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Report on the analysis of the implementation of ITS development and carbon footprint reduction projects in the Russian territory of the Barents Region, as well as proposals for the integration of Russian ITS development projects into the Joint Transport Plan of the Barents Region

KO 1029 BARENTS REGION TRANSPORT AND LOGISTICS PROJECT

SERVICE REPORT

St. Petersburg February 25, 2022

The Limited Liability Company "Institute for Enterprise Issues" (LLC IEI), hereinafter referred to as the "Executor", represented by Director Vladimir Borisovich Romanovsky, acting on the basis of the Charter, on the one part, compiled a Service Report for the Autonomous Non-Profit Organization "Center management of the implementation of projects for socio-economic, scientific, technological, innovative development and staffing of the regions" (ANO "Project Management Center"), hereinafter referred to as the "Customer", represented by Director Shapovalov Vitaly Vitalievich, acting on the basis of the Charter, on the other part.

The Executor, on the instructions of the Customer, provided services to analyze the implementation of projects for the development of intelligent transport systems and transport carbon footprint reduction in the Russian part of the Barents Region and develop proposals for the integration of Russian ITS development projects into the Joint Transport Plan of the Barents Region (hereinafter referred to as the Services) in the interests and at the expense of funds of the project KO1029 "Transport and Logistics of the Barents Region", financed under the Kolarctic 2014-2020 Cross-Border Cooperation Program (hereinafter referred to as the Project), on the terms, in the manner and within the time limits determined by the Parties in the Contract for the Provision of Services for Compensation No. 05/21 dated December 27, 2021.

Reporting materials prepared for transfer to the Customer, including the results of intellectual activity:

- Service Report in text form in MS format Word / PDF,
- Presentation with the main results of the service report in MS format PowerPoint / PDF.

Reporting materials are made in Russian and English in paper and electronic forms.

Signatures of the parties

On behalf of the Customer	On behalf of the Executor
_____ (V.V. Shapovalov)	_____ (V.B. Romanovsky)
MP	MP

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Key terms and abbreviations used in the analytical report

Term / Abbreviation	Description / Definition
5G	Fifth generation of mobile communications based on telecommunication standards (5G/IMT-2020) following existing 4G/IMT-Advanced standards
Datex II	It is Data exchange standard for the exchange of traffic information between traffic control centers, transport service providers, traffic operators and media partners. It contains, for example, traffic incidents, current road works and other special traffic-related events. The data is in XML format and modeled with UML. The standard was developed by the technical body Intelligent Transport Systems (CEN/TC 278) of the European Committee for Standardization
ITS-G5	Communication standard for vehicles
Autodata Platform	It is designed to collect big data in the automotive sector, enrich and process them, including using artificial intelligence technologies, generate statistical and analytical data and provide data-as-a-service services to a wide range of consumers [GOST R 56829–2015]
Automated vehicles	Vehicles in which at least some of the control functions of the vehicle that are critical to traffic safety (for example, steering, throttle, or braking) are performed without the direct participation of the driver. Automated vehicles can be autonomous (i.e., use only the sensors of the vehicle itself) or can be connected (i.e., use communication systems such as connected vehicle technology where cars and roadside infrastructure communicate with each other wirelessly networks). Connectivity is an important contribution to realizing all the potential benefits and widespread adoption of automated vehicles
Autonomous vehicle	It is a vehicle that moves independently using only built-in (on-board) sensors
CNG station	**Mobile compressed gas filling station** It is a set of machines, equipment, buildings, structures, and systems of engineering and technical support, combined into a single technological cycle of production, accumulation and delivery of compressed natural gas [GOST R 57433–2017]
ANSCS	**Automated Navigation Supervisory Control System of Urban Passenger Transport** It is a system designed to generate and process primary information on passenger flows on urban passenger transport routes [GOST R 54723–2019]
AWCP	**Automatic Weight and Dimensional Control Point** It is designed for measurements in automatic mode of the mass of moving vehicles, loads on the axes (groups of axes) of the vehicle, overall dimensions (length, width, height) and axial distances of the vehicle
ITS architecture	It is a formalized comprehensive description of the functional and technical structure, zonal parameters and compatibility levels of transport and telematic systems (ITS subsystems), the interaction of which ensures the required mobility of the population and the use of the road network with a given level of transport and environmental safety with maximum efficiency
AS	**Automated System** It is a system consisting of personnel and a set of means for automating its activities, implementing information technology for performing established functions [GOST 24.501–82]
AMSS	**Automated Meteorological Support System** It is a system that includes a network of automatic road weather stations (ARWS), data transmission facilities, a computer system that analyzes incoming information and displays both analysis results and measured parameter data [ODM.2018.8.001-2009]
AAFS	**Automated Aircraft Flight Safety of civil aviation of the Russian Federation** It is designed to collect, store and process data on aviation events in order to analyze the causes and trends that determine the state of flight safety [Federal State Information System for Informatization Coordination]

Term / Abbreviation	Description / Definition
ATCS	**Automatic Traffic Control System** [PNST 554–2021]
ATMS	**Automated Traffic Management System** It is designed to control the movement of vehicles and pedestrian flows on the road network of a city or highway [GOST R 56670–2015]
ARLCS	**Automated Road Lighting Control System** The lighting system for roads and tunnels is designed to solve the problems of automation and information support of technological, production and organizational processes of lighting, as well as other processes of activity at road facilities based on modern information and telecommunication technologies [GOST R 58462–2019]
APCS	**Automated Passenger Counting System for Public Transport** The system is intended for: • collection, counting and storage of data on passenger journeys along regular transportation routes, including privileged categories of citizens, in the context of flights, time intervals, categories of passengers; • improvement of settlements with carriers for the rendered transportation services; • electronic recording of information on the volume of transport work actually performed by carriers in the implementation of passenger transportation along regular transportation routes; • implementation of the functions of monitoring and control of passenger flows in order to study the needs of the population in passenger traffic
Unmanned vehicle	A vehicle equipped with environmental analysis and automatic control that can move without human intervention
Biometric passenger Identification system	Biometric identification (biometric identification): identification of a person by unique biological characteristics inherent only to him [GOST ISO / IEC 2382-37-2016]. Facial identification is the biometric form most suitable for machine readable travel documents. It is believed that biometrics will speed up the passage of passengers - transport can be used without presenting a passport. For busy airports, biometric technology will provide an opportunity to reduce queues at control and speed up boarding
Big Data	Large data arrays, characterized mainly by such characteristics as volume, diversity, processing speed and/or variability, which require the use of scaling technology for efficient storage, processing, management, and analysis. Data analytics is used to represent objects described by data in order to predict specific situations and generate step-by-step recommendations for solving problems [GOST R ISO / IEC 20546-2021] With the help of big data processing, the following tasks are solved: • road congestion (analysis of traffic jams, causes and trends of congestion); • geolocation analytics (flexible analysis and testing of a wide range of hypotheses on the development of individual territories in terms of logistical accessibility, transport network coverage); • optimization of supply chains (reduction of idle run for trucks, identification of additional windows in routes for passing loading of partially filled trucks); • equipment maintenance warning (wear analysis); • fight against fraud (blocking the ability for drivers to attribute time on flights), etc.
On-board device	An electronic device installed in a vehicle, which, as a rule, has communication and navigation modules, as well as an interface for interacting with people on board the vehicle
ITS onboard facilities	A set of hardware and software tools that are standard or additionally installed on the vehicle and provide solutions for the problems of information interaction of the vehicle with the ITS infrastructure, or with other vehicles within the framework of the functional tasks of various ITS subsystems, in order to implement the functions of monitoring the state of the vehicle, driver and cargo, control and optimization of vehicle movement, as well as providing information support for driver actions.

Term / Abbreviation	Description / Definition
	Basically, ITS onboard facilities implement the following functions: - assist the driver in predicting the traffic situation, - encourage the driver to take action to prevent a dangerous situation, - reduce driver fatigue, taking part of the load on driving a car; - automatically take control if the driver himself was unable to perform the necessary actions to prevent an accident, or reduce the severity of its consequences; - allow you to identify the vehicle and the parameters of its operation
UAV	Unmanned aerial vehicles
Interaction of vehicles, V2X	• Interaction of vehicles with road infrastructure (V2I - Vehicle to Infrastructure) Technology of interaction of vehicles with elements of road infrastructure through wireless data transmission • Inter-vehicle interaction (V2V - Vehicle to Vehicle) The technology of vehicle interaction through wireless data transmission without the participation of road infrastructure elements • Cross-board interaction through road infrastructure (V2I2V - Vehicle to Infrastructure to Vehicle) A technology for the interaction of vehicles through wireless data transmission through road infrastructure [GOST R 56829–2015] • Interaction of vehicles with any objects (V2X - Vehicle to everything communications)/ The interaction of the vehicle with any objects that may affect the vehicle, for the mutual exchange of information via wireless communication. V2X communication technology uses WLAN and works directly between V2V (vehicle-to-vehicle) vehicles and V2I (vehicle-to-infrastructure) infrastructure [GOST R 56829-2015]. • C-V2X Vehicle Interoperability complements the system with cellular and 5G V2N (vehicle-to-net) connectivity, allowing the vehicle to be located on-line in the general information environment. The combination of communication systems and technologies allows the vehicle to see and analyze the traffic situation both near it, in proximity, and at any scale.
Dedicated Short Range Communication (DSRC)	**Dedicated Short Range Communication** It is communication technology in accordance with the international standards IEEE 802.11p and IEEE 1609, used for the rapid transmission of data between vehicles and transport infrastructure facilities. One of ITS technologies
GANM	State air navigation maps
GIS	**Geographic Information System;** [GOST R 56670–2015] It is an information system that provides collection, storage, processing, access, visualization, and distribution of spatially coordinated data (spatial data).
GEF	**Gas engine fuel** It is an engine fuel that is in a gaseous state under normal atmospheric conditions. Gas engine fuel includes liquefied natural gas (LNG), compressed natural gas (CNG), liquefied carbon gases (LCG), hydrogen, etc. [GOST R 57433–2017]
GEF CNG	Gas engine fuel **Compressed Natural Gas** It is Compressed natural gas methane CH4, under pressure of 200–250 bar, which is produced at compressor stations from commercial gas and is often used as fuel for engines of low and medium power. It is the most common type of gas motor fuel. It is stored and transported in special cylinders that maintain pressure. Lighter than air and quickly evaporates without accumulating in the room
GEF LNG	Gas Engine fuel **Liquefied Natural Gas** It is Liquefied natural gas methane CH4, which is in a liquid state at a very low temperature of -161,5° C without compression. When it enters the normal atmosphere, it quickly returns to its usual gaseous state, increasing in volume by 600 times and releasing cold. High density and low volume make it possible to profitably store and transport LNG over long distances in cryogenic tanks, as well as use it as fuel for high-power engines of continuous operation vehicles or long-distance logistics.
GEF LPG	Gas Engine fuel **Liquefied petroleum gas**

