

Virtual Expert Group Meeting on Facilitating the deployment of highly and fully automated vehicles in road traffic along the Asian Highway Network

Automation infrastructure, technology and policy of Russian Federation along the AH9 route



Mikhail Nizov

4 August 2021

Facilitating the deployment of highly and fully automated vehicles in road traffic along the Asian Highway Network requires the development of transport infrastructure:

- ✓ **Physical road infrastructure** that enables the safe movement and maintenance of highly automated or fully automated vehicles on the international route of Asian Roads;
- ✓ **Systems for sustainable and safe transport management**, including ITS infrastructure.

Asian Highway AH9

The Asian Highway route AH9 is 8445 km and passes through the territory of 3 countries:
the **People's Republic of China** - 3425 km (Lianyungang – Zhengzhou – Lanzhou - Urumqi);
the **Republic of Kazakhstan** - 2787 km (Almaty - Shymkent – Kyzylorda - Aktobe)
and the **Russian Federation** - 2233 km (Orenburg – Kazan - Moscow – St. Petersburg).



Classification of the Asian Roads

The class of the road	Description of the road	Road surface
Highway	Controlled-entry highway	Asphalt concrete or cement concrete
Class I	Four or more lanes	Asphalt concrete or cement concrete
Class II	Two lanes	Asphalt concrete or cement concrete
Class III	Two lanes	Coating with double the processing of bitumen

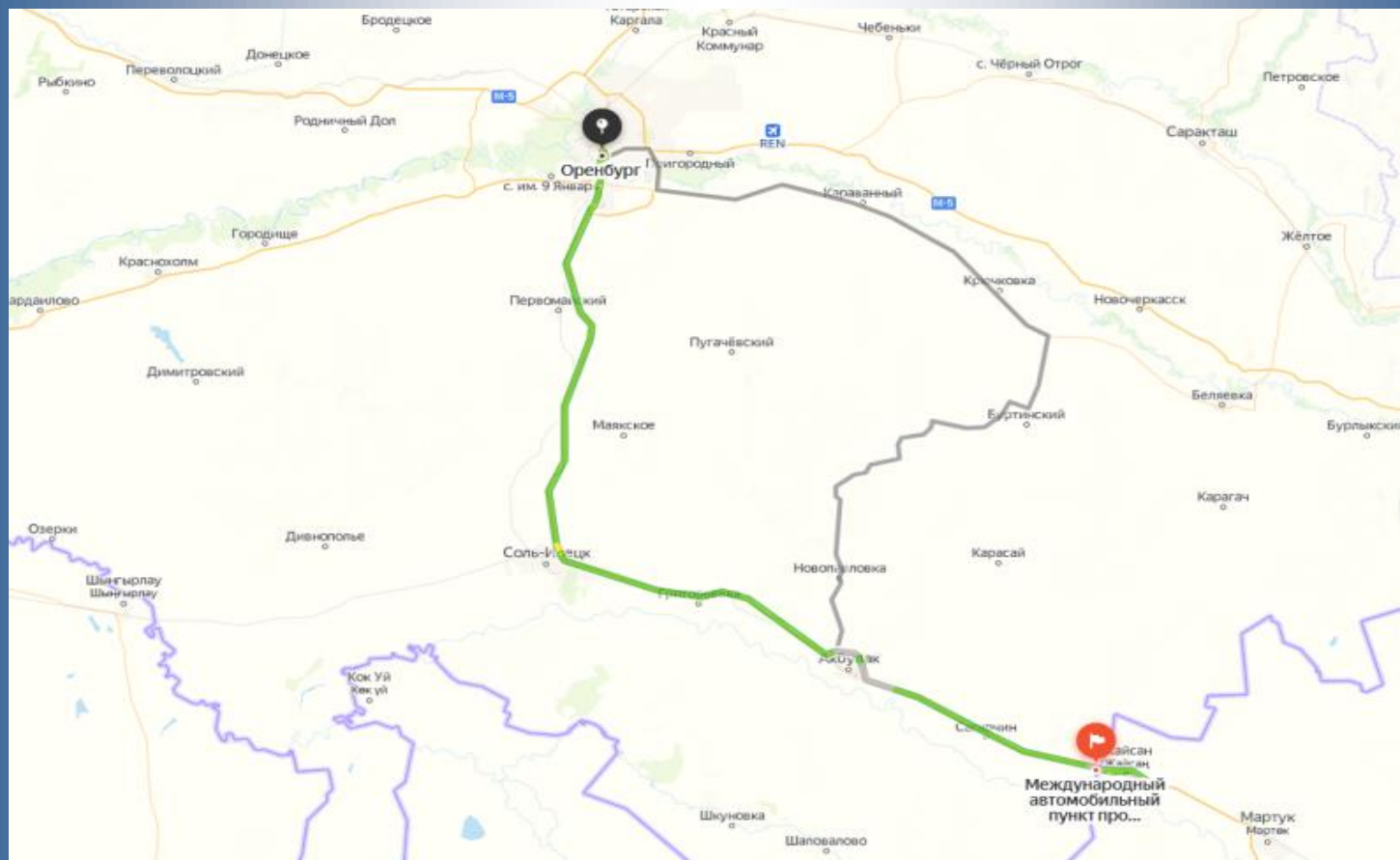
The Agreement on Asian Highways provides for: the **minimum design load for each lane of HS20-44**, the **width of each lane** of the roadway is **3.5 m**, the **dividing strip is not less than 2.5 m**.

