Portal (a platform for processing the cards, where the cards can be recharged and season tickets can be purchased and coded),
- 40 Customer Service Points,
- 109 Stationary Card Recharging Machines,
- 223 parking meters,
- 410 modules for collecting fees for municipal services,
- 800 modules for collecting fees and recharging at sellers' premises,
- 1 300 sets of devices in public transport vehicles,
- 320 devices for controllers,
- 20 Data Collection Points,
- a Data Processing Centre – server rooms (primary and back-up),
- a financial settlement system.

Categories of roads on which ITS projects are implemented:

municipal, district, provincial and national.

Information on performance indicators for ITS projects:

- product indicator – the number of systems deployed – two systems (the Silesian Public Services Card and the Dynamic Passenger Information System);
- result indicator – a reduction in travel time – as of 31 December 2014, travel time was reduced on the lines covered by the system from 17 minutes and 25 seconds to 16 minutes and 22 seconds.

Plans for the next five years:

The *Dynamic Passenger Information System II* project began to be implemented in 2017. Its aim is to expand the Dynamic Passenger Information System deployed as a pilot project in the previous programming period for EU funds. As a result of the project, the system will be expanded to include the entire KZK GOP, as well as the area of the city of Tychy, which will help accelerate and strengthen the integration of the public transport system in the Central Sub-Region of Śląskie Province.

The project will be implemented in stages on all communication routes of the KZK GOP and Tychy where public transport services are provided. It will mainly cover stops generating the largest flow of passengers, including interchanges of regional importance. The infrastructure set up will support bus, tram and trolleybus transport.

The material scope of the project includes:

- the supply and assembly (together with connections) of equipment at stops – 462 boards (412 in the KZK GOP and 50 in the city of Tychy),
- the supply and assembly of equipment for 170 vehicles owned by the Urban Transport Authority in Tychy,
- integration with the Dynamic Passenger Information System and Silesian Public Services Card system put in place in the KZK GOP and other ITS systems within the Central Sub-Region (at least at the level of information transfer),
- the supply of applications for mobile devices and mobile service equipment.

The total value of the project was estimated at PLN 43.4 million, of which PLN 26.4 million will come from the Coherence Fund under the OPIE 2014-2020, Priority VI Development of low-carbon public transport in cities, Measure 6.1 Development of public transport in cities.

7.4 Kalisz

Implementation period: 2014-2017:

1. *Creation of the Integrated Traffic Management System in Kalisz* – Stage I project implemented in the design-and-build model under the Operational Programme Infrastructure and Environment in 2008-2015,
2. Reconstruction of the traffic lights at ul. Stawiszyńskiego – ul. 3 Maja – Plac Kilińskiego – ul. Warszawska intersection as part of the *Reconstruction of sections of ul. Warszawska and ul. Stawiszyńskiego* task.

Categories of roads on which ITS projects are implemented:

district and national.

Information on performance indicators for ITS projects:

N/A

Plans for the next five years:

1. Construction of traffic lights at ul. Górnośląska – ul. Staszica intersection, coordinated with traffic lights along ul. Górnośląska, from ul. Podmiejska to ul. Polna, and installation of video monitoring covering the entire intersections, along with the connection to the Traffic Control Centre. The planned cost of the investment is PLN 360 462.78. Implementation: 5 January 2017 – 15 May 2017 (district roads),
2. Upgrading of traffic lights at the following intersections:
 - ul. Harcerska – ul. Górnośląska – ul. Nowy Świat,
 - ul. Śródmiejska – ul. Fabryczna – ul. Kościuszki,
 - ul. Harcerska – ul. Kopernika.
3. As part of the upgrading, the above intersections will be equipped with actuated traffic lights, coordinated with traffic lights along ul. Górnośląska, from ul. Podmiejska to ul. Polna, and video monitoring covering the entire intersections, along with the connection to the Traffic Control Centre. The above traffic lights are linked to the creation of a cycle path at ul. Śródmiejska (section Rogatka – ul. Kazimierzowska). An Integrated Interchange will be built in Kalisz and selected public transport stops will be equipped with dynamic passenger information boards and ticket machines.
4. If external funds are obtained, the Urban Road and Transport Authority intends to upgrade further intersections and connect them to the Traffic Control Centre as part of the implementation of stage II of the 'Creation of the Integrated Traffic Management System in Kalisz' project.

