ITS-Intelligent Transport Systems projects and road safety policies in the Russian Federation

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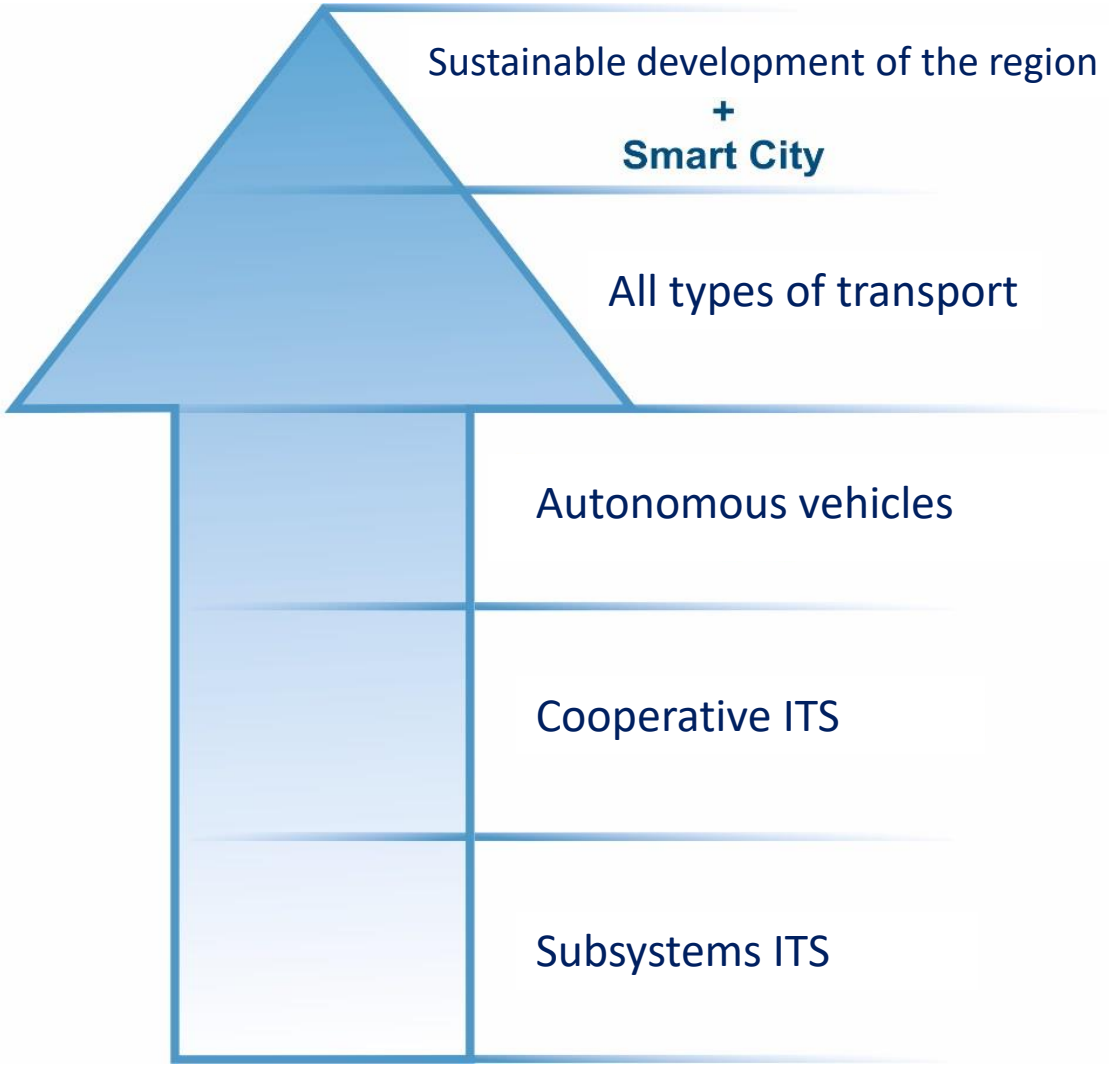
DEVELOPMENT PROCESS ITS (ITS-C-ITS-ATS) in Russian Federation



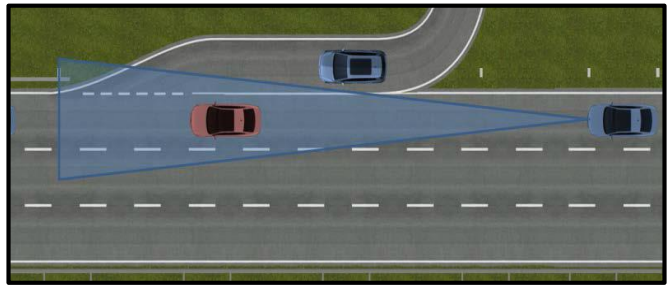
Autonomous vehicles
Autonomous vehicle traffic:
- single Autonomous vehicle in the traffic flow;
- channeled on a linear section of road;
- Autonomous vehicle groups in a conflict-free closed transport network;
- mixed (conflict) on a linear road section;
- mixed (conflict) on an open intersected urban network.

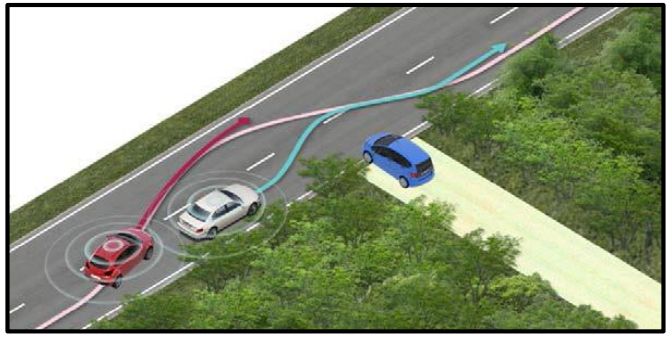
Cooperative ITS:
- driver assistance system(ADAS):
  - external technical vision (active vehicle safety);
  - inner vision (the psychophysiology of the driver).
- cooperation (V2X):
  - vehicle to vehicle(V2V),
  - vehicle to infrastructure (V2I),
  - vehicle to driver's personal device(V2P),
  - other.

Intelligent transport system (ITS) – development of transport network infrastructure, including:
- automated system traffic management (directive, indirective);
- dispatching systems on transport (passenger, cargo, special, municipal);
- control systems for road conditions (precipitation, temperature);
- rapid response systems for accidents and emergencies.