In order to improve the safety of traffic involving international road transport, as well as highly automated or fully automated vehicles, the **AH9 route should include roads with a minimum of two lanes in each direction** to facilitate overtaking without the need to enter the oncoming lane.

Roads **must have reliable separation barriers** that prevent vehicles from entering the oncoming lane and leaving the road. Road verges should include **on the right-hand side of the roadway a continuous paved or lane with a minimum width of 2.5 m**, on which, if absolutely necessary, a vehicle could stop without interfering with the movement of other vehicles.

Roads for international routes involving highly automated or fully automated vehicles should **not pass through the territory of localities**, have **intersections with other roads, railway crossings and pedestrian crossings** on the same level.

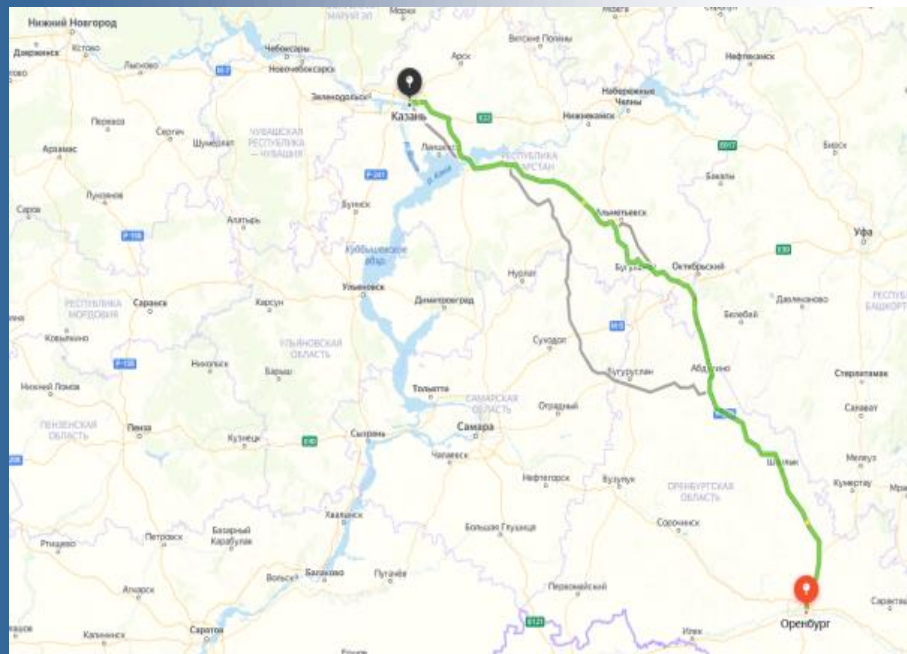
Section AH9 "Sagarchin-Orenburg" on the road P-239