7.5 Katowice

Implementation period: 2014-2016:

N/A

Categories of roads on which ITS projects are implemented:

national, provincial, district and municipal.

Information on performance indicators for ITS

projects: N/A

Plans for the next five years:

Intelligent Transport Management System in Katowice. It is planned that the system will comprise, in particular, an area traffic control subsystem (public transport vehicles will have the right of way on tram lines and main bus routes) and a driver information subsystem at selected locations, including variable-message signs directing drivers onto alternative routes (e.g. when the tunnel under Rondo gen. J. Ziętka is closed) or signs displaying information about Park&Ride parking places at interchanges. The system should be compatible with intelligent transport management systems which are planned, under deployment or operate in the area of the city and the agglomeration and should make use of the current technological solutions available for use.

The project is currently at the pre-design stage. It is to be implemented in the design-and-build model in 2018-2020.

The scope of the investment, the locations where ITS systems are to be deployed and the performance indicators will be specified in the design documentation, which is currently being prepared.

7.6 Kraków

Implementation period: 2011-2015:

‘Development of the public transport management system in Kraków’ project

- 1) Expansion of the traffic control system (UTCS), including the construction of an underground fibre optic system. Implementation of technological solutions with a view to reducing travel time by tram and expanding the Traffic Control System:
 - as part of Stage I (until mid-2014) – along the tram line in the area of al. Pokoju and ul. Nowohucka and along Teatr Bagatela – Bronowice Małe line.

- as part of Stage II (until the end of 2015) in the area of ul. Czarnowiejska and along the tram line in the area of ul. Kocmyrzowska, ul. Jana Pawła II and al. Solidarności.

Developing traffic light programs at the intersections covered by the contract, taking into account that trams have the right of way at intersections.

Laying down fibre optic cables in cable ducts on some sections of urban roads to enable the transmission of data to and from the Traffic Control Centre, including:

- the transmission of digital data (bi-directional) between the traffic control system (UTCS) and traffic light controllers at intersections,
- the transmission of digital data (bi-directional) between the tram traffic control system (TTCS) and dynamic passenger traffic information boards,
- the transmission of digital video images (unidirectional) from monitoring cameras at intersections,
- the transmission of digital data and video images (bi-directional) linked to the System of Traffic-Calmed Zone Access Control and Public Transport Lanes Monitoring.

The task was performed in two stages. Stage I was implemented in 2011-2014, while work on Stage II was performed in 2014-2015.

The area covered by the project:



Fig. 6 Map of the area covered by the project.

2) Expansion of the public transport management system (TTSS);

The following work was performed as part of the task in

2013-2015:

- the entire rolling stock designated for the tram network was equipped with on-board computers with a view to covering all trams in operation by the TTSS system and ensuring ongoing monitoring of the location of the tram rolling stock and adherence to timetables;
- technological solutions were put in place to ensure better access to real-time passenger information for passengers at tram stops by setting up passenger information boards and boards displaying information on the current urban transport network. In this regard, 203 passenger information boards are to be supplied and installed at tram stops;
- software for analysing statistical data from the TTSS system was supplied;
- 14 boards displaying information on Kraków's communication network were supplied and assembled;
- modules were supplied for the software for drawing up timetables;
- an integration module for external public transport information systems was supplied.

The area covered by the project:

**MAP OF THE SYSTEM
OF DIRECT PASSENGER
INFORMATION
BOARDS**



Fig. 7 Map of the area covered by the project.

3) Expansion of the Traffic Control Centre

The Traffic Control Centre was upgraded and equipped as part of the task in 2014-2015. The Centre is primarily responsible for around-the-clock monitoring of road and transport infrastructure, traffic and public transport. The Centre has servers and dispatch stations of the UTCS and TTSS systems. The expansion covered:

- the upgrading of the existing ICT system of the Centre;
- the purchase of equipment necessary for the Centre to function properly;
- the purchase and installation of a large-format screen;
- the launch of a system ensuring radio communication between the Centre, field services and entities cooperating with road operators;
- the upgrading of the power supply and cooling systems of the Centre's server room.