Term / Abbreviation	Description / Definition
	C3H8, C4H10 - propane-butane mixtures are the product of associated petroleum gas with a boiling point of 0 to -40°C, depending on the composition of the mixture, which makes it vulnerable to low winter temperatures. Propane-butane mixtures are stored in gas holders or special containers under pressure up to 1,6 MPa and are widely used as a fuel for transport and very rarely for individual households (due to expensive infrastructure). LPG is heavier than air, spreads along the ground and is highly flammable and explosive. It is ahead of diesel fuel and fuel oil, but inferior to natural gas in terms of efficiency and environmental friendliness as a fuel for boiler houses and transport
UPT	Urban Passenger Transport
DIB	**Dynamic Information Board** It is a device for visual display of information, which is an element of the road infrastructure and is designed to display unchanged and time-varying information in indirect traffic control systems [GOST R 56829-2015]
UCP IMRRR	**Unified Corporate Platform for Integrated Management of Resources, Risks and Reliability at the stages of the life cycle of railway transport system** The purpose of the implementation of IMRRR is to increase the efficiency of the railway transport system based on adaptive control under resource constraints. The object of application of IMRRR is a set of technical objects, systems, and technological processes of railway transport [JSC "RZD"]
UTSMP	**Unified Digital Transport System Management Platform** It is a modular system for collecting and analyzing traffic flows in real time with the ability to visualize and support decision making. UTSMP provides for the collection and analysis of data from the intelligent transport system of the urban agglomeration coming from all internal subsystems and external information systems (sources) such as: administrative and technical inspections of the urban agglomeration, traffic police, road services, taxis, carsharing, etc. [Decree of the Ministry of Transport of Russia dated March 25, 2020, N AK-60-r]
UATMS	**Unified Air Traffic Management System of the Russian Federation** It is designed to organize the use of airspace and air navigation services for aircraft flights [FSUE State Corporation for Air Traffic Management in the Russian Federation]
Green hydrogen	It is hydrogen from water electrolysis* powered by 100% renewable energy [IRENA-The International Renewable Energy Agency]
Green Digital Passenger Corridor	It is a Project of the Ministry of Transport of the Russian Federation. The task is the comfortable mobility of citizens. The implementation of the initiative should ensure the possibility of any trip without [paper] documents and without cash, taking into account benefits and real traffic. To do this, it is necessary to develop tools for non-cash payment of travel using biometrics; digital passenger profile based on a unified biometric system; online maps of routes for all types of transport
VIS	**Variable Information Sign** It is a technical mean of traffic management designed to display road signs, with the exception of signs of individual design [GOST R 56829-2015]
Simulation modeling in ITS	It is a kind of modeling implemented using a set of mathematical tools, special simulating computer programs and programming technologies that make it possible to conduct a targeted study of the structure and functions of a real complex process and optimize some of its parameters
Instrumental subsystem of ITS	It is a Transport telematics system aimed at solving one or more tasks of an integrated subsystem [GOST R 56829–2015]
ITS integration platform	Integration platform of the intelligent transport system. It is information and communication add-on in the form of software that provides management of all complex subsystems of ITS and interaction with external information systems [GOST R 56829-2015] Examples of complex ITS subsystems: • Weather monitoring subsystem

Term / Abbreviation	Description / Definition
	• Subsystem for monitoring the state of the road and road infrastructure • Subsystem of dispatching control of vehicles of road maintenance services • Automated fare collection subsystem • Subsystem of video surveillance, detection of accidents and emergencies • Transport stream parameters monitoring subsystem • Vehicle Weight and Dimension Control Subsystem • Subsystem for informing road users with the help of DIB and VIS • Traffic light control subsystem, etc. [ODM 218.9.011–2016]
Internet of Things, IoT	**Internet of Things** It is an infrastructure of interconnected entities, systems, and information resources, as well as services that allow processing and responding to information about the physical and virtual world [PNST 518-2021 (ISO/IEC 20924:2018)] ecosystem of IoT devices. IoT devices can be installed not only on public transport such as buses and trains but can also be included in the infrastructure of the city. Sensors on roads, streetlights, train platforms, bus stops, railroad tracks and other parts of traffic routes can allow traffic regulators to have constant visibility into the public transport system. IoT or Internet of Things ecosystem is all the components that enable businesses, governments, and users to connect their IoT devices, including dashboards, networks, gateways, analytics, storage, and security
Informing ITS users	It is a sequence of operations and procedures for the formation and provision of information messages to users of the intelligent transport system. Note - Examples of systems built on the technology of informing users of an intelligent transport system are the information support system for road users, the pre-trip information system, and the route orientation system [GOST R 56829–2015]
Informing road users	It is providing ITS users with both static and dynamic information about the state of the transport network, including modal movements and movements through transfers [GOST R ISO 14813-1-2011]
Infrastructure ITS	It is a set of technical means, peripheral devices and communication channels that perform functions in the ITS and are not located on board the vehicle. The ITS infrastructure includes, for example: - a road complex of all ITS subsystems, including technical means for monitoring analysis and decision-making in accordance with the functional tasks of the subsystems, means for implementing control decisions; - situational, dispatching and operational centers
ICSRT	**Intelligent Control System and automation of production processes in railway transport** The system provides analysis, modeling, and optimization of the technology of operation of railway stations and is designed to identify "bottlenecks" and form options for the technical and technological development of railway stations [JSC Russian Railways]
ITS	**Intelligent Transport System** It is a system integrating modern information, communication and telematics technologies, management technologies and designed for automated search and acceptance for implementation of the most effective scenarios for managing the transport and road complex of the region, a specific vehicle or group of vehicles in order to ensure a given mobility of the population, maximizing the indicators of the use of the road network, improving safety and efficiency transport process, comfort for drivers and transport users [GOST R 56294-2014]
ITS of public transport	It is a system that includes both equipment installed in the vehicle and equipment at stops, terminals, along the route of public transport, etc. They also include back-office IT systems for planning, dispatching, and monitoring the operation of public transport, as well as means of informing passengers about routes, time arrival/departure, possible incidents, etc.

Term / Abbreviation	Description / Definition
Carsharing	From English Carsharing is a decentralized short-term car rental / rental service that complements other modes of transport, including walking, cycling and public transport / Carsharing vehicle fleet management systems (as well as other vehicles, for example, bicycles) are close to vehicle monitoring systems, and carsharing cars themselves are becoming one of the elements of public transport with a corresponding intelligent control system
CIIS "Sea "	**Complex Integrated Information System Sea-River** It is a system for ensuring the safety of navigation and navigation through the consolidation of national, regional, and other existing information systems [Decree of Rosmorrechflot dated August 10, 2012, No. AD-205-r]
Integrated ITS subsystem	**Integrated ITS subsystem** It is a set of transport telematics systems and additional software and hardware systems that have integrity and are aimed at achieving a comprehensive goal within the framework of a management and decision-making strategy in transport [GOST R 56829-2015] Examples of complex ITS subsystems: • Automated traffic control system (ATCS) • Integrated traffic management subsystem (ITMS) • Subsystem of directive control of traffic flows (SDCTF) • Road condition management subsystem • Automated control system for routed transport, etc. [ODM 218.9.011–2016]
Cooperative Intelligent Transport Systems	Systems using \/2X interaction - the exchange of information between a car and any other object (other cars, road infrastructure, pedestrians, and passengers, etc.) via wireless communication technologies [PNST 554–2021]
CTMS	Comprehensive Traffic Management Scheme
ISDS RTI	**Integrated Spatial Data System of Railway Transport Infrastructure** It is an information technology system for collecting, processing, storing and providing registered users with coordinate information about infrastructure facilities and mobile railway transport facilities. The ISDS RTI includes a high-precision coordinate system (HCS) and a spatial database in the form of digital track models (DTM). The videoconferencing creates a single high-precision coordinate space, implemented on the basis of the mechanisms for using global navigation satellite systems GLONASS / GPS and their additions, geodetic support for all types of engineering surveys carried out for the design, construction and operation of railways, as well as field tracing of new highways. DTM is a mathematical description of the geometric characteristics and spatial position of the track and infrastructure facilities of the railways, which forms the basis of the methodology [JSC Russian Railways]
Local ITS project	It is a project designed to manage a single node or a group of interconnected nodes of a transport network [GOST R 56829–2015]
MASV	**Marine Autonomous or remotely operated Surface Vessel**
MCSP	**Murmansk Commercial Sea Port**
MPSN	**Multi-position Surveillance System** It is a spatially distributed network of synchronized transceiver stations designed to monitor air traffic
Navigation system GALILEO	European satellite system
GPS navigation system	Global Positioning System United States Global Navigation Satellite System
Navigation system GLONASS	GLObal Navigation Satellite System of Russia

Term / Abbreviation	Description / Definition
GNSS navigation system	**Global Navigation Satellite System** It is a navigation satellite system designed to determine the spatial coordinates, the components of the velocity vector and to correct the readings of the GNSS consumer clock at any point on the surface of the Earth, the waters of the World Ocean, air and near-Earth space [GOST R 52928–2010]
Navigation system RNIS	**Regional Navigation and Information System** RNIS is created as part of programs for the implementation of satellite navigation technologies using the GLONASS system in the interests of the socio-economic development of the constituent entities of the Russian Federation, improving the safety and level of service for their population in accordance with Decree of the Government of the Russian Federation of December 21, 2012, No. 1367
Optimization of transport flows	It is a set of works aimed at changing the existing organization and traffic management system (changes in the road network, in traffic light control modes, allocation of lanes for public transport, development of parking space, etc.)
Traffic management	Activities to streamline the movement of vehicles and (or) pedestrians on the roads, aimed at reducing the loss of time (delays) in the movement of vehicles and (or) pedestrians, subject to ensuring road safety
VCP	**Video control post** Includes a video camera, power supply, communications, grounding, and lightning protection
ITS peripheral equipment	Elements of the ITS subsystem located on a road, vehicle, or transport equipment [GOST R 56829-2015]
ITIDP	Integrated Transport Infrastructure Development Program
Connected vehicle	It is a vehicle whose electronic systems have access to the Internet and which, among other things, can exchange information with roadside infrastructure using wireless communications of the relevant standards
ITS subsystem	It is a subsystem of the intelligent transport system. Part of an intelligent transport system that has integrity and can function independently of other parts [GOST R 56829–2015] There are complex and instrumental subsystems of ITS
Data transfer protocol	It is a formalized set of requirements for the structure of information packets and the algorithm for exchanging information packets between data communication network devices [GOST R 56829–2015]
Russian segment of the Barents Region	Murmansk Region and Arkhangelsk Region (including the Nenets Autonomous District), Republics of Karelia and Komi
RSHCAI	**Regional Software and Hardware Complex of Aeronautical Information Of the Federal Air Transport Agency** It is the system of electronic method for the exchange of aeronautical information at all stages of its life cycle. It serves to automate the activities of aeronautical information services at the regional level
AISATC AV	**Artificial Intelligence System for Automated Traffic Control of Automated Vehicles** It is an artificial intelligence system for processing data from sensors (sensors) of an automated vehicle and generating signals transmitted to control mechanisms of an automated vehicle [PNST 554–2021]
System 112	It is the state territorially distributed automated information and control system, created within the boundaries of the subject of the Russian Federation, designed to receive and process calls from emergency operational services received by a single number "112"
eCall System	It is an automatic call of emergency services when the vehicle gets into an accident. An electronic call in the car is generated either manually by the car's occupants or automatically by activating the sensors in the car after an accident.
Free flow system	It is a system of barrier-free procedure for paying for travel on toll roads. The system equipment recognizes the state number, determines the category of the vehicle, and the payment is debited from the personal account