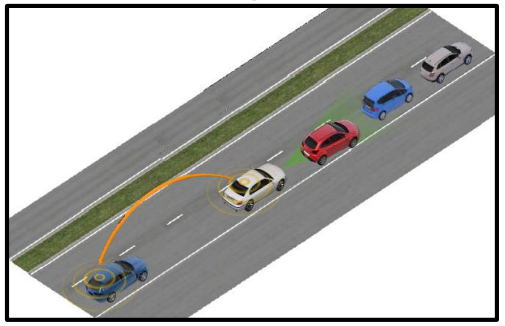
Highly Automated Vehicles and cooperative environment of road traffic safety and traffic management

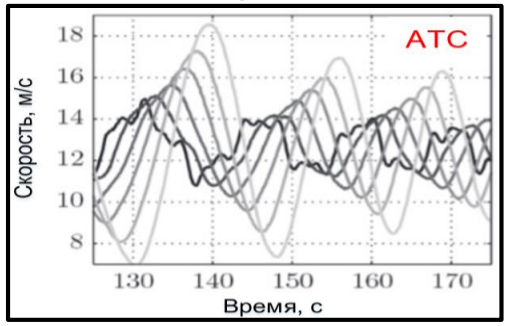
Making decisions based on data
(View obstruction conditions)



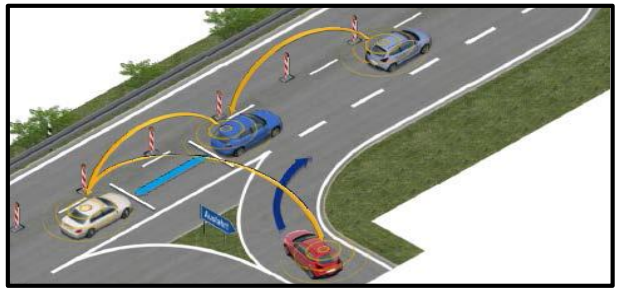


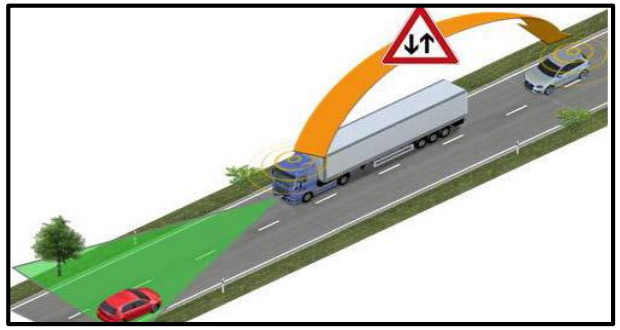
Consistent making decisions
(View obstruction conditions)



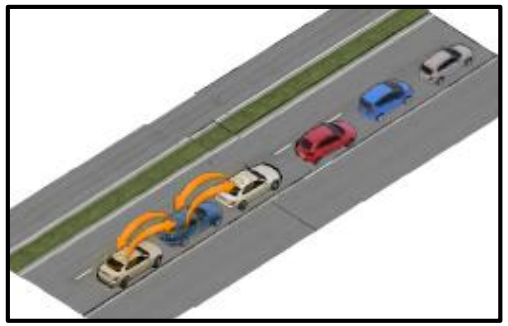


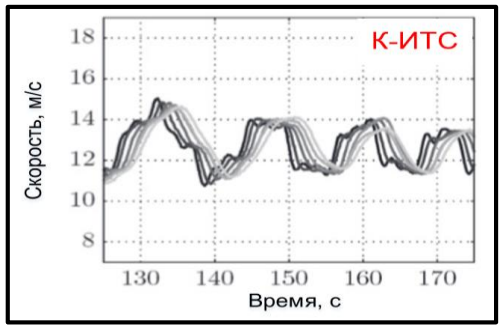
Making decisions based on aggregated data
(Full view conditions)



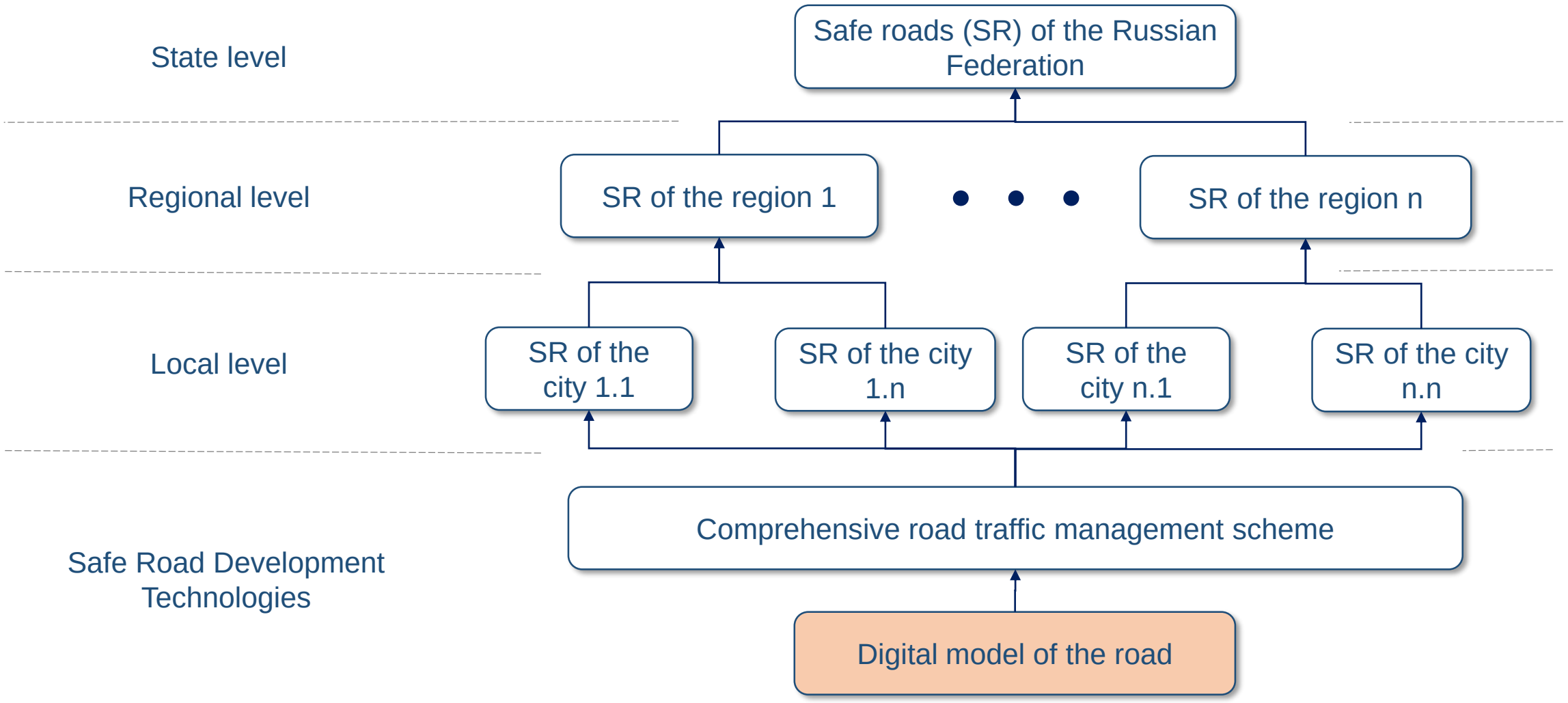


Synchronous making decisions
(Full view conditions)