4) Development of traffic control on the main communication routes in Kraków:

Completed projects (implemented in 2014-2016):

- the adjustment of the tram line along ul. Mogilska and al. Jana Pawła II to the parameters of fast trams (section from Rondo Mogilskie to Plac Centralny) – the expansion of the area traffic management system in the investment implementation area and the development of the system of dynamic passenger information boards;
- the construction of a tram line to Kampusz UJ – stage II – the inclusion into the area traffic control system of traffic lights located along ul. Tischnera, Brożka, Wadowicka, Kapelanka, Monte Cassino, Dietla (temporary track) and Zielińskiego as well as traffic lights next to most Zwierzyniecki and the tram terminus in Salwator district. Dynamic passenger information system;
- the expansion of the Kraków Fast Tram line, stage II B, together with a road system (ul. Lipska – ul. Wielicka) – the expansion of the traffic control system and the development of the system of dynamic passenger information boards.

Projects currently being implemented:

- the reconstruction of ul. Igołomska (from ul. Giedroycia to the city borders) – the expansion of the traffic management system;
- the reconstruction of al. 29-go Listopada (from the city borders to ul. Opolska) – the expansion of the traffic control system and the expansion of the system of dynamic passenger information boards;
- the construction of the Kraków Fast Tram line to Górka Narodowa terminus – the expansion of the traffic control system and the expansion of the system of dynamic passenger information boards;
- the repair of intersections, together with the inclusion into the traffic control system – along ul. Wielicka and ul. Zakopiańska, individual intersections across the city.

Categories of roads on which ITS projects are implemented:

municipal, district and provincial.

Information on performance indicators for ITS projects:

The following indicators were used to monitor the result of the expansion of the traffic control system (UTCS) deployed under the *Development of the public transport management system in Kraków* project:

- time savings for users of public transport (trams) after the expansion of the UTCS system: 10 %;
- time savings for users of individual transport after the expansion of the UTCS system: 5 %.

The remaining ITS solutions deployed in Kraków form part of larger transport investments, e.g. construction/reconstruction of roads, construction/reconstruction of tram routes. Therefore, specific indicators for monitoring the deployment of ITS components are not determined, only indicators for the entire projects. The main indicators used in transport projects covering ITS components are:

- time savings in passenger and freight transport;
- a reduction in travel time by tram on the section concerned;
- the additional number of users of the improved urban transport services;
- the number of persons using urban transport.

Plans for the next five years:

Development of traffic control on the main communication routes in Kraków – projects prepared for implementation:

- the construction of the Kraków Fast Tram line to Azory and Chełmońskiego termini – the expansion of the traffic control system and the expansion of the system of dynamic passenger information boards;
- the construction of the Kraków Fast Tram from Lema – Meissnera intersection to Mistrzejowice terminus – the expansion of the traffic control system and the expansion of the system of dynamic passenger information boards;
- the reconstruction of ul. Kocmyrzowska from the city borders to ul. Bulwarowa.

7.7 Krosno

Implementation period: 2014-2016:

As part of the 'System for improving the capacity of intersections with traffic lights along national road No 28 within the administrative borders of the city of Krosno' task, technical documentation was prepared and a system for the dynamic coordination of traffic lights at intersections along national road No 28 with roads without right of way was developed. The section comprises 10 intersections with traffic lights, one pedestrian crossing and three road traffic measurement points. The system increases the capacity of the road network through the designation of coordination routes, improves traffic flow, minimises the number of times vehicles must come to a halt along the main route of national road No 28 and increases traffic safety.

As part of the creation of the traffic control system, existing traffic light controllers were expanded and made compatible with the system, traffic monitoring stations were set up, an intersection monitoring system was created and a weather station was set up.

Categories of roads on which ITS projects are implemented:

national.

Information on performance indicators for ITS projects:

N/A

Plans for the next five years:

Purchasing new rolling stock and equipping the existing one with the electronic passenger information system and video monitoring. Equipping a bus depot with equipment for handling dynamic passenger information and digital video monitoring. Purchasing stationary ticket machines together with licences. Purchasing electronic information boards displaying the communication line number, the direction of travel, real-time bus departures and additional messages. Creating a website and mobile application providing comprehensive information on public transport, *inter alia*, public transport connections, the current timetable (Miejska Komunikacja Samochodowa Sp. z o.o.), information on departures from the nearest stop and the real-time location of public transport vehicles.