Term / Abbreviation	Description / Definition
Transport telematics system	It is a system that collects, processes and exchanges information between various users and elements of the transport system [GOST R 56829–2015]
NSR	Northern Sea Route It is the shortest sea route between the European part of Russia and the Far East. There are more than 50 ports along the route of the NSR, the most important of which are: the port of Murmansk, the port of Arkhangelsk, the port of Naryan-Mar, the port of Varandey, the port of Sabbetta, the port of Igarka, the port of Dudinka, the port of Dixon, the port of Khatanga, the port of Tiksi, the port of Pevek, the port of Beringovsky, the port of Petropavlovsk-Kamchatsky, the port of Vladivostok
TCFR	Transport carbon footprint reduction
Technical means of traffic management	They are structures and devices that are elements of road construction and are designed to ensure the organization of traffic (traffic signs, markings, traffic lights, road barriers, guide devices and other structures and devices)
Communication technology "4G (LTE)"	4G/LTE mobile radio technology provides high data rates (up to 129 Mbps), low latency, large coverage areas and high mobility. This communication technology can be used to transmit data from various road sensors to traffic control centers, as well as vehicles and pedestrians.
5G communication technology	It is a fifth-generation wireless mobile communication technology that will provide 10 times faster speeds than current 4G LTE technologies (1-10 Gbps), response time (ping) up to 1 ms, mobility support up to 500 km/h, bandwidth up to 1 GHz and a very high density of connected devices (up to 1 million per 1 sq. km.)
LPWAN communication technology	LPWAN technologies are narrowband radio technologies that have low radiation power and extended coverage area with a radius of up to several kilometers
"NB - IoT" communication technology	NB - IoT (NarrowBand Internet of Things): Cellular communication technology for telemetry devices with low data exchange volumes [GOST R 59026-2020]. In 2017-2018, the largest cellular operators of the Russian Federation deployed network sections working with NB - IoT
WLAN communication technology	Wireless Local Area Network; Wireless LAN; WLAN It is a wireless computer network that links two or more devices using a wireless delivery method (often via radio orthogonal frequency division multiplexing) over a limited area (home, university, office building)
"FOCL" communication technology	**Fiber Optic Communication Line** It is a fiber-optic system consisting of passive and active elements, designed to transmit information in the optical (usually near infrared) range [GOST R 54417-2011]
"Quantum Communications" communication Technology	Quantum communications are a set of technological directions that use single quantum objects to transfer information. The most technically advanced area of quantum communications is quantum key distribution (also known as quantum cryptography). Quantum communications are considered as the basis for the development of the architecture of information networks of the future. Their use can radically improve the reliability and efficiency of communication lines
"Distributed Registry Systems (Blockchain)" communication Technology	Distributed registry technology is an approach to the exchange and storage of information, in which: • each participant can have a full copy of the registry; • synchronization of registry copies occurs on the basis of a distributed consensus protocol, that is, an agreement among participants to add new information; • each participant in the interaction can have access to the transaction history. Distributed registries allow you to maintain up-to-date copies of the database on multiple nodes, thereby providing increased operational resilience. Blockchain is a variant of the implementation of a network of distributed registries, in which data on completed transactions are structured as a chain (sequence) of related blocks of transactions. Not all distributed registry networks operate on the basis of blockchain technology [Roadmap for the development of "end-to-end" digital technology "distributed registry systems"]

Term / Abbreviation	Description / Definition
Transport navigation system	It is a part of a vehicle's on-board control system or third-party add-on used to determine its location and direction of travel
Vehicle	Vehicle
Road Network	Road Network
Traffic management	It is an ordering the movement of vehicles and pedestrians on the roads [GOST R 56829–2015]
Traffic flow management	• Directive control of traffic flows (DCTF) The principle of traffic flow control, which implies the unambiguity of decision-making by road users in accordance with the provided control action, the obedience to which is regulated by the rules of the road [GOST R 56829-2015] • Indirect traffic flow management (ITFM) The principle of traffic flow management through the management of the motivation of road users through the provision of information. Note - Most often, motivation management is carried out through the provision of information on route options and traffic conditions [GOST R 56829–2015]
Physical architecture of ITS	It is a hierarchically organized set of morphological descriptions of ITS subsystems and the relationships between them, as well as the relationships of software and equipment that make up them. Note - The physical architecture defines the basic requirements for the functioning, interaction, and placement of the element base of the intelligent transport system [GOST R 56829-2015]
FNTT	**Federal Network of Transport Telematics** The FNTT will be used to create a technological environment for the exchange of data between road users, including conventional cars and drones. It is assumed that the FNTT will become the basis of the Unified navigation and communication information system of the transport complex. The transport telematics system will include two types of communication networks: - narrowband network - to provide communication for static objects, various control nodes, sensors. It will be used where small amounts of information are transmitted and the signal delay time is not important. - a broadband Internet access network is needed to ensure the reliable operation of unmanned and intelligent transport systems, modern services, including video transmission.
Functional architecture of an intelligent transport system	Functional architecture of ITS: a hierarchically organized set of functional descriptions of subsystems, subjects, and objects of ITS, as well as their interactions [GOST R 56829–2015]
Digital twin	It is a system consisting of a digital model of the product and two-way information links with the product (if the product is available) and (or) its components. Digital model: A system of mathematical and computer models, as well as electronic documents of a product, describing the structure, functionality, and behavior of a newly developed or operated product at various stages of the life cycle, for which, based on the results of digital and (or) other tests in accordance with GOST 16504, a conformity assessment was made requirements for the product [GOST R 57700.37-2021]. Examples of digital twins in transport: • Smart locomotive. Allows you to automate the process of data analysis and search for incidents in the operation of locomotive equipment, generate a list of over-cycle work and prepare the necessary materials and spare parts before the locomotive enters the depot. • Digital wagon - associated with each wagon model and contains physical, technological, and predictive models for wagon components and parts. The model allows you to have an accurate idea of the current state of locomotives through remote automated diagnostics; carry out repair work not according to the standard schedule, but according to the results of predictive diagnostics

Term / Abbreviation	Description / Definition
	• Aerodrome digital model - a set of data describing the structures and characteristics of the aerodrome itself, as well as its equipment and facilities, in particular: high-precision cartographic data; data on the state, rules of use, work regulations, separation standards
Element of the subsystem of the intelligent transport system	Element of the ITS subsystem: Functionally indivisible block of information, telematics, or hardware for the subsystems of the intelligent transport system, considered as a whole and having system properties [GOST R 56829-2015]
ESD (Electronic navigation seal)	**Electronic Sealing Device** It is a sealing device with elements of electronic memory, logic, and information transmission, automatically generating additional identification features (radio frequency, optical), signals of safety and opening of the ESD, information about the state of the object, automatically transmitted (or read) to the control panel [GOST 31282–2004]
Efficiency of traffic management	It is the ratio of time losses (delays) in the movement of vehicles and (or) pedestrians before and after the implementation of measures to organize traffic, subject to ensuring road safety

Introduction

This study on the analysis of the implementation of projects for the development of intelligent transport systems (ITS) and transport carbon footprint reduction in the Russian part of the Barents Region and the development of proposals for the integration of Russian ITS development projects into the Joint Transport Plan of the Barents Region was completed in December 2021 - February 2022 in the interests and at the expense of the project KO 1029 "Transport and Logistics of the Barents Region", funded under the Kolarctic Cross -Border Cooperation Program 2014-2020.

Statement of the problem and prerequisites for the study

The widespread development of the use of personal, commercial and public transport using internal combustion engines and electricity has provided both new public benefits associated with an increase in the opportunities for comfortable transport mobility of people, building supply chains for goods and raw materials on a global scale, and has created significant problems associated with the organization effective management of traffic flows, the increase in the number of traffic accidents, the impossibility of continuous investment in the extensive growth of transport routes, especially in urban agglomerations, and environmental pollution from exhaust gases and noise.

Efficient and sustainable operation of all modes of transport while ensuring the necessary safety for the population, climate- dependent sectors of the economy and the environment are among the priority areas in the strategic development plans of the countries of the Barents Region. The implementation of such plans is directly aimed at ensuring the growth of the quality of life of people of current and future generations and the sustainable development of the economy in the long term.

This report considers two complementary directions for solving these problems related to increasing the economic efficiency and environmental safety of the use of transport systems that have a developed practice of application in the Barents Region - the development of intelligent transport systems (ITS) and the transport carbon footprint reduction[1]. At the same time, transport carbon foot print reduction is considered both as an independent area of activity for adapting the spheres of public administration, sectors of the economy and regional infrastructure to changing climatic conditions and ensuring stabilization of the concentration of greenhouse gases in the atmosphere at a level that would not allow dangerous anthropogenic impact on the climate system, and as a derivative from the implementation of projects in the field of creation and operation of ITS, which, among other things, reduce the carbon footprint and emissions of harmful substances from transport systems by optimizing their functioning.

The prerequisites for conducting a study and developing an analytical report in relation to the Russian ITS and transport carbon footprint reduction projects in the Barents Region are:

- Consistent ratification by the Russian Federation of international agreements in the field of climate, incl. of the UN Framework Convention on Climate Change, the Kyoto Protocol to the UN Framework Convention on Climate Change and the Paris Agreement

[1]In accordance with the Paris Climate Agreement (United Nations Framework Convention on Climate Change COP-21 UNFCCC of December 12, 2015, signed in Paris)

(ratified in 2019) in conditions of a higher than the global average rate of climate warming in the Russian Federation and the highest rate of increase in average annual temperature on the coast of the Arctic Ocean, the formation of significant risks due to climate change, primarily for the population, national infrastructure and climate-dependent sectors of the economy, the risks of degradation of various ecosystems as a result of changes in thermal and humidity conditions (for example, degradation of permafrost soils and mountain glaciation, accelerated aging of buildings)[2]. Approval in 2021 of the strategy for socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050,

- The need for synchronization and complementarity of plans for the development of ITS, as well as the exchange of data on traffic flows in order to improve the quality of transport planning in the Barents Region and ensure greater safety, economic efficiency and speed of cross-border movement of passengers and goods, in the context of the future dominance of digital technologies, the development of the availability of digitalization in transport and focus on sustainable industrial processing chains, the use of green technologies[3],
- The need to harmonize the principles of sustainable development with the working processes of the transport systems of the Barents Region[4],
- Inclusion of issues of ITS development and transport carbon footprint reduction activities in the number of directions for the implementation of national development goals until 2030 in accordance with Decrees of the President of the Russian Federation of July 21, 2020, No. 474 and relevant national and federal projects, and other strategic planning documents of the Russian Federation and regions of the Russian segment of the Barents Region,
- Identified by the Ministry of Transport of the Russian Federation, the need to supplement the results of the development of the analytical report "Intelligent transport systems in the Barents Region - current status and proposals for the implementation of pilot projects" (Barents Region ITS report. Current and existing ITS status and suggestions for the ITS pilots in the Barents Region) made as part of the Barents project Region Transport and Logistik (hereinafter BRTL) in 2020, where the development of ITS and transport carbon footprint reduction was considered mainly in Norway, Sweden and Finland, without the necessary focus on the active development of similar projects in the Russian Federation.

Geographical and functional boundaries of the study

The geographical boundaries of this study are represented by five subjects of the Russian Federation belonging to the territory of the Barents Region: the Murmansk and Arkhangelsk Regions, the Republics of Karelia and Komi. The Nenets Autonomous District is considered in the scope of the study to a limited extent, since this subject of the federation is not connected by land roads and railways with other regions of the Russian Federation, and due to the very low population density and the small size of the capital of the region, the introduction of ITS is impractical.