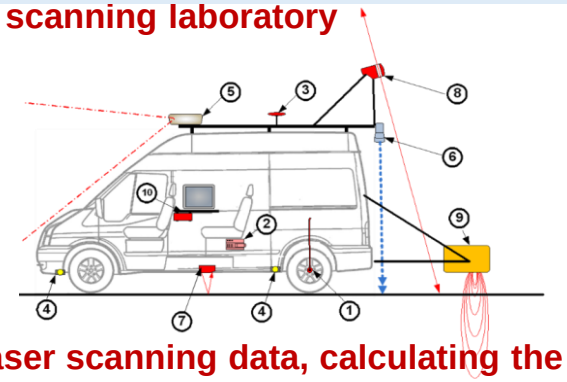
Perspective development of safety roads in the Russian Federation



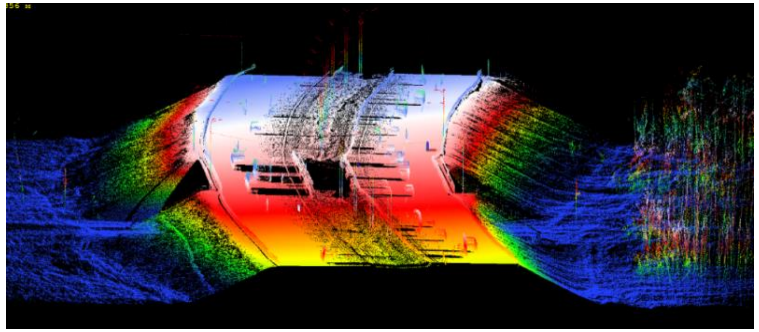
STAGES OF CREATING A DIGITAL ROAD MODEL

1. Creating a network of base stations of differential corrections
2. High-precision digital road survey
3. Creating a digital road double
4. Equipment installation of cooperative intelligent transport system
5. Collecting traffic flow parameters and traffic conditions data
6. Strategic movement management of Vehicles, Highly Automated Vehicles: Road Traffic Safety, Traffic Management, services

Mobile laser scanning laboratory



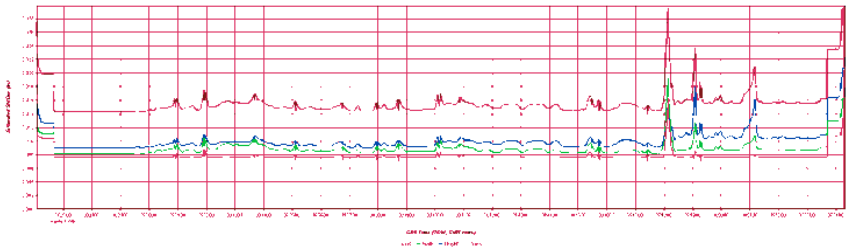
Uploading laser scanning data, calculating the coordinates of the" cloud " of laser scanning points



Provides digital road model information for customers, including Highly Automated Vehicles, ITS

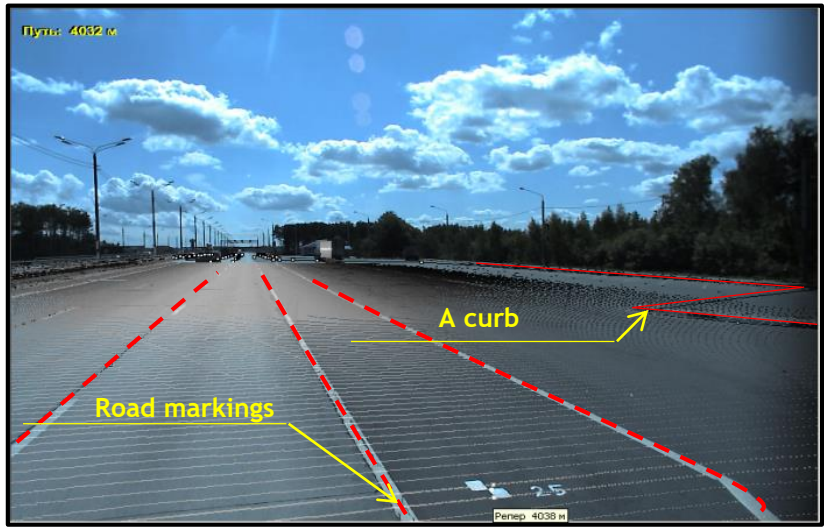
PROCESSING OF THE INFORMATION BY THE ON-BOARD SYSTEM

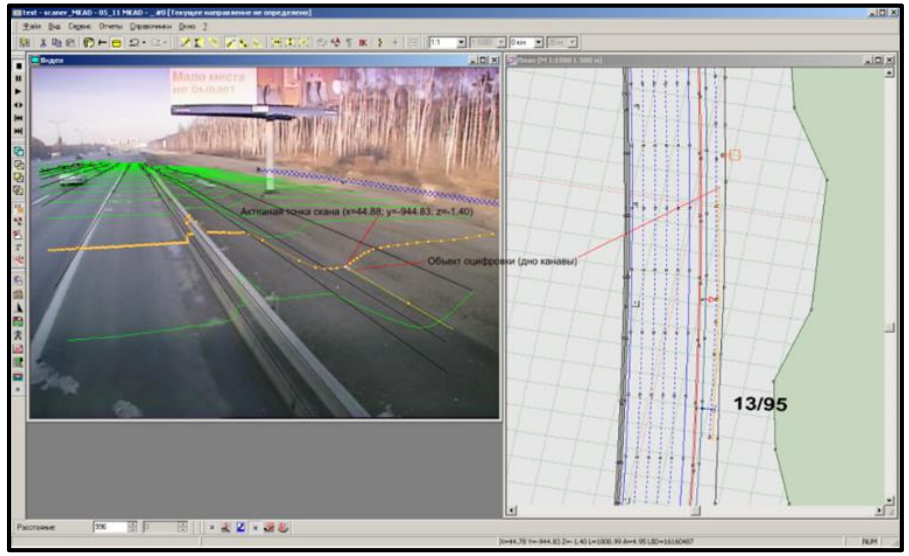
Analysis of positioning accuracy on a road section