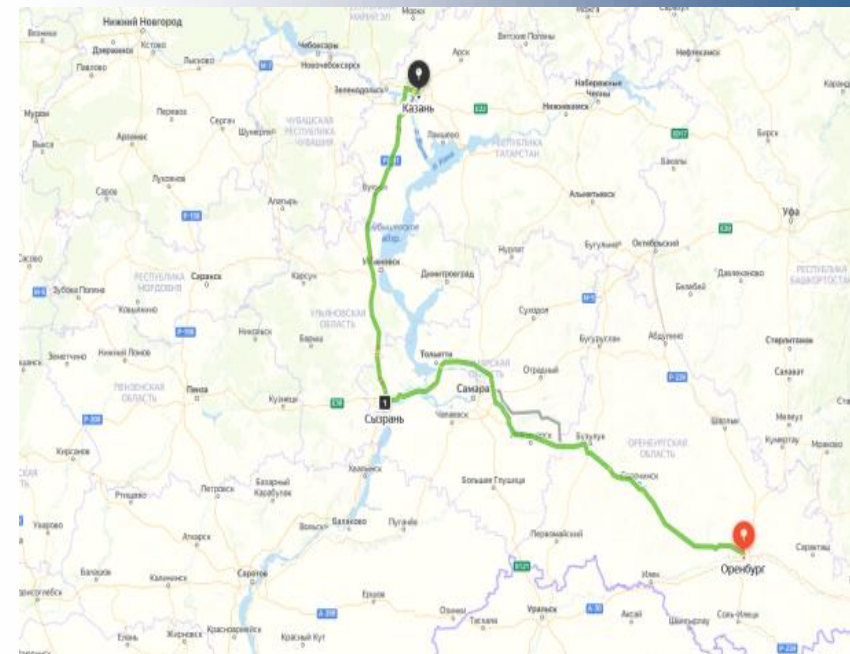
Section AH9 "Orenburg-Kazan"

to the road M-7 "Volga"