[2]Strategy for socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050, approved. Decree of the Government of the Russian Federation of October 29, 2021 No. 3052-r

[3]Based on the recommendations of the BRTL report Global Transport and Logistics Market 2020

[4]Based on the recommendations of the BRTL report Global Transport and Logistics Market 2020

The functional boundaries of the study are determined primarily by the study of ITS systems and transport carbon footprint reduction activities focused on the public good, solving socio-economic development problems, and implemented in the interests of a wide range of individuals and legal entities in the Barents Region using transport systems and infrastructure. That is, the focus of this study is on the areas of activity and projects implemented primarily by federal, regional and local authorities, as well as the largest Russian backbone companies with state participation.

The study covers all types of transport operating on the territory of the Russian segment of the Barents Region (with the exception of pipelines) with a priority on road, sea and rail transport, which, in the specified ranking order, are mainly used in this macro-region (in terms of freight and passenger turnover), including in the framework of cross-border transportation of passengers and goods, and the organization of traffic along transport corridors from East to West and from South to North. Air transport is considered in this study in less detail, since flights between the countries of the Barents Region are recognized by the participants in the transportation as in fact economically inexpedient. In addition to modes of transport, the study touches upon the development of digital logistics infrastructure and digitalization of customs, as well as the development of production and refueling infrastructure for new types of fuel with a reduced carbon footprint.

The study on Russian strategic plans and projects in the field of ITS and transport carbon footprint reduction covers the time period 2018-2022 with two main forecast periods: medium-term - until 2024, and long-term - until 2030.

The scope of the study did not include all-Russian projects and initiatives on ITS and transport carbon footprint reduction covers implemented by the Government of the Russian Federation outside the territory of the Russian segment of the Barents Region, including pilot solutions and approbation (for example, approbation of a strategy and technology for decarbonization and CO2 emissions trading implemented in the Sakhalin Region, or projects for payment.

The study takes into account the latest changes as of the end of Q1. 2022 associated with military-political and macroeconomic changes caused by the special military operation of the Russian Federation in Ukraine.

Goals and objectives of the study

In accordance with the prerequisites and boundaries of the study, its purpose is to identify and analyze the main directions and problems of the implementation of Russian projects for the development of ITS and ensuring the transport carbon footprint reduction and to prepare recommendations for their integration and synchronization with the plans of other states of the Barents Region.

As part of achieving the goal of the study in this report, the following tasks were implemented:

- Analysis of documents of international cooperation, strategic planning of the federal, sectoral, regional and corporate levels in relation to plans and directions, systemic logic for the development of ITS and plans for transport carbon footprint reduction, measures of state incentives for projects in these areas,
- Determination of the main technological directions and architecture of ITS development in the Russian segment of the Barents Region in relation to the modes of transport, technologies and geography of implementation,

- Formation of a list of regional state, municipal and corporate projects for the development of ITS and plans for transport carbon footprint reduction in the Russian segment of the Barents Region, determination of their structure and current status, main technical and economic characteristics, timing, target results and their impact on the solution of strategic tasks of the development of ITS and plans for transport carbon footprint reduction in the region,
- Establishing the degree of alignment of plans for ITS and transport carbon footprint reduction with the neighboring countries of the Barents Region,
- Development of practice -oriented recommendations for the integration of Russian plans and projects for the development of ITS and the implementation of transport carbon footprint reduction activities into the Joint Transport Plan for the Barents Region.

Study Data Sources

The main sources of data within the framework of the study regarding plans and projects in the field of ITS and transport carbon footprint reduction were:

- Documents and projects of international cooperation within the framework of the Arctic Council and the Council of the Barents/ Euro-Arctic Region,
- Regulatory legal acts of the federal and regional levels, including federal, regional and sectoral (departmental) strategic planning documents in the field of transport development, logistics and the provision of transport services, digital transformation, communication systems and satellite navigation, energy and new types of fuel, development of management systems and the use of artificial intelligence,
- Plans and reports on the implementation of National projects of the Russian Federation, including the Safe and High-Quality Roads project, federal and regional projects within it,
- Open data, including publications in industry and public business media, scientific peer-reviewed journals, official press releases of state executive and legislative authorities,
- Official statistical reporting, including departmental,
- Public reporting and plans of Russian companies and corporations for digital transformation, development of transport systems and implementation of ESG strategies (RZD, Rosatom, Norilsk Nickel, Phosagro, Lukoil, Rosmorport, Rostec, etc.), conducting economic activities in the Barents Region,
- Public reporting on the activities of working groups within the framework of the National Technology Initiative, groups for international and national standardization in the field of ITS, working groups at industry transport and logistics associations ("Digital Transport and Logistics", "CET", ASMAP, etc.),
- Materials of all-Russian and regional conferences on ITS and transport carbon footprint reduction,
- International and national normative and technical documents on standardization,
- Project declarations on current and planned investment projects in the field of development and implementation of ITS, implementation of transport carbon footprint reduction projects,
- Reporting on research projects for cross-border cooperation programs,

- Expert opinions of industry specialists on the development and implementation of ITS and the implementation of transport carbon footprint reduction activities, including experts from regional governments, representatives of freight carriers and associations, Roszheldor, etc.
- Data on public and corporate procurement,
- Results of inquiries to the governments of the subjects of the federation and municipal authorities of the largest cities in the Russian segment of the Barents Region.

Research Methodology

To analyze the data and synthesize conclusions based on the data obtained from the above sources, the study used the scientific methodology of systems, which considers transport and logistics activities and the infrastructure necessary for its functioning (road network, communication systems, telecommunications and navigation, digital infrastructure and control centers, roadside infrastructure, stations and ports, airports, energy and fuel distribution facilities) in the Barents Region as a single system.

Based on this methodological basis, when developing proposals for integrating Russian strategic plans and projects for the development of ITS and transport carbon footprint reduction into the Joint Transport Plan for the Barents Region, the following principles are used: consistency, development, compatibility, synchronization, standardization, efficiency and safety.

To develop the analytical result of the study, a set of general scientific and specialized methods was used, including bibliographic search and gap analysis, structural-functional and structural-genetic analysis, generalization, ranking, comparative studies, presentation and processing of spatially distributed information in geographic information systems, intelligent filtering, deterministic factor analysis, multi-criteria classification and others.

Verification of the results of data collection and analysis was carried out by sending requests (in February-March 2022) to the executive authorities of the governments of the regions and largest municipalities of the Russian segment of the Barents Region authorized for ITS and and transport carbon footprint reduction, as well as by holding a strategic session with representatives of the Managing Authority of the BRTL project (February 18, 2022) to discuss the concept and intermediate results of the study.

The general concept of developing an analytical report in accordance with the chosen methodology is focused on:

1. Identification and description of the system of strategic priorities and directions for the development of ITS and transport carbon footprint reduction in relation to the Russian segment of the Barents Region, including priorities determined in the framework of international agreements and interaction (within the Arctic Council and the Council of the Barents/ Euro-Arctic Region, the Northern Dimension), as well as federal and regional plans and directions for the development of ITS and transport carbon footprint reduction based on the relevant regulatory legal acts and strategic planning documents, geographically linked to the Russian segment of the Barents Region.
2. Determination of the systemic logic of development and architecture of ITS and transport carbon footprint reduction in the Russian Federation on the example of projects for their implementation in the Russian segment of the Barents Region, implemented primarily within the framework of the BKAD National Project in the period 2018-2024, as well as other systemic Russian and international ITS- and transport carbon footprint reduction projects, incl. in the

field of satellite navigation and emergency communications (Glonass), collection and processing of big data on telematics of vehicles (Avtodata), development of new technological solutions for air traffic control at airports in the Barents Region (multi-position surveillance systems), development of projects for digitalization of checkpoints across the state border ("Digital Customs"), corporate programs for creating ITS elements related to the implementation of the concept of "mobility as a service" (MaaS) by the largest Russian digital ecosystems, transport monitoring and management of corporate fleets of "connected" vehicles, the implementation of corporate programs by natural monopolies (RZD, Gazprom) and etc.

3. Determination of the order of technical and technological priority and directions for the implementation of projects for the introduction of ITS elements as digital maturity and competencies in this area form in the Russian segment of the Barents Region, taking into account the development goals of transport and logistics systems and cross-border transportation of passengers and goods. As a basic vision of the model for the development of ITS systems, the following order of implementation of projects in this area is considered: infrastructure - software - expert systems and artificial intelligence - predictive analytics.
4. Determination of the logic and structure for the implementation of projects in the field of transport carbon footprint reduction in relation to the Russian segment of the Barents Region, including the relationship between government measures to regulate and stimulate transport carbon footprint reduction, and the economic feasibility for carriers to renew / modernize the fleet of vehicles using environmentally friendly fuels (public transport, main and industrial rail transport, water and air transport), the pace of development of the infrastructure necessary for this.
5. Detailed description of projects in the field of development of ITS and transport carbon footprint reduction and their effects.
6. Formation of substantiated recommendations, taking into account the systematic consideration and analysis of the prerequisites, goals and ways of developing ITS and transport carbon footprint reduction projects in the Barents Region, the connection with foreign projects, the possibility of linking them for the mutual socio-economic effect of the countries participating in cross-border cooperation.

Limitations on the use of research results and the date of relevance

In accordance with the schedule for the preparation of the study, the main work related to the formation of an information and analytical database and the structure of areas and project areas in the field of ITS and transport carbon footprint reduction were completed in January-February 2022 and agreed at an interim meeting with the Managing Authority (18.02.2022) before the start of the special military operation of the Armed Forces of the Russian Federation in Ukraine, launched on February 24, 2022.

Taking into account the significant change in military and political conditions in the short term, for reasons beyond the control of the Contractor, documents of international cooperation, strategic plans of the Russian Federation and the regions included in the Russian segment of the Barents Region, corporate strategies, plans for the implementation of specific projects may receive significant changes, including suspension of development certain areas of work, reduction in funding or shifting the timing of projects.

In this regard, it is advisable to consider February 23, 2022, as the date of relevance of this report and, in accordance with this date, refers to the obtained analytical results and recommendations.

Summary of the main results of the study

The study was carried out in January-February 2022 in the context of a significant change in international and domestic political and economic conditions.

The aim of the project was to identify and analyze the main directions and problems in the implementation of Russian projects for the development of ITS and ensuring the transport carbon footprint reduction and to prepare recommendations for their integration and synchronization with the plans of other states of the Barents Region.

In order to achieve the research objective, the following tasks have been implemented in this report:

- Analysis of documents of international cooperation, strategic planning of the federal, sectoral, regional, and corporate levels in relation to plans and directions, systemic logic for the development of ITS and plans for transport carbon footprint reduction, measures of state incentives for projects in these areas,
- Determination of the main technological directions and architecture of ITS development in the Russian segment of the Barents Region in relation to the modes of transport, technologies, and geography of implementation,
- Formation of a list of regional state, municipal and corporate projects for the development of ITS and plans for transport carbon footprint reduction in the Russian segment of the Barents Region, determination of their structure and current status, main technical and economic characteristics, timing, target results and their impact on the solution of strategic tasks of the development of ITS and plans for transport carbon footprint reduction in the region,
- Establishing the degree of alignment of plans for ITS and transport carbon footprint reduction with the neighboring countries of the Barents Region,
- Development of practice-oriented recommendations for the integration of Russian plans and projects for the development of ITS and the implementation of activities for the transport carbon footprint reduction into the Joint Transport Plan for the Barents Region.