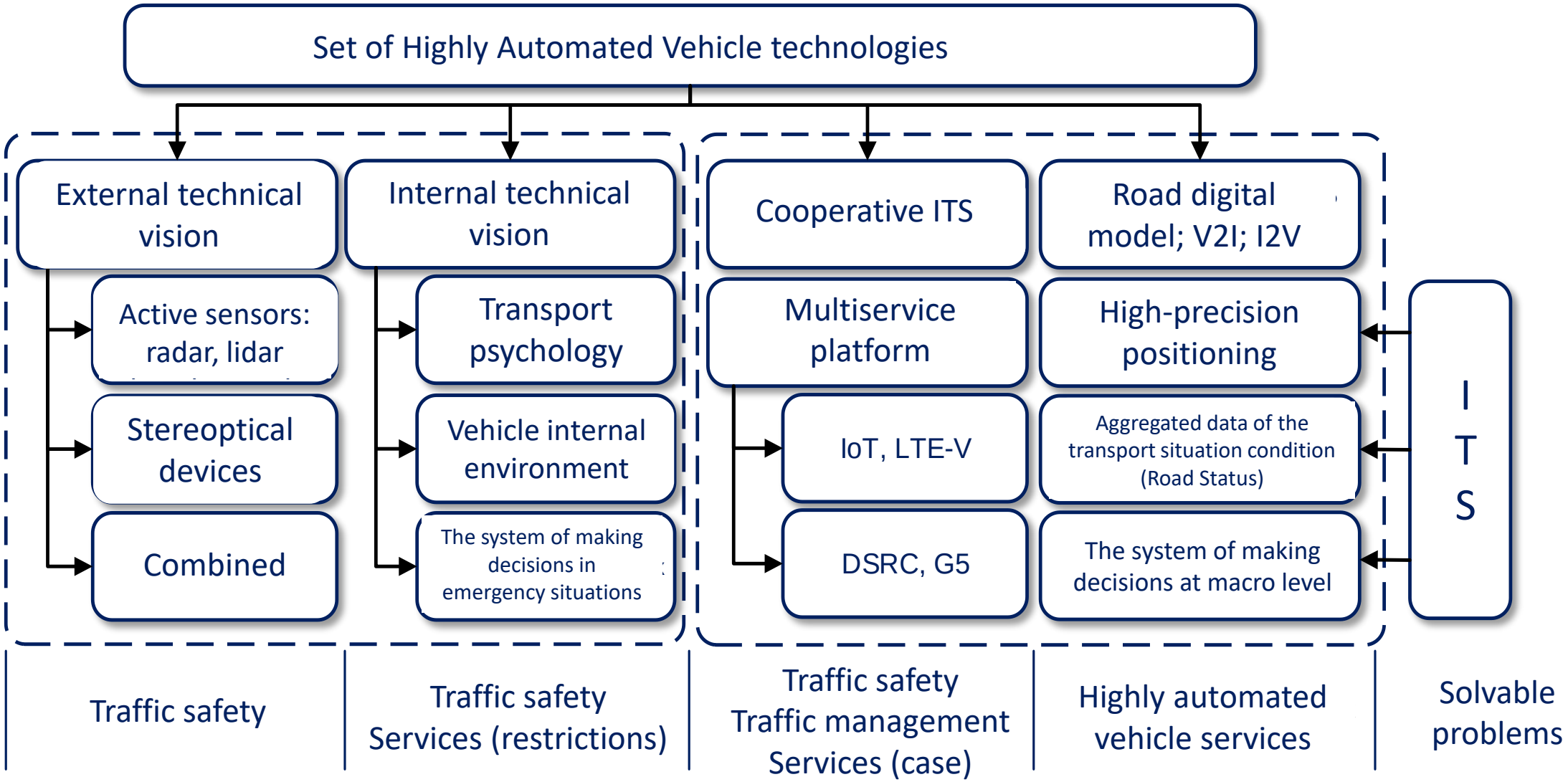
Analysis of positioning accuracy (mm)			
Accuracy	Average	Maximal	Minimal
Horizontal alignment	4.4мм	5.2мм	3.3мм
Height	5.6	6.1	3.4
Total	8.4	9.2	6.1

Registration of road surface elements and description of object parameters with Russian special software





BASIC TECHNOLOGICAL DIRECTIONS IN DEVELOPMENT OF HIGHLY AUTOMATED VEHICLES



HIGHLY AUTOMATED VEHICLES MOVEMENT ON A DIGITAL MODEL OF THE ROAD

1. Obtaining a high-precision map with the current traffic management scheme. (direction of traffic, road signs, road marking)
2. Building a route of movement.
3. Getting traffic information while driving: weather, accidents, traffic congestions, safe driving speed.

4. The ability to avoid static and dynamic obstacles using technical stereo vision..

5. The ability to exchange information on V2X technologies (DSRC, G5, LTE-A).

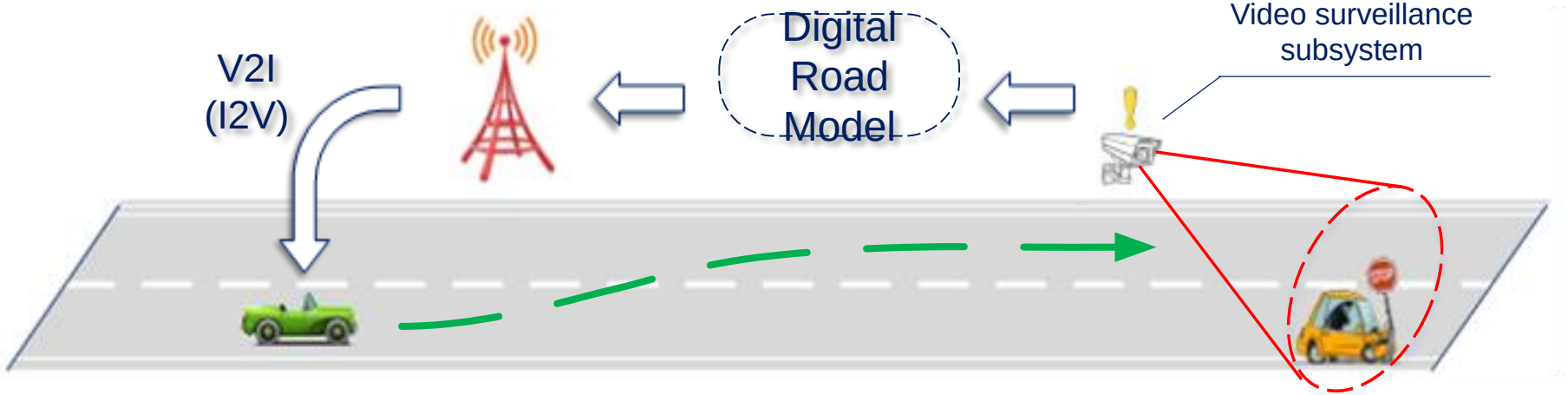
6. The protection against unauthorized access and vehicle cybersecurity.