7.8 Legnica

Implementation period: 2014-2016:

The *Creation of the integrated traffic and public transport management system in the city of Legnica* project was implemented and led to the creation of:

- the integrated traffic and public transport management centre, supporting all functions of the subsystems of the integrated traffic management system;
- area optimisation and traffic control subsystems, together with the detection of road incidents and the possibility of analysing traffic measurements within the area covered by the system;
- a driver information subsystem – variable-message boards (VMS) installed over roads and registration plate monitoring;
- a redundant communication system between intersections and the centre, based on the TCP/IP communication protocol implemented in the Ethernet fibre optic network and radio networks, a video monitoring subsystem for the intersections covered by the system, and a subsystem for visualising changes in and disruptions to traffic in the city through an internet portal;
- a subsystem for implementing public transport priorities, managing public transport and handling the right of way of special vehicles;
- a passenger information subsystem – electronic boards for Dynamic Passenger Information (DIP);

- a weather information subsystem.

Categories of roads on which ITS projects are implemented:

The project was implemented on national roads (No 3 and 94), provincial road No 364 and district roads.

Information on performance indicators for ITS projects:

- a reduction in travel time by car – 2.05 % – 6.01 % after verification;
- a reduction in travel time for passengers using public transport in the area covered by ITS – 2.04 % – 2.20 % after verification.

Plans for the next five years:

In 2018, the city of Legnica plans to implement ITS investments as part of the *Reducing low emission from transport in Legnica by purchasing modern urban buses for the purposes of public transport, together with the dynamic passenger information system (DIP)* task. Five DIP boards with a total value of PLN 670 000.00 are to be purchased.

7.9 Lublin

Implementation period: 2014-2016:

A traffic control system was deployed on 15 December 2015 under the *Integrated Urban Public Transport System* project. The cost of that system was PLN 27 921 000.00 gross. The ITS system was deployed under the project mainly to ensure the optimal flow of persons and goods within the area covered by the project with a view to ensuring a better flow of traffic across the city, thus reducing exhaust emissions.

Categories of roads on which ITS projects are implemented:

district, provincial and national.

Information on performance indicators for ITS projects:

N/A

Plans for the next five years:

In 2017, the ITS system in Lublin is to be expanded further to include over 60 new intersections. Newly built road nodes are included in the existing system on an ongoing basis.

7.10 Olsztyn

Implementation period: 2014-2016:

The following components were created as part of the *Modernisation and development of the public transport system in Olsztyn* project:

- a traffic control system, together with giving the right of way to public transport vehicles;
- a traffic control centre;
- a dispatch centre for public transport vehicle traffic management and control;
- a passenger information system on the internet, at stops and in vehicles;
- electronic tickets (city cards), together with a charging system and on-board equipment in trams and buses.

Categories of roads on which ITS projects are implemented:

municipal, district, provincial and national.

Information on performance indicators for ITS projects:

- the number of persons using urban transport (persons/year);
- time savings in passenger transport (PLN/year);
- increase in the population using public transport (persons/year).

Plans for the next five years:

Two projects covering ITS solutions, co-financed from the Operational Programme Eastern Poland 2014-2020, are to be implemented in Olsztyn over the next five years.

- 1) The expansion of the existing ITS system under the *Development of public transport in Olsztyn – ecomobility chains* project is to involve:
 - the expansion of the traffic control subsystem, together with giving the right of way to public transport vehicles;
 - the expansion of the video monitoring subsystem at the intersections covered by the traffic control system;
 - the expansion of the passenger information subsystem at stops and in vehicles, together with the expansion of the monitoring system;
 - the expansion of the Olsztyn City Card system to include card personalisation and recharging points;
 - the expansion of the dual-band WiFi Mesh network (2G+5G).

- 2) The expansion of the existing ITS system under the *Development of public transport in Olsztyn – tramway system* project is to involve:
 - the expansion of the video monitoring subsystem at intersections covered by tram line expansion;
 - the provision of equipment for the Traffic Control Centre and the configuration of that equipment to work in the transmission network of the existing system;
 - the expansion of the passenger information subsystem at stops and the installation of ticket machines, together with the expansion of the monitoring system for the tram lines to be expanded;
 - the expansion of the dual-band WiFi Mesh network (2G+5G) linked to tram line expansion.

