Highly automated / autonomous vehicles in Russia
World experience in testing driverless vehicles

Small test sites

Example: “NAMI” Testing Centre’s test site for driverless vehicles. Implementation of a limited number of driving scenarios.

Big proving grounds

Example: K-City. The ability to safely implement most of the driving scenarios.

Public roads

The ability to test an unlimited number of scenarios.

Big risks for other road users!
Testing the driverless vehicles on public roads. Possible ways of development

“USA way”

Reduction of administrative barriers by eliminating preliminary tests at the proving grounds and mandatory certification of the HAV. All responsibility for the technical condition of the vehicle lies with the applicant.

“European way”

Separation of areas of responsibility between the applicant of the HAV and the supervisory authority appointed by the regulator, which allows monitoring and assessment of the vehicle before releasing it to public roads. These actions are carried out on the basis of local government acts, implying verification of the HAV and control over its driving.

“Russian way”

?
3-component approach to assessing the safety of HAV

Road tests
- General impressions of vehicle behavior on the road
- Assessment of the capabilities of the automated control system to manage real traffic situations - verification according to a standard checklist
- Assessment of execution of typical maneuvers (analogue of a practical exam for obtaining a driver’s license)

Track tests
- Validation of audit simulation results
- Confirmation of individual audit results
- Assessment of the behavior of the automated control system in difficult situations that are hard or impossible to verify on public roads
- Use of standardized test methods (allows for reproducible results)

Audit
- Project audit (methods, standards used in the design)
- Assessment of the safety concept (functional and operational safety) and measures for its implementation
- Checking as to what extent the established safety requirements and the implementation of traffic rules are taken into account
- Modeling the vehicle’s behavior in various situations
- Assessment of the results of the manufacturer’s own research
- Vehicle safety declaration
Regulatory documents regarding the development of HAV technologies in the Russian Federation


➢ Draft concept of ensuring the road safety with the participation of HAVs on public roads.

From December 1\textsuperscript{st} 2018 to March 1\textsuperscript{st} 2022 the highly-automated vehicles are legally able to drive on public roads.
On carrying out the experiment on trial field testing of highly-automated vehicles on public roads

Participants of the experiment

Ministry of Industry and Trade of the Russian Federation

Ministry of Internal Affairs of the Russian Federation

LABORATORY - The central research automobile and automotor institute "NAMI"

The legal person who owns the highly-automated vehicle and who participates in carrying out experiment on voluntary basis
On carrying out the experiment on trial field testing of highly-automated vehicles on public roads

ORDER OF THE GOVERNMENT OF THE RUSSIAN FEDERATION
Of November 26, 2018 № 1415

Paragraph 10 (b)
The testing laboratory conducts an assessment in the form of testing highly automated vehicles for compliance with the mandatory requirements established by the Technical Regulation of the Customs Union "On the safety of wheeled vehicles" (TR CU 018/2011) and the United Nations Regulations, which are applied by the Russian Federation by virtue of its participation in the Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations, concluded in Geneva on March 20, 1958, which are affected by changes made to the design of the vehicle.
On carrying out the experiment on trial field testing of highly-automated vehicles on public roads

97 Approvals on the vehicle compliance with the requirements of Government Order No. 1415 were issued

Participants of the experiment:
Yandex
MADI

In the near future may become participants of the experiment:
KAMAZ
“NAMI”
STAR LINE
NSTU
BASE TRACK
and other companies

The law draft on driverless vehicles and the licenses for test drivers of the HAVs will be submitted to the State Duma on February 20, 2020.

It is aimed at creating a regulatory system in order to ensure the safe operation of innovative vehicles.

The law shall include:
- Requirements for test drivers on the mandatory obtaining of special driver's licenses
- Rules for mandatory driverless vehicle insurance
- Safety rules, namely the protection of the driverless vehicles from hacker attacks and security breaches.

The adaptation of road infrastructure to the HAVs shall also be gradually introduced: adaptation of marking, road signs, etc.
“NAMI” Testing Centre. Highly-automated, connected, driverless vehicles testing zone “City”

- Area is 17,000 m² that simulates urban traffic conditions.
- The variety of units of the facility infrastructure allows simulating large number of scenarios.
- Street lighting provides round-the-clock testing.
- Video recording system is able to store the data.
- Accessibility of workshops, laboratories and presentation facilities.
- Accessibility of proving ground test tracks and constructions.
- Mobile units of infrastructure allow to change the facility configuration.
MODERNIZATION OF THE PROVING GROUND INFRASTRUCTURE BY “NAMI” WITHIN THE “DIGITAL PROVING GROUND” PROJECT (assessment of HAV and interaction with V2X platform)

Specific tracks. Test sites with asphalt pavement.
Testing and tuning of ADAS systems and driverless vehicles behavior algorithms in emergency situations. (Emergency braking, detouring obstacles, driving at high speeds in dangerous corners, etc.)

Closed-circuit roads with asphalt pavement.
Recognition and assessment of the road environment depending on the conditions of the surrounding area. Driving in conditions of enclosed surrounding space (forest, guard railing), changing terrain (alpine or long slopes with a change in height).

Dynamometric track.
High Speed Test Site

High speed circle

Tunnel structures (viaducts)

Test Control Center

Plain soil-surfaced road

An area for simulating traffic in an urban environment.
Tests to check the ability of the driverless vehicle to recognize and respond to environmental changes in traffic conditions in urban environments. (passage of controlled and uncontrolled intersections, roundabouts, bus stops, tunnels, closed areas, etc.)
Purpose: Proving ground for HAV testing when simulating traffic in urban environments and suburban traffic

Objectives:
• working out the basic scenarios describing most standard traffic situations using virtual modeling;
• working out non-standard scenarios using virtual modeling;
• testing new versions of vehicle control automation algorithms;
• training of the test drivers.

Total area: 180,000 sq.m.
Number of tested HAVs: more than 100
Infrastructure: road marking, road signs, guard rails, traffic lights, tunnel simulation, organizational and technical control center.
Specific aspects of the climatic conditions in the Russian Federation

- The length of public roads in Russia is 1 million 529.4 thousand km.
- The main part of Russia lies within the temperate climate zone.
- Large temperature differences, ranging from -55C to +35C.
- Humidity range 30 - 100%.
- Precipitation (rain, snowfall, snowy roads, icy roads, fog).
- Climatic conditions affect road infrastructure.

Low sun, rain, snow, ice, night-time, or all these conditions at the same time – are HAVs ready for this?
“The Winter City” Contest
Date of the contest (Final): December 10, 2019

Goal: Development of the technologies of safe automated driving of driverless vehicles under climatic and road conditions of Russia.

Competition task:
Cover a distance of 50 km in 3 hours

TECHNOLOGICAL BARRIER:
Driving of an driverless vehicles in an autonomous driveless mode and at different times of the day, in compliance with the traffic regulations under winter conditions of urban infrastructure, possibly with no road markings, under low visibility of the roadway, in the presence of traffic and hindrance to traffic, at an average driver's speed and safety level.
Thank you for your attention
Your questions are welcomed