ADVANTAGE OF USING A DIGITAL ROAD MODEL

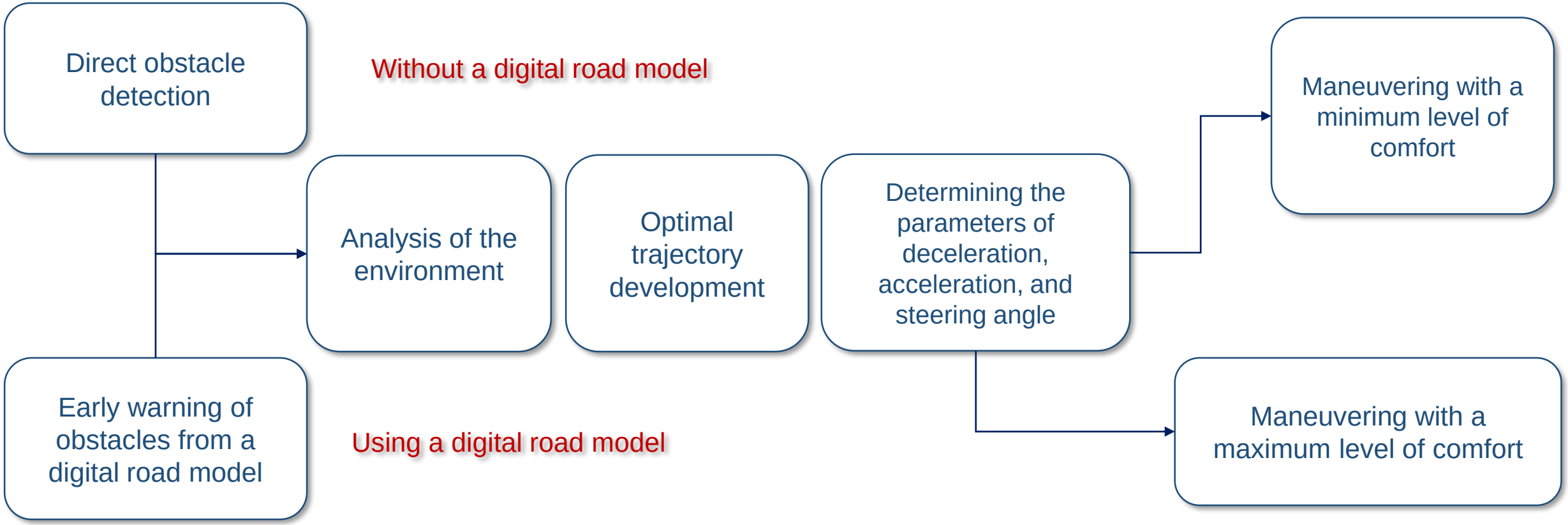
Условие: Condition: lack or impossibility of inter-side interaction(V2V)

The lack of a digital road model

Digital Road Model Application



ADVANTAGE OF USING A DIGITAL ROAD MODEL

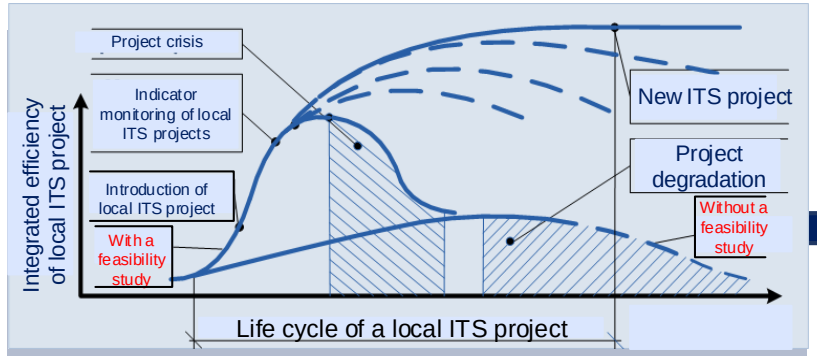


The time required to complete the operation	Extra time for maneuvering

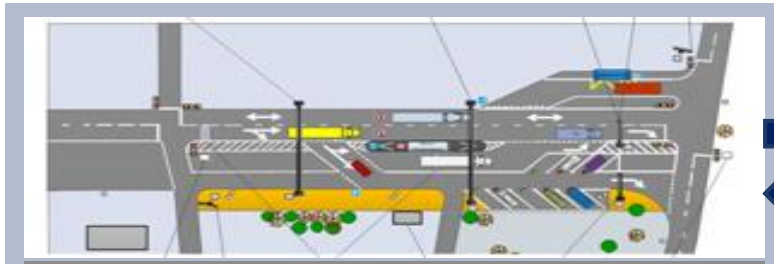
ITS TECHNOLOGICAL CYCLE IN THE TRAFFIC SAFETY AND MANAGEMENT ISSUES

FOUNDATION → ENGINEERING → INTRODUCTION → OPERATION → MODERNIZATION

Creation of the MADI Research center for justification and development of life cycles of local ITS projects based on national specifics



Scientific and methodical complex



Functions: *- testing, certification*
- standardization
- training

Test and polygon complex

Scientific Research Complex

Functions:
- *построение цифровой модели УДС*
- *управление цифровым графом УДС*
- *micro modeling of the ITS object*
- *psychophysiological analysis of driver behavior*
- *отработка межбортового взаимодействия*

ТК по ИТС

(Приказ Росстандарта № 3821 от 22.07.2011)

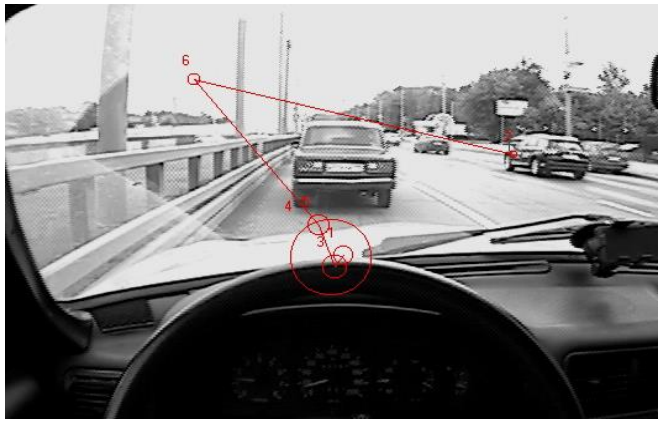
Justification for the selection of the element base of local ITS projects