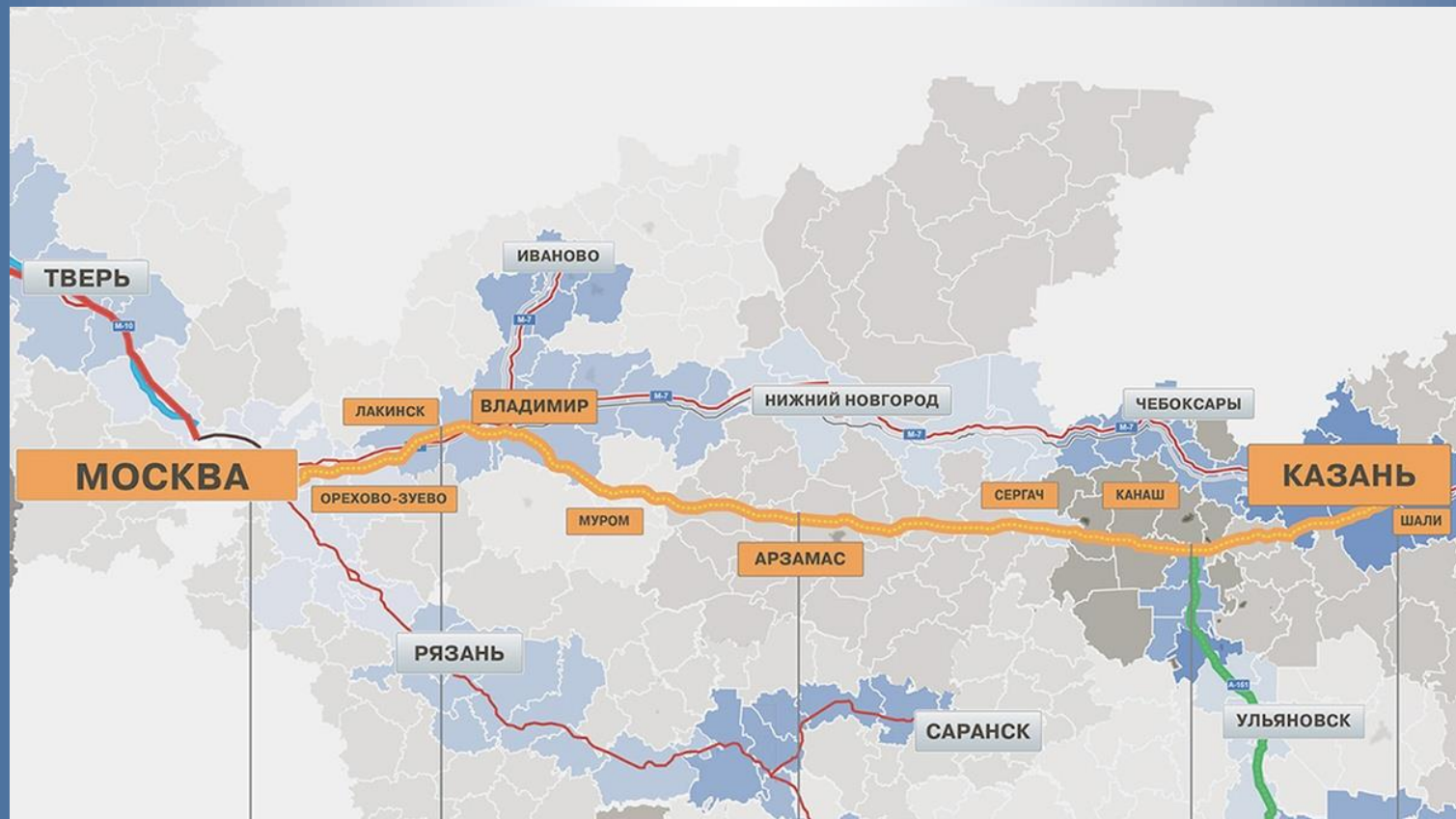
on the road **P-239**