For a systematic solution of the goals and objectives of the project, the following stages of the study were implemented:

1) Open-source data analysis, compiling the project's information and analytical base.

Information on the structure of strategic planning documents and regulatory and technical regulation in the field of ITS and transport carbon footprint reduction in the Russian Federation and the constituent entities of the Federation included in the Russian segment of the Barents Region has been collected. Documents on publicly available corporate strategies in the field of digitalization and sustainable development for Russian corporations with production enterprises and divisions in the Barents Region have been worked out. The analysis of documents was carried out to identify strategic priorities and the main directions of the implementation of ITS and transport carbon footprint reduction development, their compatibility with projects and plans identified in similar studies on BRTL projects, including the KO1029 project, in Sweden, Norway, Finland.

2) Preparation and coordination of the Concept of the analytical report with the Project Management Body (as part of a video conference on February 18, 2022, chaired by the project manager Jussi Huotari),
3) Verification of data on projects and plans in the field of ITS and transport carbon footprint reduction through requests to regional, local, and sectoral authorities, conducting expert interviews.

   Responses to inquiries and expert opinions were received from the Ministries of Transport of the Murmansk and Arkhangelsk Regions, the Republics of Komi and Karelia, the North-Western Territorial Administration of the Federal Agency for Railway Transport, the branch of Russian Railways Oktyabrskaya Railway, the municipal administrations of Murmansk, Syktyvkar, Petrozavodsk, Arkhangelsk, Federal State Institution Management of the St. Petersburg - Murmansk Highway of the Federal Road Agency and regional operating enterprises of the road sector.
4) Development of an analytical report in accordance with the Terms of Reference and the conclusions of the research (results in sections 1–2 of the report),
5) Development of conclusions and proposals for the integration of Russian projects into the Joint Barents Transport Plan (see section 3 of the report).

As part of the implementation of the tasks, the following main results were obtained:

1. As a result of the analysis of the regulatory framework for strategic planning, the documents in its composition were ranked according to their importance (according to the criteria for the compliance of plans with real project initiatives in the regions) and key documents were identified that determine the development of ITS and transport carbon footprint reduction in the Russian segment of the Barents Region and priority strategic directions for specified areas at the federal, regional and sectoral levels:

1) In terms of strategic directions for the development of ITS:

– *The transport strategy of the Russian Federation until 2030 with a forecast for the period up to 2035* defines such strategic directions as the introduction of integrated transport services (Mobility as a Service / MaaS, Freight-as-a-Service), digitalization of cargo flows (tracking the movement of goods, intelligent analytics of cargo flows), digitalization of vehicles (implementation of advanced driver assistance systems, unmanned vehicles), digitalization of transport infrastructure, including ITS, digital twins of transport infrastructure facilities, predictive repairs of transport infrastructure facilities, digital terminals (passenger, cargo, checkpoints across the state border of Russian Federation.
– *The federal project "System-wide measures for the development of the road sector" (until 2024), implemented within the framework of the National project "Safe high-quality roads"* defines strategic guidelines and targets across the Russian Federation in terms of solving the problems of introducing ITS in urban agglomerations of over 300 thousand people, equipping individual sections of highways and artificial structures of federal significance with elements of ITS, equipping individual sections of highways and artificial structures of regional significance with elements.
– *The federal project "Information Infrastructure" (until 2024) as part of the national program "Digital Economy of the Russian Federation"* is aimed at solving the problems of forming the concept and technical requirements for covering transport infrastructure with communication networks for data transmission systems, including GLONASS coordinate-time information, and multi-position surveillance systems, the implementation of measures

to cover priority transport infrastructure facilities with communication networks with broadband wireless data and voice transmission capabilities necessary for the development of ITS and narrow-band communication networks for collecting telemetry information built using LPWAN technology, providing coverage of federal highways with radiotelephone communications.

- *Methodological recommendations for the development of applications (including local projects for the creation and modernization of intelligent transport systems) of the constituent entities of the Russian Federation for receiving other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation in order to implement the measure "Implementation of intelligent transport systems that provide for the automation of traffic control processes in urban agglomerations, including cities with a population of more than 300,000 people"* defines the requirements for applications from the constituent entities of the Russian Federation for other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation in order to introduce ITS, and also contains recommendations for the creation, development and operation of ITS in urban agglomerations (in including priority ITS services).
- *The road sector digitalization program in the Russian Federation (until 2030)* includes activities to create the concept of a national ITS, a federal ITS network platform, implement ITS in urban agglomerations, create regional platforms and integrate them with the federal ITS platform.
- *Regional projects " System-wide measures for the development of the road sector in the Arkhangelsk Region, Murmansk Region, the Republic of Karelia, the Republic of Komi (until 2024)* are aimed at solving the problems of introducing the ITS system in the capitals of the regions, as well as individual elements of the ITS on roads of federal and regional significance (stationary cameras for photo and video recording of violations, automatic points for weight and size control of vehicles).
- *Strategies in the field of digital transformation of sectors of the economy, social sphere and public administration of the Arkhangelsk Region, Murmansk Region, the Republic of Karelia, the Republic of Komi for the period up to 2024* solve the problems of digital transformation of economic sectors, including the implementation of ITS, as well as the implementation of individual subsystems and modules. The strategies include such projects as " Digital management of the transport complex of the Russian Federation", "Digitalization for transport security", "Digital twins of transport infrastructure facilities", "Intelligent transport system, etc.

2) In terms of strategic directions for the development of the transport carbon footprint reduction:

- *Strategy for socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050* defines measures to ensure the reduction of greenhouse gas emissions by 2030 the use of new energy-efficient vehicles, the transfer of road transport to hybrid power plants, the promotion of public transport, the construction of a gas engine and electric charging infrastructure.
- *The federal project "Modernization of passenger transport in urban agglomerations" (until 2024)* is aimed at updating the fleet of vehicles in urban agglomerations (buses, trams, trolleybuses, suburban railway rolling stock).
- *Federal project "Clean Air" (until 2024)* as part of the national project "Ecology" determines the implementation of investment projects to reduce emissions into the atmosphere

from mobile sources in urban areas based on public-private partnerships - public transport, road infrastructure, fuel alternatives (in particular, measures to renew the urban electric transport fleet).

- *The sub-program "Development of the gas motor fuel market" (until 2024)*[5], developed within the framework of the State Program of the Russian Federation "Energy Development", is aimed at expanding the infrastructure of the gas filling infrastructure for compressed and liquefied natural gas, popularizing and increasing demand for natural gas vehicles, increasing the available range of natural gas vehicles.
- *The environmental strategy of JSC Russian Railways for the period up to 2017 and for the future up to 2030* has been developed to reduce emissions of harmful substances into the atmosphere from mobile sources, including greenhouse gas emissions, provides for the development and implementation of new economically and environmentally efficient power plants, locomotives using alternative diesel fuels (gas turbine locomotives, gas diesel locomotives, etc.).
- *Regional programs for gasification of housing and communal services, industrial and other organizations for 2021-2030 in the Arkhangelsk Region, the Republic of Karelia* are aimed at expanding the scope of natural gas use, including through the conversion of motor vehicles to natural gas in these regions.
- *The action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)"* is aimed at expanding the fleet of vehicles running on compressed natural gas, developing gas filling infrastructure, as well as a network of service centers in the Republic of Komi.

2. ***In accordance with the identified strategic plans, it is advisable to summarize the following as a general systemic logic for the development of ITS and transport carbon footprint reduction regarding the Russian segment of the Barents Region:***

Regarding the development of ITS

1) The Russian Federation consistently ensures a large-scale digital transformation of the transport industry and related areas of activity (communications, roads, navigation, public administration, security, customs, etc.) in order to achieve multiplication of the effects of predominantly budgetary financing of projects at the expense of the federal budget within the framework of National projects. Digitalization is a priority for all regions, they have developed appropriate strategies, including in relation to transport and logistics.
2) Digital transformation involves the development of tools that provide the accumulation and analysis of big data on traffic flows and their use to optimize the functioning of transport systems to ensure their safe and sustainable operation, reduce transaction costs and losses of road users, prioritize public transport, reduce the burden on the environment, ensure effective management of the life cycle of road infrastructure.
3) In the context of objective budgetary, technological, infrastructural, geographic and personnel constraints, the priorities in building ITS are to cover the largest urban agglomerations with a population of more than 300 thousand people (mainly the capitals of regions with suburbs) with such systems. This makes it possible to ensure the maximum return from the introduction of systems, measured in technical and economic

[5]Now, the program has been temporarily canceled and is being reformatted by the Government of the Russian Federation for the purposes of a larger implementation.

indicators, including the impact on the growth of the regional gross product, the quality of life of the population, the efficiency and safety of transportation.

4) The development of ITS in the urban agglomerations of the Russian segment of the Barents Region implies, in accordance with the architecture approved by the Ministry of Transport of the Russian Federation, the potential for transition from the creation of subsystems in functional areas (weight and dimension control, digital twins of the road network, photo and video recording of violations, etc.) to the creation of platform solutions in the region and their integration into the federal network. This potential has not yet been fully realized, including due to existing budgetary, personnel and technological constraints.
5) The architecture and standardization of ITS solutions in the Russian segment of the Barents Region allows in the future to develop interaction and data exchange between national and regional transport systems using the Datex II protocol, the use of standardized solutions based on ITS-G5 will allow the development of v2x solutions for connected cars and "smart" roads throughout the Barents Region, harmonized Glonass/eCall emergency communication systems will reduce the consequences of accidents and emergencies on transport routes. The factor inhibiting the increase in connectivity of national transport systems is the difference in frequencies of the promising 5G cellular communication standard, differences of a systemic nature will lead to limitations in the use of v2x solutions in the Barents Region.
6) State and corporate solutions are being widely implemented (including in companies with state participation, infrastructure managers)[6] in terms of industry and local ITS in the field of sea transport and railways, aviation transport, which provide digital transformation of the processes of managing the movement of vehicles and cargo and passengers, optimization of navigation, safety and speed control, traceability of traffic parameters and cargo condition. Due to the scale, these decisions form the main positive effect on the main transport corridors for the movement of goods in the East-West, North-South directions.

In terms of transport carbon footprint reduction

1) The Russian Federation, as one of the world leaders in natural gas production, sets priorities in the field of sustainable development in transport using natural gas as a source of reducing greenhouse gas emissions. Practical solutions in this area are widely presented for automobile (passenger, freight and public) transport and sea vessels, tests of railway equipment for main and industrial routes are being carried out. The development of filling stations infrastructure within the framework of regional gasification programs remains one of the key priorities of the sustainable development policy. The greatest effect for the transport carbon footprint reduction is expected from the development of the movement of LNG-powered ships along the Northern Sea Route.
2) The development of the movement of modern comfortable public transport with low floor rolling stock within the framework of the Transport Reform in the Russian

[6]Among them are FSUE "Rosmorport", JSC "Russian Railways", FSUE "State Corporation for Air Traffic Management in the Russian Federation"

Federation is being implemented in the Barents Region in accordance with the implementation of the National Goals and relevant federal projects. Modernization of the rolling stock to models with a higher environmental class and the development of a network of electric transport routes (trolleybuses) are combined with solutions in the field of ITS and transport planning focused on traffic optimization, comfortable intervals, and traffic regularity. Taken together, the logic of public transport development is focused on reducing the number of regular trips by cars and small-capacity commercial buses (route taxis) with the corresponding effect of reducing CO2 emissions and improving the quality of life of the population.