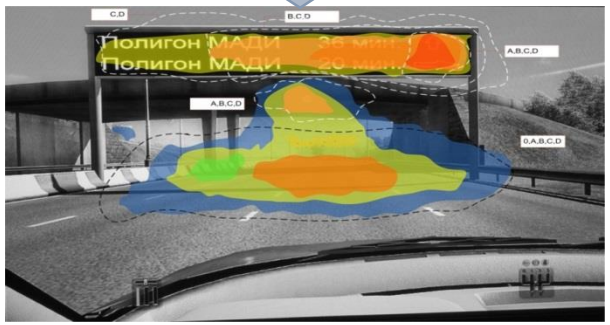
Performance monitoring of local ITS projects

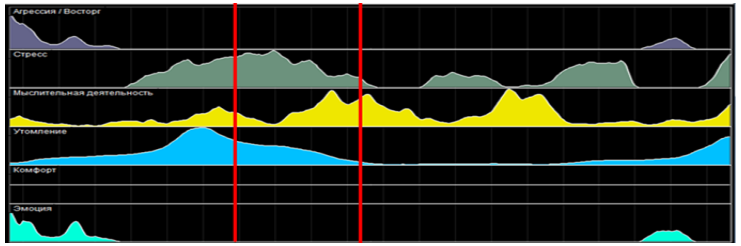
Justification for modernization of local ITS projects

STUDY OF BEHAVIORAL STANDARDS ON THE ROAD

Complex of psychophysiology







TASKS OF DIGITAL POLYGONS AND TEST BADS

The main stages of the development of highly automated vehicles and digital infrastructure, requiring testing at digital polygon test sites

Development of experimental samples (R&D)	Standardization of elements ВТС и ЦИ	Creation of industrial designs (OCD)	Certification of items ВТС и ЦИ
Testing scientific hypotheses and mathematical models	Experimental substantiation of standardized parameters	Tests for the required accuracy, reliability and reliability	Regulatory Tests

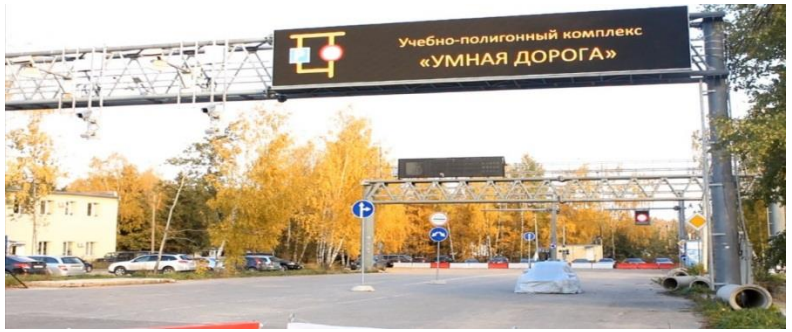
Polygon-test complex MADI "Smart Road"
ТК 057 по ИТС Росстандарта

Test Center "NAMI"
(ТК 056 Росстандарта)

MADI EDUCATION AND RESEARCH TEST BAD "SMART ROAD"

The designation of the pilot section of the ITS road at the MADI testing ground (Moscow region, 34 km of the Leningradskoye highway) :

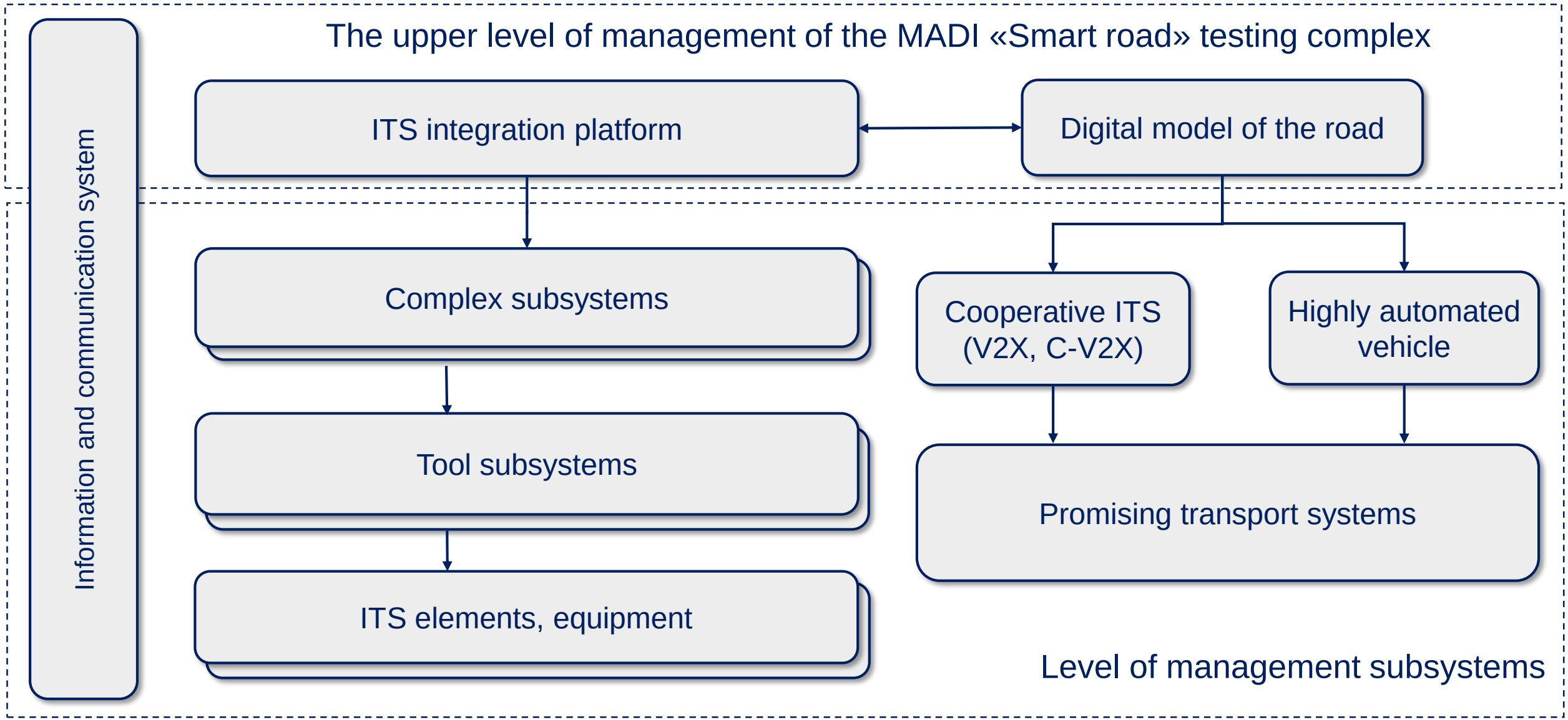
- **creation of a reliable prototype of integrated ITS in the experimental section of the road;**
- **development of requirements for technical solutions and software products developed and applied in ITS scope;**
- **creation of polygon conditions for the development of technical requirements for hardware and software for all types of ITS systems offered on the market by various operators;**
- **creating conditions for research, testing, calibration and other operations in the complex of tasks of developing standards in ITS scope;**
- **formation of a research base required for a wide range of types of scientific and research work in ITS scope;**
- **development of an educational laboratory base designed to prepare students in a specialized field, as well as to conduct continuing education courses and specialized retraining of specialists.**