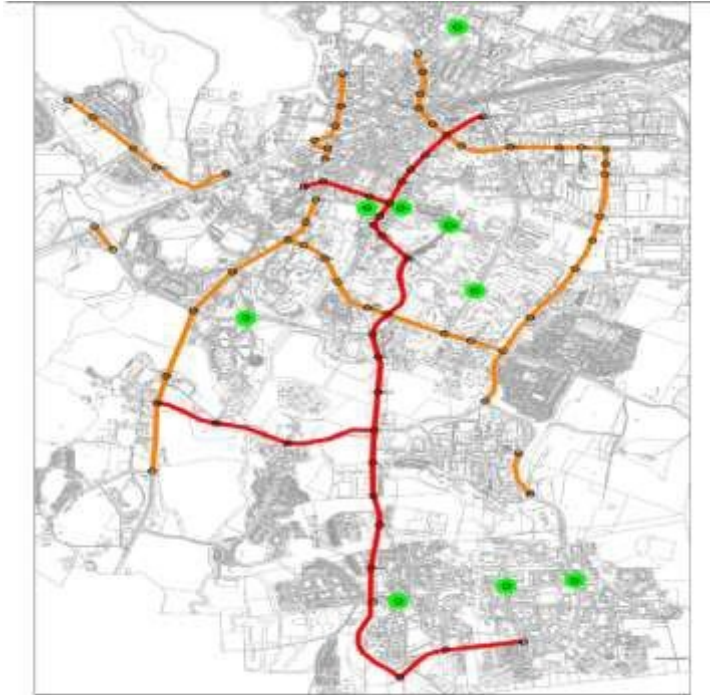


Fig. 1. Division of the area covered by the system into traffic control sub-areas

Fig. 8 Division of the area covered by the system into traffic control sub-areas

7.11 Rzeszów

Implementation period: 2014-2016:

1. As part of the *Creation of a system integrating public transport in the city of Rzeszów and the neighbouring areas* project, the Rzeszów Intelligent Transport System was designed and deployed as a coherent system integrating the operation of the following subsystems, *inter alia*, in the city:
 - the *Area Traffic Control System* – deployed in 2014-2015

This system supports traffic management, depending on traffic volume, through the dynamic optimisation of the operation of traffic lights, giving the right of way to public transport vehicles. The system comprises 17 variable-message boards, by means of which drivers can be promptly informed about disturbances, current weather, traffic organisation changes or recommended diversions, as well as the meteorological situation. This information is also available at www.rtm.erzeszow.pl.

- *Public Transport Management System* – implemented in 2014-2015. The system makes it possible to identify the location of vehicles, calculate the number of passengers and monitor whether operators comply with passenger service quality standards, which, in turn, will make it possible to respond to the current needs of public transport in Rzeszów in terms of timetables, road system reconstruction, verification of control algorithms, etc.

- The system is compatible with the following systems:

the *Passenger Information System (E-INFO)*, which uses and processes data from all systems and subsequently generates information that help passengers plan their travels. This information is made available on boards placed at stops, where real-time departures of buses of individual lines are displayed. On boards placed in buses, passengers can find information on, *inter alia*, routes, the current stop and the next stop. In turn, ticket machines allow passengers to check the routes and current timetables. Information relating to travel planning is also provided on a website accessible via stationary and mobile computer devices, including smartphones (www.rtm.erzeszow.pl);

the *Urban Transport Electronic Ticket System (E-BILET)*, as part of which a new, electronic form of payment for the use of public buses (Rzeszów City Card) was introduced³¹.

2. As part of the *Improving the functioning of public transport in the centre of Rzeszów by limiting transit traffic and introducing a paid parking zone* project, the *Parking Zone Service System*, the purpose of which is to manage the paid parking zone (management, fee collection, information on free parking lots and their location), was deployed in 2015, apart from the completion of the north-eastern part of the city bypass.
3. The expansion of the *intelligent road transport system in the city of Rzeszów* – implemented in 2015.

³¹ Regardless of the date and time, passengers can manage e-tickets (through stationary and mobile ticket machines, ticket validating machines or on-line – www.rtm.erzeszow.pl), which includes recharging funds, purchasing short- and long-term tickets for the next validity period, changing tariffs, etc. Traditional paper tickets can also be bought from ticket machines at all times.

The following systems and devices were supplied and assembled as part of the project:

- 89 e-information board modules for dynamic information on public transport were purchased and assembled (expansion of the system);
- nine e-kiosks for information on public transport were purchased and assembled (expansion of the system);
- a Weight in Motion Dynamic Vehicle Weighing System was put in place on five main entry roads to the city.

Categories of roads on which ITS projects are implemented:

municipal, district and national.