3) The development of vehicles using hydrogen fuel and electric vehicles is declared as a priority in the Russian Federation, but is limited by macroeconomic realities and sanctions, the physical and technical characteristics of fuel and batteries for such vehicles, the lack of mass production of such vehicles within the Russian Federation with a high degree of localization, as well as the lack of filling infrastructure. It is reasonable to expect the development of transport on such types of fuel after the organic passage of the cycle of modernization of equipment on gas-engine fuel and provision of infrastructure and technical conditions for the operation of equipment.
4) Development of ITS (including industry solutions) and MaaS services based on them, as well as commercial systems in the field of Fleet management (including connected vehicles with telematics sensors and other solutions) are practically built into the logic of implementing the UN sustainable development principles in the Russian segment of the Barents Region. This is done by providing through the ITS economic incentives for the population and enterprises to optimize the modes of use of various modes of transport to reduce transport costs, fuel consumption and travel time, the cooperative use of vehicles, and the wider use of public transport.

3. Based on a set of strategic plans of an international, federal, regional, and sectoral nature, a database of target results was formed (see section 1.2).

4. Technological directions for the development of ITS and transport carbon footprint reduction in the Barents Region and the effects of project implementation

As general technological trends in the digital transformation of all modes of transport in the Russian segment of the Barents Region, it is worth noting:

- The introduction of multimodal passenger transportation, the introduction of a single ticket for all modes of transport,
- Equipping freight transport with on-board devices to optimize traffic flows,
- Digital solutions in the field of "Big Data", including forecasting the intensity of traffic flows, as well as digital solutions in the field of video analytics, including video analytics in public passenger transport,
- Connecting the vehicle to communication systems at any point of the road infrastructure,
- Digital monitoring of infrastructure condition,
- Digitalization of cross-border logistics,

– Information security system. An important issue for the development of ITS for all modes of transport is the high level of vulnerability of the information and telecommunications infrastructure. A ban has been introduced on the use of foreign software by state-owned companies and critical infrastructure facilities.

Based on the trends in the digital transformation of transport, the main design technological directions for the development of ITS and related (interrelated) industries that are currently being implemented or planned for implementation have been identified. A summary database of projects in the Russian segment of the Barents Region is presented in Section 2.1.

The implementation of the main design technological areas in terms of ITS is being implemented in accordance with the Order of the Ministry of Transport of the Russian Federation of March 25, 2020, No. AK-60-r approved by the Unified transport system management platform, which is a modular system for collecting and analyzing traffic flows in real time with the possibility of visualization and decision support. The Unified transport system management platform provides for the collection and analysis of data from the intelligent transport system of the urban agglomeration coming from all internal subsystems and external information systems (sources) such as: administrative and technical inspections of the urban agglomeration, traffic police, road services, taxis, carsharing, etc. In fact, the Unified transport system management platform defines the architecture of ITS, which are currently being implemented in the urban agglomerations of the Russian segment of the Barents Region.

From the point of view of implementing the structure of project technology areas in ITS and related areas, it is concentrated around the following basic functional blocks as part of the Unified transport system management platform, which form the basis of local ITS in the largest cities (regional capitals) of the Russian segment of the Barents Region, see the figure below. On certain sections of federal highways (P21 Kola, etc.) and in cities, they are also supplemented by weather information systems, which are important for ensuring traffic safety and road operation, and solutions for digital twins of road infrastructure.

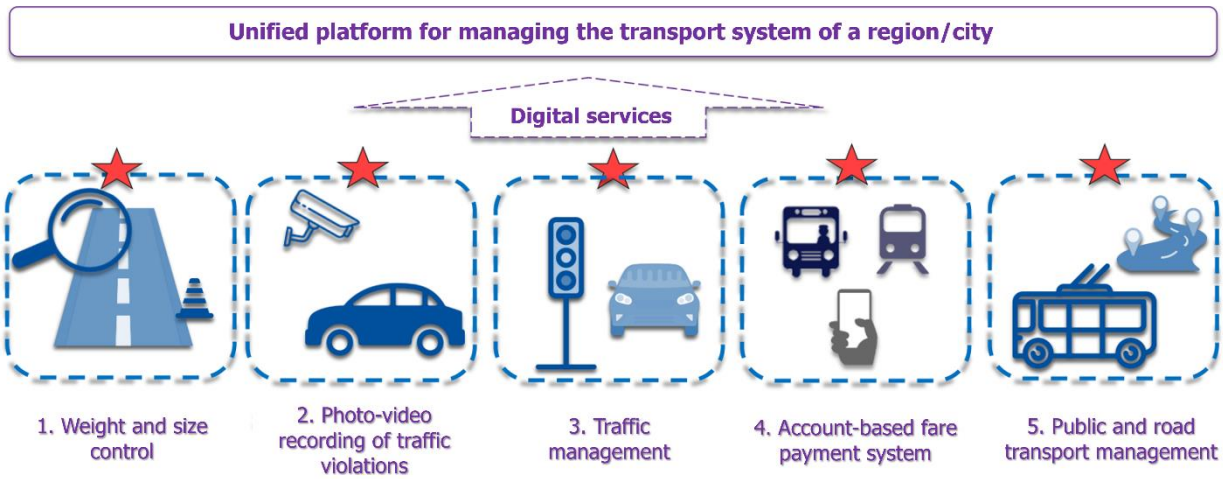

Figure 1. Main functional blocks of ITS integrating technological solutions

The sequence of implementation of the main technological solutions in the field of ITS in the Russian segment of the Barents Region, as well as the possibility of predicting further trends in the development of technologies in this area, is determined by the stages of implementation of

ITS based on the Unified transport system management platform architecture within the framework of local projects[7], see the figure below.

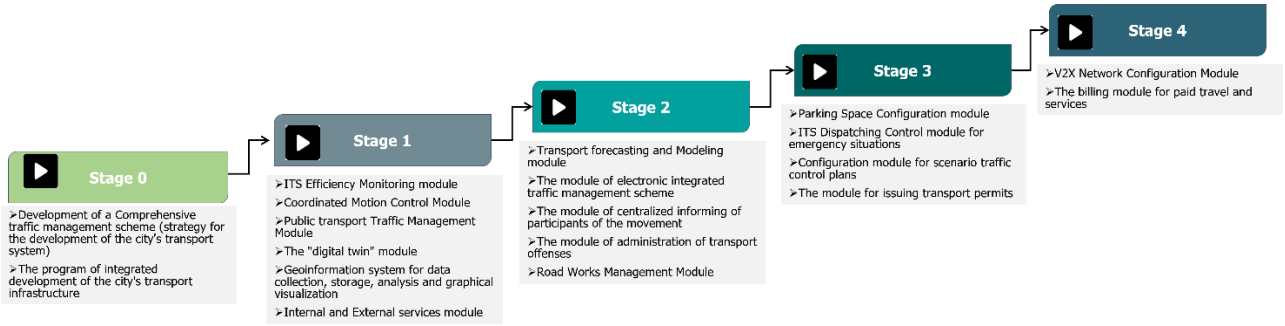

Figure 2. Typical stages of ITS implementation in urban agglomerations in the Russian segment of the Barents Region

When assessing the level of implementation of specific technologies related to ITS (and related areas) in the Russian segment of the Barents Region, it is advisable to take into account the progress achieved as of 1 quarter. 2022, the level of technological maturity of ITS systems in them (as of the implementation of modules and subsystems in accordance with the requirements for the architecture of such systems approved by the Ministry of Transport of the Russian Federation). The figure below shows an expert assessment of the level of technological maturity.

Figure 3. Assessment of the technological maturity of local ITS systems in the Russian segment of the Barents Region per 1 sq. 2022

The main technological directions for the development of ITS as part of the implementation of the Unified Platform for Transport System Management in the largest urban agglomerations of the Russian segment of the Barents Region (Murmansk, Arkhangelsk, Petrozavodsk, Syktyvkar):

1) Automated traffic control on a single modular platform, including "smart" traffic lights and traffic control, implementation of the "digital twin" module of the agglomeration's street and road network.

[7]According to the developments of Transflow, http://www.transflow.ru/eputs

2) Implementation of modules for the administration of transport offenses (video recording of traffic violations, weight, and size control).
3) Implementation of ITS dispatch control modules for emergencies.
4) Implementation of solutions for traffic management and improving the efficiency of public transport.
5) Implementation of road works management modules on the road network of agglomerations.
6) Implementation of modules for centralized informing of traffic participants (weather information, blocked traffic, etc.).
7) Implementation of MaaS systems (mobility as a service), including by exporting data from ITS to commercial ecosystems (MaaS solutions Yandex.Go) and government information systems and user applications (planning trips by public transport, etc.).
8) Pilot implementation of V2X system modules based on regional road infrastructure.
9) Pilot implementation of modules of cyber-physical systems in transport (IoT).

In related transport sectors, state-owned enterprises (JSC Russian Railways, FSUE ATM Corporation, Federal Customs Service, FSUE Rosmorport) are actively developing industry solutions related to the digital transformation of transport and foreign economic activity, affecting the quality, speed, transparency, and traceability of cross-border transportation of passengers and goods:

- Digitalization of the passage of transport through checkpoints across the state border,
- Digital transformation of rail transportation (IoT, collection and processing of telematic data on vehicles and cargo, electronic seals, etc.),
- Development of new technological solutions to improve the efficiency of air traffic control at airports in the Barents Region (Murmansk, Arkhangelsk, Syktyvkar, Petrozavodsk) based on wide-area multi-position surveillance systems,
- On-site ITS in Russian ports and on the routes of the Northern Sea Route to manage the safe movement of ships, control ice conditions, including using UAVs,
- Collection of big data on telematics of motor vehicles within the framework of the state system (Avtodata platform based on Era-Glonass),
- Trial operation on public roads of highly automated vehicles (unmanned taxis) in the Barents Region (Murmansk Region),
- Pilot operation of unmanned sea vessels (Murmansk Region),
- Development of eCall emergency communication systems based on Glonass,
- Improvement of coverage by mobile communication networks of the federal and regional road network.

According to the indicated technological directions of ITS development in the territory of the Russian segment of the Barents Region, 106 projects were identified at various stages of implementation (pre-project work, investment stage or implementation of software and hardware systems, trial and full operation). Their description is given in section 2.1 of the report.

The main effects from the implementation of ITS development projects and projects for the digitalization of transport and related industries are the optimization of vehicle traffic, achieving a balance between the capacity of the road network and the actual load on the existing infrastructure, improving comfort for road users and improving safety.

Specific examples of ITS impact outcomes are:

- Reducing travel delays and increasing the average speed of vehicles, reducing fuel consumption - the results that affect the increase in traffic and the optimization of traffic;
- Reducing the mass of emissions of harmful substances is a result that affects the quality of life of society as a whole;
- Reducing the number of accidents and the time of their liquidation - the results that affect the increase in traffic and improve safety;
- A decrease in the zone of increased wear of road surfaces is a result that affects the road infrastructure.
- Provision of commercial services and data in the field of transport (MaaS , etc.) is a result that affects the optimization of transportation.