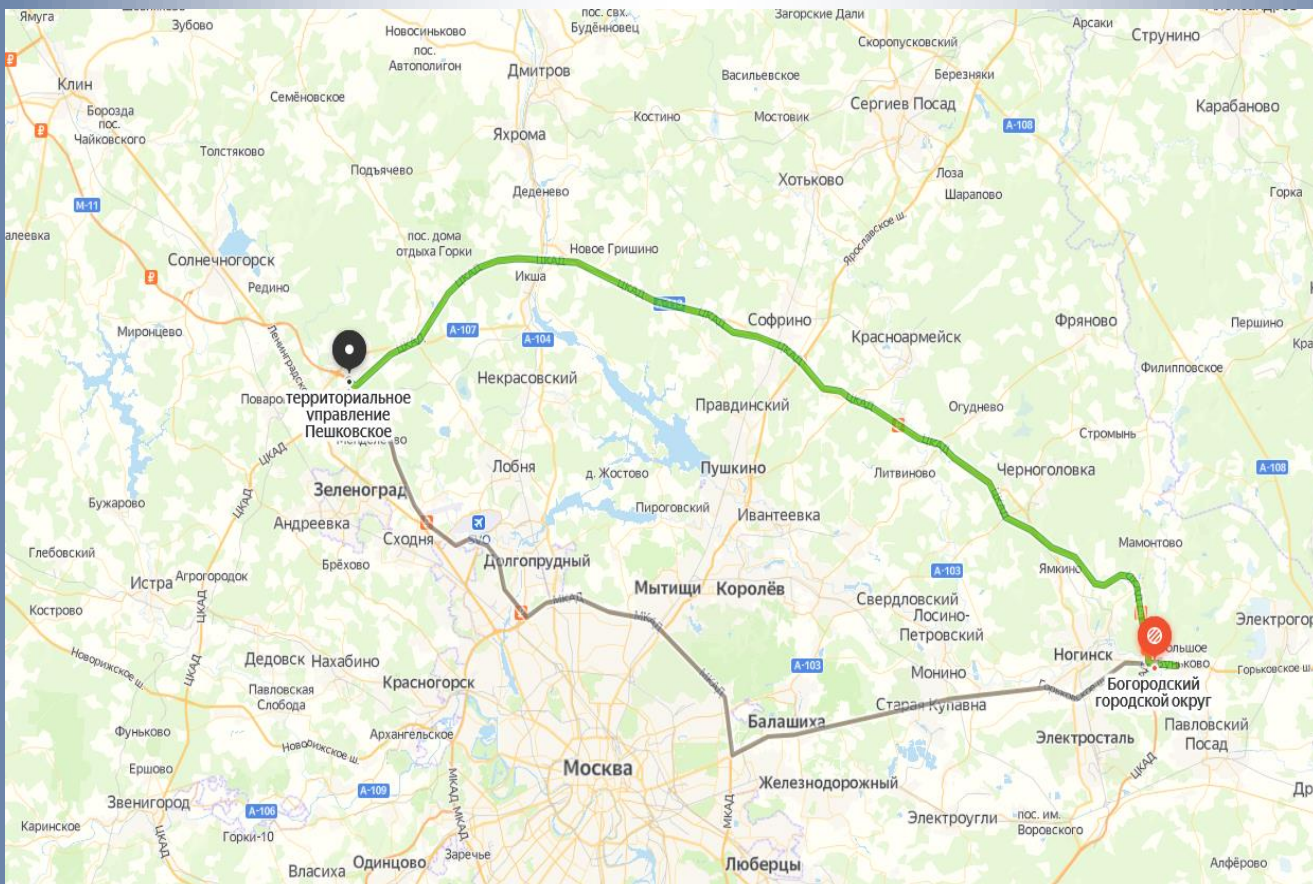
on the road **M-5 "Ural"** and **P-241**