Information on performance indicators for ITS projects:

- road safety:
 - the number of collisions and their costs are included in an economic and financial model;
- efficiency and reduction in traffic congestion:
 - the number of users of urban transport (understood as the number of passengers using public transport),
 - increase in the population using public transport (understood as an increase in the number of passengers using public transport),
 - time savings in passenger transport,
- a reduction in pollution emissions:
 - a positive impact of the investment was assumed (a reduction in emissions, vibration and noise) without determining specific indicators

Plans for the next five years:

In 2017-2020, Rzeszów City municipality plans to implement the three transport projects listed below, as part of the 2014-2020 EU financial perspective:

- 1) Development of the public transport system in Rzeszów – the project covers:
 - a) the expansion of the Area Traffic Control System, which is used to perform traffic management tasks in Rzeszów;
 - b) the expansion of the ITS urban transport system covering stops and the Local Station;
- 2) Integration of different modes of public transport in Rzeszów – the project covers:
 - a) the expansion of the Area Traffic Control System to include two subsystems:
 - an intelligent system recording red-light running at intersections, which makes it possible to record and identify vehicles entering intersections after traffic lights turn red and draw up documentation on the offences,
 - a system for giving the right of way to rescue vehicles to make it easier for emergency vehicles to drive through intersections with traffic lights, thus allowing such vehicles to efficiently leave intersections and save time;
 - b) the expansion of the Dynamic Vehicle Weighing System (including the construction of measurement stations where vehicles are weighed by the authorised services), making it possible to detect overloaded vehicles in a flow of vehicles and record information on the offences detected;
 - c) the expansion of a website for drivers,
 - d) ITS for the Rzeszów Communication Centre, covering, *inter alia*, the supply and deployment of the Rzeszów Communication Centre Management System (including the E-INFO system and the Intelligent Video Monitoring system),
- 3) Expansion of the public transport system in Rzeszów – an IT system for calculating the number of parking places within the Paid Parking Zone is to be deployed as part of the project.

7.12 Szczecin

Implementation period: 2014-2016:

- 1) On 27 November 2015, Szczecin City municipality concluded stage II of the *Improving the functioning of urban transport in Szczecin agglomeration through the use of intelligent telematic systems* project, which covered:
 - the expansion of the Electronic Ticket System, which constituted a continuation of work started during stage I and covered, *inter alia*, equipping all urban transport vehicles with electronic ticket validating machines, assembling 55 information points/ticket machines for selling and recharging city cards and single paper tickets, and purchasing ticket machines;
 - the creation of the Transport Monitoring System, which covered infrastructure for monitoring key transport nodes by means of 86 traffic cameras;
 - the creation of the City Card System, which covered infrastructure for city card acceptance in public utility points and the inclusion of services provided under tourist cards into the electronic ticket distribution system;
 - the expansion of the Passenger Flow Calculation System, which expanded on the work performed during stage I to include further 40 vehicles in which the infrastructure installed would make it possible to process, present and analyse the recorded data;
 - the expansion of the Dynamic Passenger Information System, which covered the purchase of further 80 passenger information boards, the expansion of a wireless access point to passenger information to include 20 new locations and the installation of multimedia passenger information in all vehicles;
 - the expansion of the Video Monitoring System for vehicles, which covered equipping the remaining vehicles in the urban transport fleet with the video monitoring system;
 - the creation of the Technical Vehicle Location and Monitoring System supporting the 'Winter Campaign', which covered the installation of on-board infrastructure for locating and monitoring snowploughs and spreaders;

- the creation of the Demand-Responsive Transport System, which covered infrastructure for ordering a means of transport in advance, and the introduction of a route optimisation system;
 - the creation of the Communication Network Optimisation System, which covered the creation of a central system for collecting and aggregating data with a view to streamlining connections, the network of stops or timetables applicable in urban transport.
- 2) The Weight in Motion Preselection System was completed on 22 December 2016. It is a computer system for automatically detecting and identifying oversize vehicles without stopping them.
 - 3) Pedestrian crossing warning lights were installed in the first quarter of 2017 to improve pedestrian safety.
 - 4) Furthermore, four traffic lights installations were upgraded in 2014 by adapting them for operation in the actuated mode.

Categories of roads on which ITS projects are implemented:

N/A

Information on performance indicators for ITS projects:

N/A

Plans for the next five years:

31 actuated traffic lights installations are to be upgraded and set up in the next five years.