In the Barents Region of the Russian Federation, a greater number of ITS development projects are aimed at optimizing road transport. The projects implemented by ITS for-road transport are at the regional level, and each region implements projects independently. ITS development projects for railway, water and air transport are mainly implemented at the federal level

Russian complex projects in the field of ITS development are currently still at the stage of implementation. Basically, only individual modules and subsystems of ITS are in operation, the current state of ITS can be characterized as a "fragmentary" implementation. Linking regional systems into a single whole is a matter of the future. Systems in urban agglomerations have predominantly a basic level of technological maturity (Petrozavodsk, Arkhangelsk, Syktyvkar) or an initial level (Naryan-Mar). A relatively mature ITS operates in Murmansk. The effectiveness of the implementation of ITS at the current moment cannot be assessed, it is possible to evaluate the effectiveness of only disparate working modules and subsystems (individual results are given above for the blocks of communication between ITS development tasks and projects).

Also, on the basis of open sources and data provided by the regional authorities, the structure of key project technological areas for the Russian segment of the Barents Region in the field of transport carbon footprint reduction was formed:

1) Development of the use of new types of fuel with a reduced level of CO2 emissions and the corresponding filling infrastructure (public, freight, municipal vehicles, sea transport - primarily Murmansk, Syktyvkar),
2) Modernization of the rolling stock fleet of carriers of urban and intermunicipal passenger transport and the transition to modern technology with an environmental class of at least Euro-5 (primarily in urban agglomerations - Murmansk, Syktyvkar, Arkhangelsk, Petrozavodsk),
3) Development of urban surface electric transport, expansion of the route network, modernization of rolling stock (trolleybuses, including those with autonomous running in Petrozavodsk and Murmansk),
4) Switching to the use of low-sulfur diesel fuel for marine vessels (and abandoning marine fuel oil), taking into account Russian and international standards, IMO requirements, etc.,
5) Development of public electric transport in Murmansk and Petrozavodsk, purchase of new modern rolling stock, expansion, and optimization of the route network,
6) Improving the efficiency of transportation and reducing the carbon footprint using telematic data collection and processing services for freight and passenger road transport (solutions based on Glonass and other vendors),

7) Development of filling infrastructure for gas motor fuel (CNG and LNG) for road transport, development of bunkering of LNG ships, as well as filling stations for electric vehicles,
8) Development of small tonnage LNG production, including for the purpose of delivery in the form of fuel for transport.

48 projects at various stages of implementation (pre-project work, investment stage, trial and full operation of technical means and solutions or implementation of measures) were identified in the specified technological areas of the transport carbon footprint reduction in the territory of the Russian segment of the Barents Region. Their description is given in section 2.1 of the report.

The main effects from the implementation of projects in the field of reducing the carbon footprint in the Russian segment are primarily associated with the transfer of vehicles (road, sea and, in the future, railway transport) to new types of more environmentally friendly fuels with lower CO2 emissions (gas motor fuel, low-sulfur marine fuel), development of refueling and bunkering infrastructure and production of natural gas motor fuel. Related to ITS is the implementation of projects and obtaining effects from them related to the optimization of the operation and regularity of public transport in the largest agglomerations (using ITS subsystems), as well as the use of modern comfortable rolling stock on the lines, which increases its attractiveness compared to the use of personal road transport.

The replacement of obsolete vehicles is carried out in accordance with the Federal project "Modernization of passenger transport in urban agglomerations", and the transition to gas motor fuel is carried out in accordance with the State subprogram "Development of the gas motor fuel market".

The largest number of passenger buses are operated in the Arkhangelsk Region and the Republic of Komi, 5,7 thousand units each, and the smallest in the Murmansk Region – 3,0 thousand units. Modern buses (with Euro-5 environmental class) for the period 2019-2021 most of all were purchased in the Republic of Komi - a little less than 150 units, and the least - in the Republic of Karelia - less than 30 units.

The number of passenger buses using natural gas fuel in the Barents Region of the Russian Federation in the period 2019–2021 according to Rosstat is a little over 400[8]. The largest number of passenger buses running on gas motor fuel are operated in the Arkhangelsk Region more than 300 units, and such buses are not operated in the Republic of Karelia.

The maximum reduction in emissions during the transition to the Euro-5 environmental class was revealed in the Murmansk Region and the Republic of Komi, and the maximum reduction in the transition to gas motor fuel was in the Arkhangelsk Region.

As a result, in fact for 2021, the transport carbon footprint reduction is:

- 9,7 tons per year or 0,9% of the emissions of all operated buses upon transition to the Euro-5 class;
- 9,1 tons per year or 0,8% of the emissions of all buses in operation when switching to natural gas.

At the same time, up to 2024 inclusive, the Barents Region announced the purchase of another 175 modern buses with the Euro-5 environmental class (80 in the Murmansk Region, 50 in the Arkhangelsk Region and 45 in the Republic of Komi). Also during this period in the Arkhangelsk Region, they plan to purchase 200 buses running on natural gas fuel.

The planned result for the transport carbon footprint reduction until 2024 inclusive will be:

[8] Rosstat website. https://www.gks.ru/free_doc/new_site/business/trans-sv/trans_gaz.htm

- 5 tons per year or 0,4% of the emissions of all buses in operation when some buses switch to the Euro-5 class;
- 6 tons per year or 0,5% of the emissions of all buses in operation when some buses switch to natural gas.

The pace of transport carbon footprint reduction processes in public transport needs to be accelerated, and the scale of the conversion of vehicles to natural gas fuel is insufficient to have a serious effect on CO2 emissions in the region.

In accordance with the announced and ongoing projects for the development of LNG vessel traffic on the Northern Sea Route (in order to export LNG from the fields of the Yamalo-Nenets Autonomous District), an important project area for transport carbon footprint reduction is the construction of new LNG vessels with the support of the Government of the Russian Federation. Taking into account the announced plans for the construction and movement of 15 new LNG carriers in the Barents Region, the planned results should be a final transport carbon footprint reduction of 237 thousand tons per year.

Comparable importance for the transport carbon footprint reduction can be obtained by decisions on the conversion of railway locomotives to natural gas motor fuel. Given the current dynamics of this process, the results of such activities are expected no earlier than 2030.

Impact of project implementation on the connectivity of national transport systems

The ITS projects being implemented in the Russian segment of the Barents Region are consistently building up potential and new opportunities for the development of cross-border passenger and cargo traffic. The already formed architecture of the ITS makes it possible to exchange data between the systems of border countries and regions according to a single standard. New services are being formed for carriers and travelers, requiring agreements on language and information integration.

Maximum opportunities are being developed in terms of cargo logistics, where large-scale solutions for digital transformation are being implemented, as well as the use of new types of fuel (LNG) by system operators of the transportation and fuel market (JSC Russian Railways, Novatek, Rusatom Cargo, etc.).

At the same time, a number of areas require a systemic solution for the countries of the Barents Region to increase the connectivity of national transport systems and increase the flow of cross-border traffic. They concern:

- 5G communication networks that ensure the operation of ITS modules as part of the management of intermodal transport complexes,
- intensification of the development of connectivity of local projects for the development of ITS in the Russian Federation and further with the countries of the Barents Region in terms of the exchange of key data for organizing trips (meteorological information, the state of the road infrastructure, road congestion, the availability of rest points for drivers, etc.),
- achieving synchronization of policies in the field of ensuring refueling of environmentally friendly modes of transport (electric vehicles, vehicles running on gas motor fuel),
- implementation of multilingual applications within the framework of the MaaS concept for private and commercial users, including on the basis of data exchange between the ITS of the Barents Region,
- refinement of current local ITS projects in the Russian Federation to a mature technological level with their connection to a single platform for managing the transport system.

5. Measures to encourage sustainable development practices in transport

The main measures to stimulate sustainable development practices in transport in the Russian Federation, including the use of vehicles with a reduced carbon footprint, include:

Financial, economic and tax measures:

1) Subsidizing.
- Construction and development of gas filling infrastructure (CNG filling stations, cryo filling stations),
- Compensation for the costs of businesses and citizens for the conversion of vehicles to gas motor fuel,
- Compensation to manufacturers of equipment running on gas motor fuel in the amount of the discount provided to the buyer,
- Targeted subsidies for individual projects (construction of LNG-powered ships),
- Financing of R&D for the creation of competitive Russian equipment and some types of transport on hydrogen fuel,
- Measures to support industrial clusters (cost compensation) for the created test sites and clusters for testing hydrogen energy technologies.

2) Financing of activities for the renewal of rolling stock
- Procurement and re-equipment of public transport,
- Preferential leasing programs for water, air, railway transport,
- Distribution of the program of preferential car loans for electric vehicles,
- Utilization grant for water transport.

3) Financing measures to improve and develop transport infrastructure
- Financing the development of programs for the development of transport infrastructure, integrated schemes of organization,
- traffic and planning documents for the regular transportation of passengers and luggage,
- Reconstruction of roads and street roads at the expense of the budget and on the basis of PPP (as a condition for the proper operation of the vehicle),
- Financing the creation of environmentally friendly (non-motorized) transport infrastructure.

4) Benefits for taxes and fees
- Vehicle tax exemption for electric vehicles (selected regions)

Among the promising measures that are appropriate for implementation and tested outside the Barents Region are the reduction of transport tax rates in relation to gas-powered transport and discounts on port fees for LNG vessels.

5) Subsidizing passenger transportation by public transport (as a pricing policy measure to increase the availability of passenger transport for the population, resulting in a decrease in the use of personal transport)

6) Development and implementation of ITS at the expense of the budget.

Non-financial and administrative measures:

- Amendments to legal acts, regulations,

- Reduction of administrative barriers in the implementation of investment projects for the construction of facilities to produce environmentally friendly fuels and refueling infrastructure,
- Formation of a request and a state order for R&D and creation of conditions for the introduction of the best available technologies,
- Informing the population and promoting environmentally friendly approaches to transport.

6. List of problems and constraints on the implementation of projects in the field of ITS

As part of the analysis of data sources on the implementation of Russian projects in the field of ITS and transport carbon footprint reduction, including data from open sources, the results of inquiries and interviews with representatives of the executive authorities of the Russian regions (within the Barents region), data from departmental reports, the main climatic, technical, economic, political, and social constraints, and barriers to project implementation.

The identified limitations and barriers to the implementation of projects in the field of ITS and transport carbon footprint reduction are both opportunistic and systemic in nature, determining the nature of their impact on projects, opportunities, timing, financial and technical and economic parameters of their implementation.