Section AH9 “Kazan-Moscow” on the road M-7 “Volga” or on the road M-12



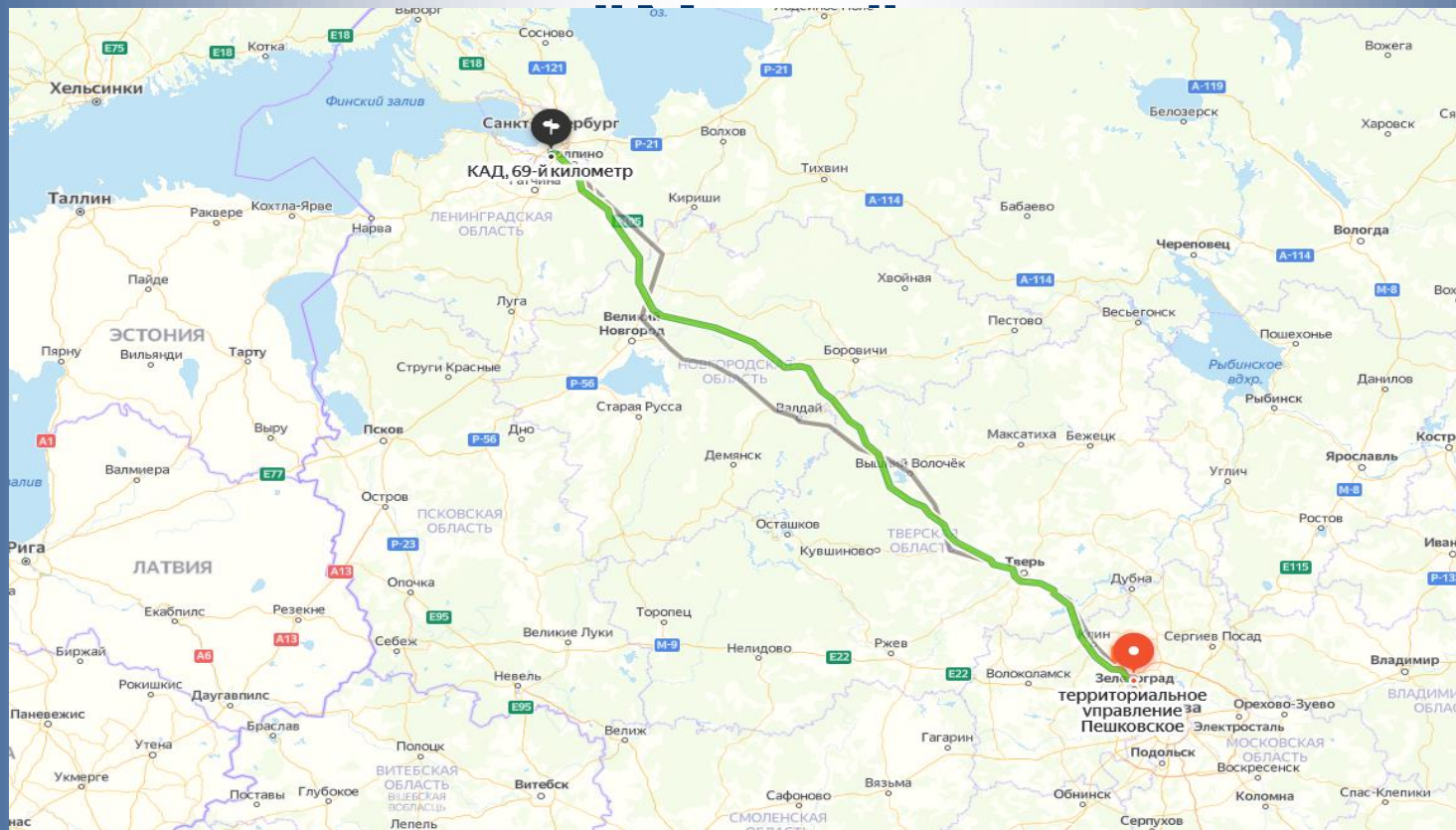
Section AH9 on the road A-113 “Central Ring Road” “CKAD”