7.13 Warsaw

Implementation period: 2014-2017:

- 1) The Urban Roads Authority implemented projects as part of which 38 intersections upgraded during the following tasks were covered by the Integrated Traffic Management System:
 - the construction of a tram route to Żerań Wschodni district – 14 intersections;

- the construction of a tram route – Nowodwory district – five intersections;
- the construction of the second metro line – ul. Świętokrzyska – seven intersections;
- the construction of the second metro line – ul. Targowa – three intersections;
- a tram investment at ul. Targowa – two intersections;
- the inclusion of Wał Miedzeszyński intersections into the system – seven intersections.

At the same time, traffic lights installations were upgraded or new installations were built in 20 locations across the city.

2) The Urban Transport Authority implemented projects involving:

- the design and deployment of the Integrated Vehicle Position Management System;
- a system for collecting fees at strategic 'Park&Ride' parking places;
- the creation and deployment of a Data Warehouse for the Urban Transport Authority.

3) Tramwaje Warszawskie Sp. z o.o. implemented projects aimed at:

- expanding the Passenger Information System to include 104 electronic boards installed on nine routes;
- giving the right of way in traffic control at intersections with traffic lights (13 investment tasks);
- developing the Rolling Stock Performance Analysis System supporting the work of Tramwaje Warszawskie Sp. z o.o.'s traffic control services, which operates also in real time, based on databases recorded by the Tram Traffic Monitoring System and the Passenger Information System.

4) Miejskie Zakłady Autobusowe Sp. z o.o. implemented projects involving:

- on-board bus systems, including: passenger information, automatic passenger calculation and emergency radio communication systems;
- a system for handling incidents involving Miejskie Zakłady Autobusowe's vehicles;
- the construction of the Vehicle Traffic Management Centre.

5) Metro Warszawskie Sp. z o.o. implemented projects involving:

- the assembly of a passenger compartment monitoring system, together with the upgrading of a passenger-driver emergency communication system in vehicles of series 81;
- the installation of the Passenger Information System in 35 new vehicles.

6) Szybka Kolej Miejska Sp. z o.o. implemented projects involving:

- the development and deployment of integrated Dispatching Stands supporting the work of Szybka Kolej Miejska's dispatchers, software and all the required licences, together with installation and deployment services necessary in order to launch the system;
- the upgrading of on-board systems for reporting to the Operation Work System with a view to enabling access to an interactive CZK-P map (visualisation of the current traffic situation on the network of rail lines managed by PKP PLK);
- the adjustment of the CZK-P Map system owned by PKP PLK for Szybka Kolej Miejska's needs;
- the installation of systems supporting passenger handling installed in vehicles

Categories of roads on which ITS projects are implemented:

N/A

Information on performance indicators for ITS projects:

N/A

Plans for the next five years:

The Urban Transport Authority and municipal companies plan to implement the following projects in 2017-2022:

- 1) the expansion of the system for collecting fees at strategic 'Park&Ride' parking places;
- 2) the implementation of new software for drawing up timetables and exchanging them with operators;

- 3) the introduction of mobile applications, together with an SMS notification system for sudden changes;
- 4) the expansion of the passenger information system for public transport vehicle running at selected stops and communication nodes in the capital city of Warsaw;
- 5) the preparation of a search engine for transport connections for persons with reduced mobility;
- 6) the introduction of BEACONS (Bluetooth low energy transmitters) to urban transport, together with an application for mobile devices;
- 7) the purchase and placing into service of new metro vehicles, equipped with, *inter alia*, the Passenger Information System;
- 8) further development of Tramwaje Warszawskie's Passenger Information System, including the launching of a functionality for displaying the projected departures of trams from all tram stops in Warsaw on virtual boards and on the company's new website, and the introduction of a Passenger Information System mobile application;
- 9) further right of way given with regard to traffic lights on newly built and upgraded tram routes;
- 10) the expansion of on-board bus systems;
- 11) the expansion of the system for handling incidents involving Miejskie Zakłady Autobusowe's vehicles.

7.14 Wrocław

Implementation period: 2014-2015:

As part of the expansion of the Intelligent Transport System:

- 1) 16 083 m of service ducts were designed and built to further develop ITS system communication in the city of Wrocław and 14 218 m of fibre optic cables were moved from leased ducts (TP S.A.) to the newly built ducts;
- 2) the passenger information subsystem put in place at an earlier date was expanded by equipping 120 urban transport stops with dynamic passenger information boards.