Systems installed on the test site complex:

- Vehicle Identification subsystem by three technologies
- Integrated system for radio frequency identification of transport infrastructure and traffic
- Information transfer subsystem in the V2V, V2I, I2V formats, including using dynamic information boards, variable information signs, on-board information systems
- A subsystem for assessing the weight and size parameters of vehicles, which allows collecting values of target parameters without stopping or significantly reducing the speed

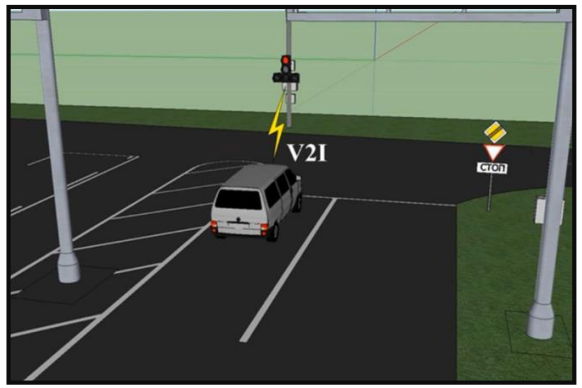
THE PHYSICAL STRUCTURE OF THE MADI TEST BAD "SMART ROAD»



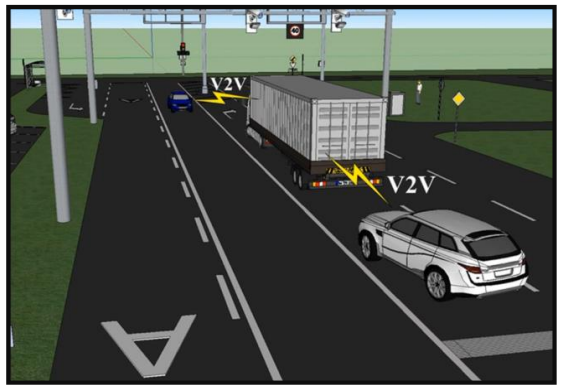
DIGITAL INFRASTRUCTURE SCENARIOS IMPLEMENTED ON THE MADI TEST BAD «SMART ROAD»

Modeling and testing advanced technological and technical solutions in the field of digital road model, ADAC, autonomous vehicle technologies, etc.

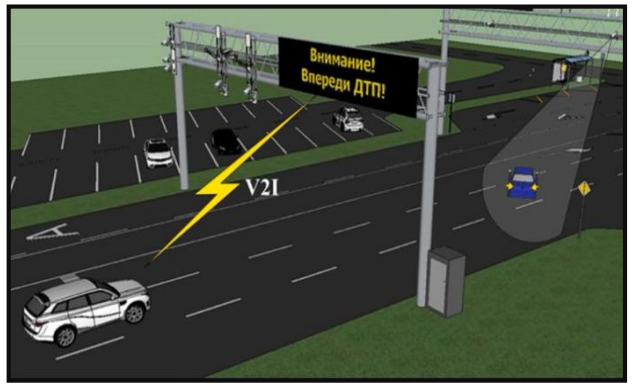
Subsystem for informing about the phases of traffic lights

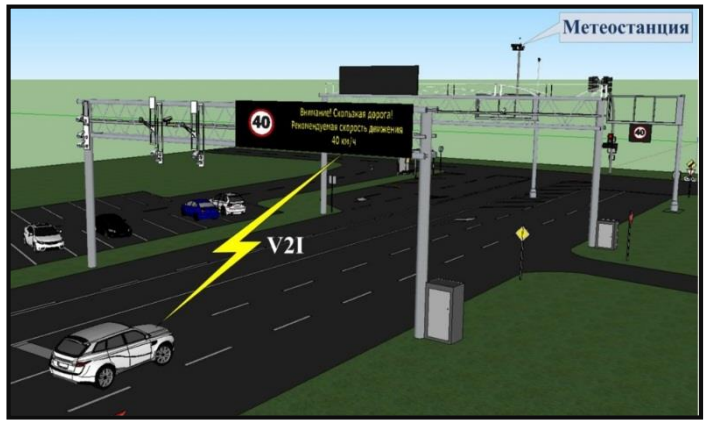


Subsystem for collision avoidance(V2V)

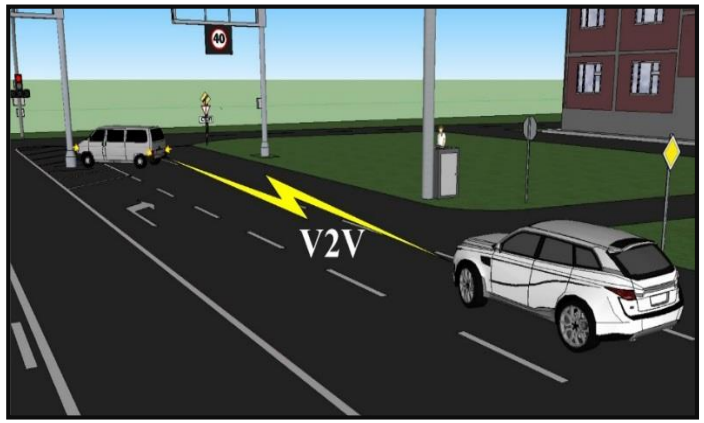


The subsystem of information about the accident





A system for reporting weather conditions



Getting information from a vehicle in front

Short term

Implementation :

- Autonomous traffic in mixed traffic on highway;
- 22 conflict scenarios on the urban road network.