"CKAD"s coordination Center

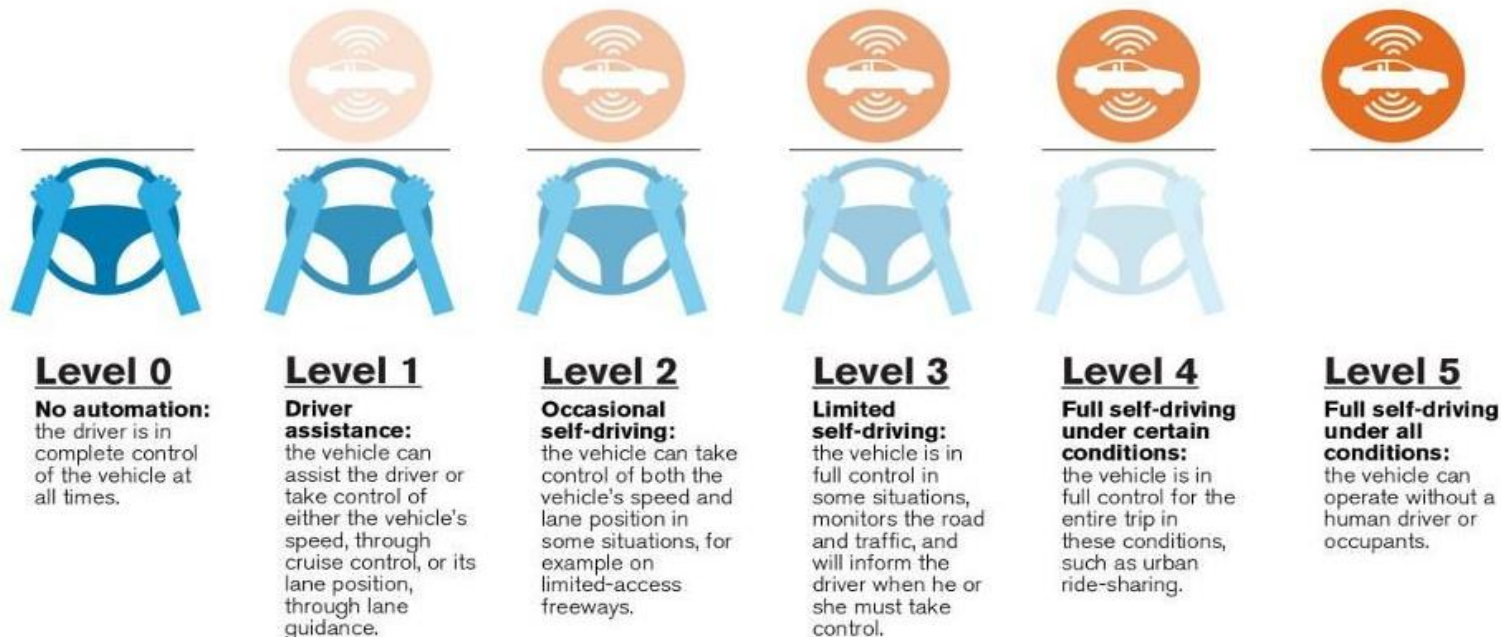


Section AH9 "Moscow-St.Petersburg" on the road M-11



Levels of Vehicle Autonomy

Five Levels of Vehicle Autonomy



Source: SAE & NHTSA

Examples of existing in the Russian Federation vehicles for the transport of goods in unmanned mode



Unmanned version of the
KAMAZ-43083



Unmanned "KAMAZ" truck with "Avatar" kit



Cabless unmanned vehicle "KAMAZ"



Cabless unmanned vehicle "NAMI" with electric drive
based on the KAMAZ chassis



Cabless unmanned vehicle EVO-1 with the ability to
refuel with hydrogen

The division of responsibility between a person and a vehicle

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	<p>You <u>are</u> driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering</p> <p>You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety</p>			<p>You <u>are not</u> driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”</p> <p>When the feature requests, you must drive</p> <p>These automated driving features will not require you to take over driving</p>		
What do these features do?	<p>These are driver support features</p> <p>These features are limited to providing warnings and momentary assistance</p> <p>These features provide steering OR brake/acceleration support to the driver</p> <p>These features provide steering AND brake/acceleration support to the driver</p>			<p>These are automated driving features</p> <p>These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met</p> <p>This feature can drive the vehicle under all conditions</p>		
Example Features	<ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time 	<ul style="list-style-type: none"> • traffic jam chauffeur 	<ul style="list-style-type: none"> • local driverless taxi • pedals/steering wheel may or may not be installed 	<ul style="list-style-type: none"> • same as level 4, but feature can drive everywhere in all conditions

"Concept of ensuring road safety with the participation of autonomous vehicles on public roads"

Goals:

- ✓improving road safety;
- ✓increase the nominal capacity of the road;
- ✓optimization of transport processes;
- ✓formation of the set behavior of road users and driving culture;
- ✓development of various services for users of the transport system;
- ✓maintaining the specified level of maintenance of the roadway and road transport infrastructure.

Concept, the development of technologies for connecting a vehicle to the road transport infrastructure should be aimed at implementing the following **safety principles**:

- ✓ minimizing the likelihood of road accidents;
- ✓ providing protection against terrorist attacks carried out using highly automated vehicles;
- ✓ providing protection against cyber attacks;
- ✓ providing protection against the deliberate destabilization of road traffic through the use of highly automated vehicles;
- ✓ ensuring the confidentiality of personal data of drivers and users of vehicles.

Concept, possible use of highly automated vehicles in the conditions of traffic on the highway in the near and medium term are:

- ✓ road trains in organized groups that operate in semi-automatic or automatic mode;
- ✓ automated trucks that carry out transportation on sections of highways equipped with intelligent infrastructure.

Strategy of the Digital transformation includes six key initiatives of the Ministry of transport:

- ✓ "highly and fully automated vehicles for passengers and cargo";
- ✓ "Green Digital Passenger Corridor";
- ✓ "Seamless cargo logistics";
- ✓ "Digital management of the transport system of the Russian Federation";
- ✓ "Digitalization for transport security";
- ✓ "Digital counterparts of transport infrastructure objects".

Testing of automated vehicles in the Russian Federation

Testing of automated vehicles in the Russian Federation in accordance with the Decree of the Government of the Russian Federation No. 200 of February 22, 2020 is allowed from March 1, 2020 for two years in the following regions:

Moscow, Vladimir, Samara, Nizhny Novgorod, Novgorod and Leningrad Regions, the Republic of Tatarstan, Khanty-Mansi and Yamalo-Nenets Autonomous Districts, Krasnodar Territory, Chuvashia, Moscow City and St. Petersburg.