Categories of roads on which ITS projects are implemented:

N/A

Information on performance indicators for ITS projects:

Project result indicator – Transport in Wrocław becoming more attractive and more accessible, as evidenced by a 5.5 % reduction in travel time by car.

Studies conducted in 2015 and 2016 showed that the value of the indicator was:

- 2015 – 18.3 %,
- and 2016 – 16.2 % respectively compared with the base value.

Plans for the next five years:

The *Expansion of the traffic management system in Wrocław, also to include new traffic lights, auxiliary ITS displays and a mobile application* project is to be implemented in 2017-2018. Its aims are to:

- standardise the sharing of collected data, covering the location of public transport vehicles, driving conditions, disturbances and road incidents for urban institutions and external parties; ensure API access to standardised ITS data; and in particular create data type standards adjusted to commonly available data standards, create a set of these standards and an interface enabling interested customers (e.g. higher education institutions, navigations, mobile applications, etc.) to download them;
- promote multimodal transport by integrating means of transport for suburban bus transport, rail transport, urban transport, bicycle sharing stations, electric car sharing stations and other modes of transport; provide assistance during travel and in selecting the means of transport; and provide information on free parking lots on newly built P&R parking places and the existing multi-storey parking places;
- ensure comprehensive management of incidents linked to urban transport space dysfunctions; integrate the management of traffic incidents/disturbances falling within the competence of many urban services and units responsible for addressing such matters and ensure that information about the incidents/disturbances and their status can promptly reach the inhabitants through a mobile application and a website;

- increase the safety of travel through the city and ensure that travelling by tram is more comfortable, reduce travel time for public rail transport and give the right of way to urban buses at ITS intersections;
- collect and use data on travel preferences and the selection of the means of transport.



8. Scientific and research activities

8.1 Applied research financed by the National Centre for Research and Development

In accordance with Article 30(1) of the *Act of 30 April 2010 on the National Centre for Research and Development* (Journal of Laws No 96, item 616, as amended), the Centre initiates new programmes that significantly contribute to the growth of innovation in the Polish economy and stimulate investments in R&D activities by undertakings.

In 2014-2017, the Centre continued to support the areas directly linked to ITS systems (the power sector and electrotechnology, mechanics and transport, and interdisciplinary areas) as part of the Applied Research programme. In the period at issue, 14 projects have been or are being implemented on the basis of national funds:

1. Multimodal Traffic Monitoring System;
2. System for analysing the environmental impact of road traffic parameters, using a model for traffic and emission testing under real conditions;
3. Intelligent adaptive public transport – SMART-PT;
4. Simulation system for the sustainable management of a mixed electric and diesel taxi fleet;
5. Development of a method for assessing passenger safety using video image analysis;
6. Green and sustainable freight transport systems in cities – GRASS;
7. Intelligent system for monitoring the technical condition of road surfaces;
8. Innovative simulation technologies for assessing vehicle driving automation systems in respect of road safety;
9. Intelligent Vehicle Weigh-in-Motion System with Enhanced Accuracy – NEUROWIM;

10. Integrated System Supporting the Management of Rail Passenger Traffic Information;
11. Development of an information system supporting the loading of consignments in rail transport;
12. Database information system supporting Eurasian rail transport (CIM/SMGS);
13. Intelligent real-time monitoring and safety system for flight operations;
14. Mobile inland navigation.

8.2 Studies conducted by the General Directorate for National Roads and Motorways

1. Implementation of the 'European ITS Platform' project – implementation period: 2015-2020.

The aim of the project implemented by the GDDKiA together with a consortium of Member States is to prepare a feasibility study for the *North Sea-Baltic (East-West)* TEN-T core network corridor on the implementation of uniform, interoperable ITS services. Furthermore, quality levels for ITS services will be determined and the need for deploying ITS will be evaluated, taking into account the priority actions indicated in the ITS Directive.

Project co-financed by the EU from CEF funds. Project No: 2014-EU-TM-0317-S. Value of the project for Poland: EUR 145 000. The co-financing constitutes 50 % of the eligible costs.

2. Implementation of the FRAME NEXT project – implementation period: 2017-2020.

The aim of the project is to update and develop the framework ITS architecture for Europe. The project is to be implemented using CEF funds, together with other Member States.

9. Annexes:

- 9.1 Table 1: List of national projects;
- 9.2 Table 2: List of provincial projects;
- 9.3 Table 3: List of projects in urban areas;
- 9.4 Table 4: List of R&D projects.