TECHNOLOGIES OF HIGHLY AUTOMATED VEHICLES IMPLEMENTED ON THE MADI TEST BAD «SMART ROAD»

Project of vehicles equipment with servo system for automatic control of driver assistance systems

An algorithm for driving cars in an automated column has been developed

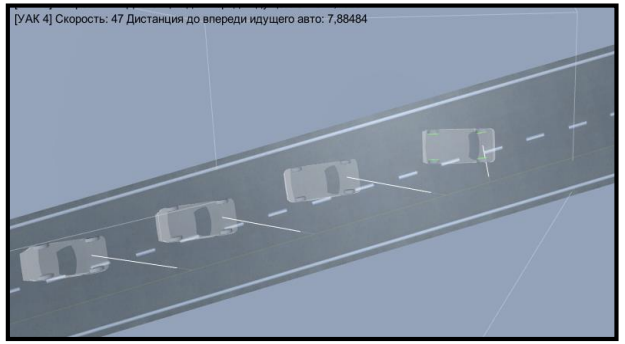
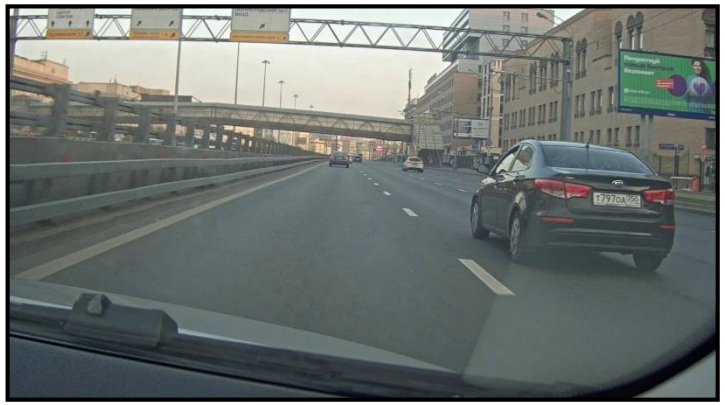
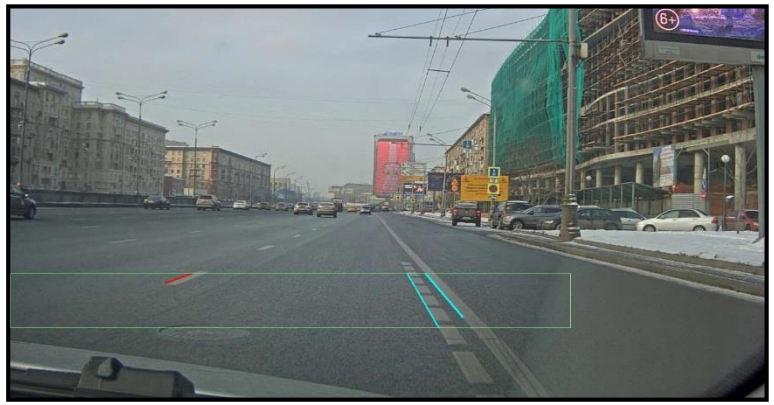


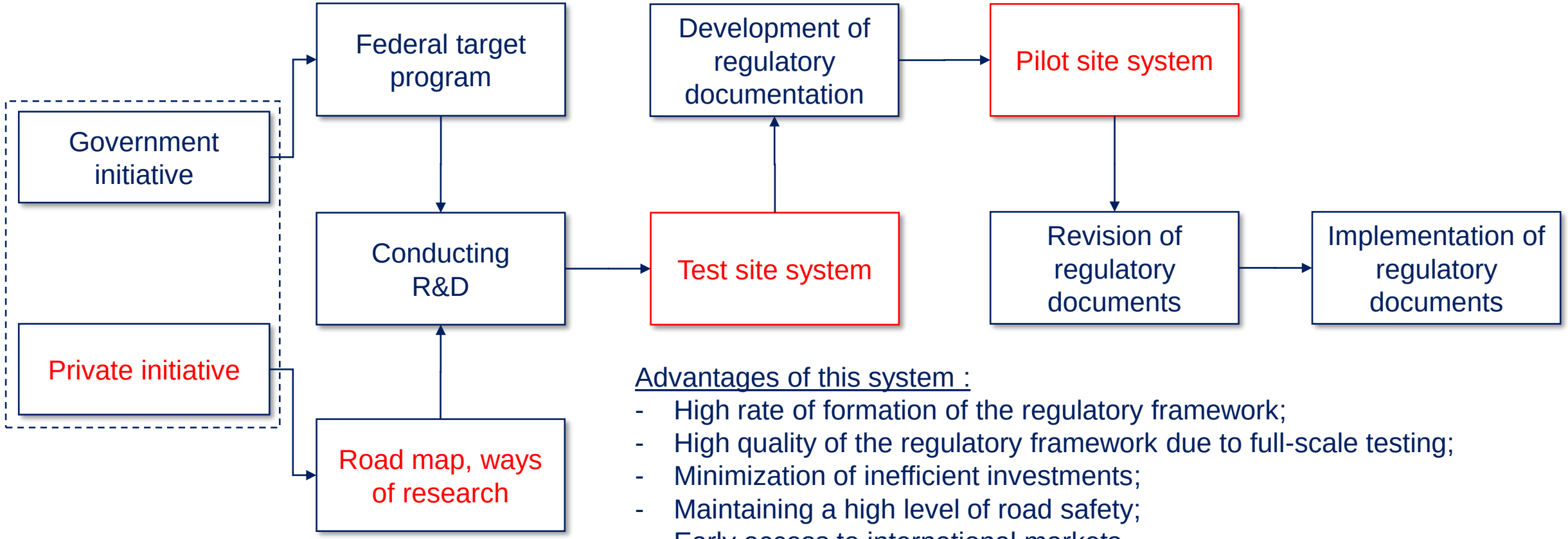
Image processing system for recognizing road conditions and road elements using video cameras



Results of testing of automatic braking and lane keeping systems based on data from external machine vision systems



THE PROCESS OF DEVELOPING REGULATORY DOCUMENTS



Advantages of this system :

- High rate of formation of the regulatory framework;
- High quality of the regulatory framework due to full-scale testing;
- Minimization of inefficient investments;
- Maintaining a high level of road safety;
- Early access to international markets.

REGULATORY REGULATION IN THE FIELD OF AV AND C-ITS IN THE RUSSIAN FEDERATION

Current state of regulatory regulation in the field of Intelligent transport systems

	ITS	Highly automated vehicle, cooperative intelligent transport system , ADAS
National standards and preliminary national standard	>20	9
Current national standards and a preliminary national standard that will enter into force in 2019	<10	2
Projects preliminary national standards	>20	2 (in related fields)

Promotional activities

- Resolution Of the government of the Russian Federation No. 1415 "on conducting an experiment on trial operation of highly automated vehicles on public roads"
- National competitions, test sites («Karavan», «Zimniy gorod» и т.д.)
- Testing of prototypes-formation of the best solutions to the tasks set
- Development of regulatory documents

Thank you for your attention!