The beginning of practical cargo transportation by automated vehicles on the AH9

In June 2021, at the St. Petersburg International Economic Forum SPIEF-2021, the Ministry of Transport of Russian Federation signed an agreement with a number of Russian companies (the association "Digital Transport and Logistics", KAMAZ, National Telematics Systems NTS, Sberavtotech, Business Lines, Globaltruck, First Forwarding Company and X5 Group) on the implementation of practical transportation using autonomous vehicles on the road M-11 "Neva" until 2024.

The first stage of this project will be the launch of autonomous cargo transportation on the M-11 "Neva" (AH9).

Restrictions on the use of automated vehicles without drivers on the roads

According to the rules of the "Convention on Road Traffic" signed in Vienna, November 8, 1968, a **person must be behind the wheel of a vehicle**, regardless of whether autonomous systems work in the vehicle or not.

The Russian Federation and European States propose to introduce into the convention the concept of an "automated driving system", that is, a software and hardware complex that performs dynamic control over the vehicle.

By the complex, the authors of the amendments mean all the functions necessary for movement: road control, driving, planning and signaling about maneuvers.

It is also proposed that the automated system can be recognized by the driver if the vehicle meets the technical and operational requirements of the States that have recognized the amendments.

The level of modern automated vehicles does not provide complete safety

- ✓ Modern sensors cannot provide the necessary amount of information for control;
- ✓ Even the availability of high-quality video cameras cannot be fully effective due to the low video quality after sunset and at night. Even in daylight, the camera cannot determine the color of the traffic light with 100% accuracy;
- ✓ In adverse weather conditions, the situation is even worse, because there are no reliable technologies that allow you to use an autonomous vehicle when it snows. Sensors developed for autonomous vehicles recognize snow as an obstacle. As a result, during a snowfall, the vehicle simply stops.

There are still areas of responsibility for the safe transportation of cargo, its integrity and safety of properties, the fulfillment of the cargo delivery schedule, the maintenance of the vehicle during transportation in technically sound condition.

The operation of autonomous vehicles on international routes is hindered without the adoption of regulatory and internationally agreed requirements, including:

- ✓ Requirements for automated driving systems;
- ✓ Requirements for the organization of the transportation process, including in international traffic, using highly automated and fully autonomous vehicles;
- ✓ Operating tolerance and methods for checking (validating) the parameters of a highly automated vehicle;
- ✓ Human-machine interface;
- ✓ Information and cybersecurity of highly automated vehicles.

Resolution on the introduction of highly and fully automated vehicles in road traffic conditions

The Global Forum on Road Traffic Safety (ITC UN ECE) adopted at its 78th session (Geneva, 25-29 March 2019) a resolution on the introduction of highly and fully automated vehicles in road traffic conditions.

The definitions recommended by this resolution, in particular, the term **"highly automated vehicle"** takes precedence over the term **"unmanned vehicle"**.

The frequently encountered term **"unmanned" is less accurate**, since it emphasizes the absence of a driver (pilot) in the vehicle, and this can not always be realized at the current level of technology development, the term "unmanned" also does not take into account the presence of intermediate levels of automation.

In addition, an unmanned vehicle can be controlled remotely, through the commands of an external operator, which may mean that there is no automation of the vehicle as such.

The most correct understanding of the term **"unmanned vehicle" is as a highly or fully automated vehicle operating in unmanned mode**, which means that during the use of this mode, the vehicle is under the control of an automated driving system.

Modernization of infrastructure AH9

The formation of a telecommunications road transport infrastructure for managing connected and unmanned vehicles includes:

- ✓ the creation of a linear and station infocommunication and object tool infrastructure on the highway network;
- ✓ the creation and development of a technological platform that includes application software modules, data transmission channel protection tools, as well as ensuring the functioning of the entire infrastructure based on unified open protocols as a single digital ecosystem.

Thank you for your attention!

Contact:

Mikhail Nizov

E-mail: 0310705@mail.ru