List of problems and constraints on the implementation of projects in the field of ITS

System constraints and barriers

1) Geographical and demographic constraints

- A combination of climatic factors affects:

- the increase in the cost and timing of the implementation of complex projects for the development of ITS infrastructure due to the short construction season
- the increase in the cost of equipment and operating costs for the operation of ITS subsystems due to increased operational requirements for equipment in terms of climate conditions and the higher cost of such equipment and a more frequent need for maintenance and repair

- The system of resettlement and placement of productive forces in the Russian segment of the Barents Region is characterized by low population density outside the capitals of the regions and a large length of transport communications between urban agglomerations, large industrial and mining facilities, and border checkpoints:

- the increase in the cost of ITS development projects outside urban agglomerations due to the need to use a large amount of equipment and the construction and operation of extended engineering networks to ensure the operation of devices and data exchange (communications, electric power industry)
- difficulties with maintenance of elements of ITS subsystems outside settlements (on federal highways) and an increase in operating costs
- non-compliance of most agglomerations of the Russian segment of the Barents Region with the requirements of the National project "Safe high-quality roads" in terms of population - more than 300 thousand people. This creates constraints on the speed, consistency and quality of the implementation of the Unified transport system management platform subsystems, since regional and local budgets are limited in their capabilities without federal co-financing of projects

2) Disadvantages of the public procurement system

Federal Law N 44-FZ "On the contract system ...":

- makes it difficult to purchase technical equipment and system integration services as part of the development, implementation, and commissioning of ITS as a single lot
- limits the implementation of projects due to the peculiarities of customers making decisions on the volume of advance payments for projects, including in the context of volatility in exchange rates and growth in lending rates for businesses

3) Budget constraints on the implementation of ITS projects

4) Dependence of project implementation on foreign components

It creates risks of project implementation due to the volatility of the ruble exchange rate against major world currencies, disruption of logistics chains, shortage of electronic components due to the pandemic, sanctions constraints

5) Shortcomings of the regulatory and methodological framework for the implementation of projects in the field of ITS

Insufficiently developed and formalized regulatory and methodological framework for the creation and operation of ITS causes non-systematic (fragmentary) implementation of ITS elements in the regions without ensuring data integration, systemic linking of functional blocks and ensuring cross-cutting tasks of traffic safety and efficiency.

It is required to develop a legal framework and regulations that define:

– the concept of digital road infrastructure,
– mandatory requirements for equipping roads with digital infrastructure and its functionality,
– unity of requirements, interaction protocols and physical connectivity of digital infrastructure,
– the order of interactions in the creation and use of digital infrastructure,
– property relations,
– financing arrangements,
– expansion of the list of concession facilities.

6) Staffing of ITS creation and operation projects

Due to the long-term outflow of young people and highly qualified personnel from the Barents Region to the largest megacities of the Russian Federation, due to the great competition for personnel in the IT services market from large commercial ecosystems and system integrators, the transport digitalization industry in the public sector is characterized by insufficient provision of highly qualified personnel in the field of ITS, affecting the quality of project implementation, the efficiency of ITS operation, as a study of regulatory and technical solutions

7) Frequency regulation of 5G communication systems and differences in the used ranges in the Barents Region

The 4,8-4,9 GHz frequency bands formed for testing 5G networks (as well as other spectra - millimeter-wave frequencies 24,25-24,65 GHz, 694-790 MHz band) do not correspond to world practice, reduce the efficiency of solutions, do not have developed ecosystem of equipment, and have technical constraints on use.

The use of different frequency bands for 5G communication systems will create difficulties in the interaction of equipment during the cross-border movement of passengers and goods.

Market constraints and barriers

1) Problems of the distribution of powers of state executive bodies and local authorities in the implementation of projects for the creation and operation of ITS
2) Imbalances in the global electronics market as a consequence of the Covid-19 pandemic and constraints on the supply of ITS components
3) Due to the Covid -19 pandemic and the emerging imbalance of supply and demand for electronic components, conditions have arisen to limit the supply and a significant increase in the cost of such components and equipment based on them used in the construction of ITS infrastructure
4) Constraints on the supply of certain types of equipment to the Russian Federation, constraints on settlements that affect the achievement of new levels of ITS maturity (sanctions)
5) Technical and technological problems of implementing projects for the creation and development of ITS

– Incompleteness of integration of ITS subsystems into a single system within the framework of the approved Unified transport system management platform architecture, lack of a single functioning traffic control center; lack of a unified information exchange system between functional subsystems
– Low coverage of urban agglomerations by existing ITS elements
– The use of inefficient outdated technologies of traffic light regulation
– Current failures of legacy infrastructure causing frequent failure of coordinating equipment
– Lack of integration of the ITS of the urban agglomeration with the ITS of adjacent other highways (federal highways)

6) Constraints on ITS interactions in the border areas of the Barents Region

Suspension in 2022 of cross-border cooperation projects, joint work of international groups on the harmonization of standards in the field of ITS will affect the formation of opportunities for organizing data exchange between ITS systems in the border areas of the Russian Federation, Norway, Finland, and Sweden according to the Datex standard II and others to ensure the safe and efficient movement of passengers and goods along the East-West transport corridor

List of problems and constraints on the implementation of projects in the field of transport carbon footprint reduction

System constraints and barriers

1) Infrastructural constraints

Insufficient level of gasification of the regions of the Russian segment of the Barents Region (primarily the Murmansk and Arkhangelsk Regions) and the absence of these regions among the priorities for the implementation of programs for the use of gas motor fuel

2) Geographic constraints

– Constraint on the use of battery-powered electric vehicles due to their faster discharge rate and low efficiency (compared to traditional internal combustion engines) during the cold season and the insecurity of use outside of settlements in low temperatures
– The system of settlement and placement of productive forces in the Russian segment of the Barents Region is characterized by a low population density outside the

capitals of the regions and a large length of transport communications between urban agglomerations, large industrial and mining facilities and border checkpoints, which determines the increase in the cost of projects for the development of a network of fuel stations with a low carbon footprint (primarily, gas engine fuel and electricity) outside major cities due to the need to build a large number of new facilities at a distance from cities and difficulties with ensuring fuel supplies

3) Staffing for transport carbon footprint reduction projects

Due to the long-term outflow of young people and highly qualified personnel from the Barents Region to the largest megacities of the Russian Federation (St. Petersburg and Moscow), due to higher wages and quality of life, projects in the field of sustainable development and transport carbon footprint reduction are experiencing an insufficient supply of local highly qualified personnel

4) Insufficient amount of federal subsidies to cover the difference between the cost of natural gas and diesel vehicles

In some cases, the volume of subsidies, taking into account the decrease in recent years, does not cover the difference in cost between similar CNG and diesel models and leads to the purchase of cheaper diesel-powered vehicles by transport companies

5) Budget constraints at the regional and local level on the modernization of equipment and the transition to a higher environmental class
6) Low competition in the gas engine fuel supply market

Low competition in the gas engine fuel supply market does not provide competitive pricing, creates serious economic risks of fuel cost growth and loss of economic effect for organizations and individuals from the operation of gas-powered automotive, marine and railway equipment.

Market constraints and barriers

1) Changes in the supply structure and payment system for natural gas and oil/petroleum products in Europe in 2022

If they remain for a long period, they can lead to a significant change in raw material flows, a decrease in hydrocarbon production in the Russian Federation and a shift in the timing of the implementation of projects related to the development of LNG production, the construction of large-tonnage LNG-powered vessels, the production of green hydrogen, the development of refueling infrastructure for electric vehicles, while maintaining the level consumption of traditional automotive fuels, minimizing incentives to switch to new environmentally friendly fuels

2) Limited opportunities for the production and supply of electric and gas-powered vehicles in the Russian Federation

Due to the disruption of the supply chains of high-tech components, plans for the production in the Russian Federation and delivery to the Regions of the Russian segment of the Barents Region of new gas-powered buses and trolleybuses (including autonomous running) for the modernization of public transport rolling stock may be postponed or disrupted, projects for the production of new models of passenger electric vehicles for private consumers and use in car-sharing services and taxis (commercial MaaS). Price increase - at least 35-40%

3) Departure from the Russian market of key foreign suppliers of equipment and software for the transport sector

The withdrawal of a number of large technology vendors from the market, including Gurtam (the owner of the Wialon platform , the leader in the supply of satellite monitoring systems

for rolling stock) and the withdrawal of leading suppliers of software and hardware solutions for ship and aviation navigation from the Russian market will lead to the diversion of resources of transport companies from the topic of sustainable development and the use of solutions with the lowest possible technological maturity in the face of a shortage of financial resources

4) Imbalances in the transport carbon footprint reduction measures for the transition to the use of new fuels with a low carbon footprint

A number of imbalances associated with the advanced development of the infrastructure of gas stations for gas-fueled cars at their low load requires the expansion of subsidies to increase the fleet of vehicles at the GMT. The development of GMT consumption (including bunkering/ equipment infrastructure) on the railway network and in sea/river ports is not adequately ensured due to the lack of appropriate vehicles (JSC Russian Railways only conducts tests of equipment) or their minimum number (sea transportation), while these types of transport can provide significant reduction of greenhouse gas emissions in absolute terms during the transition to GMT

7. . Assessment of the level of consistency of strategic planning documents with the plans of the neighboring countries of the Barents Region

The comprehensive analysis and comparison of the planned documents showed that the goal of developing the universal economic system of Russia, Norway, Finland, Sweden is generally similar, and especially in strategic approaches and development priorities. First of all, the strategic targets of the countries of the Barents Region include such factors as:

- Ensuring economic growth and social development of countries (including regional development) through the national transport system;
- Ensuring the safety of road users;
- Improving mobility and transport accessibility;
- Digitalization of the transport industry;
- Ensuring the carbon footprint reduction and the harmful impact of transport on the climate.

There are several factors that determine the inconsistency in the development of ITS in the Nordic countries (Norway, Sweden, Finland) and in Russia:

- The development of Russian ITS is mainly focused on the installation of systems in large agglomerations, while in the Nordic countries ITS is being developed not only in agglomerations and rural settlements, but also on main roads (See the structure of projects in Table 30). This vector of development of Russian ITS is determined by the settlement system and the concentration of the population of the Russian Federation in large cities, budgetary and infrastructural constraints. Thus, by 2024, according to the Federal project "Public measures for the development of the road sector", it is planned to introduce integral ITS systems in 64 urban agglomerations with over 300 thousand people. It is planned to introduce ITS elements on federal roads (120 sections) (an increase in the number of stationary cameras for photo and video recording of traffic violations), and on regional roads (60 sections) it is also planned to introduce individual elements of ITS (photo and video recording cameras for traffic violations, automatic points of weight and size control of vehicles). On main roads (highways of federal significance), the introduction of integrated ITS systems is carried out on the most significant metropolitan structures (such as the Central Ring Road, the M11 Moscow - St. Petersburg highway), whereas in the regions of the Barents Region on roads of federal

and regional significance, as already noted above, it is planned to implement individual elements of ITS.

- Increased attention from the Nordic countries (Norway, Sweden, Finland) to the development of ITS in ensuring traffic safety on roads in winter conditions and on difficult road sections (See the structure of projects in Table 30). The Barents Region and its transport network is in the Far North, which creates significant problems for traffic. On some routes of the northern regions, the problem of closing roads during snowstorms and snowfalls is significant. Norway has some of the longest tunnels in the world in mountainous terrain, and there are narrow stretches of road where it is difficult for oncoming heavy vehicles to pass. The use of ITS contributes to the optimization of traffic, increasing its reliability and safety in any conditions. At the same time, much less attention has been paid to this area in the development of Russian ITS.

As part of environmental policy (including transport carbon footprint reduction), all the countries of the Barents Region, including Russia, have ratified the Paris Climate Agreement (2015).

Norway, Sweden, and Finland have broadly similar strategies in place to achieve emission reduction targets in the transport sector. At the same time, these countries have various incentive mechanisms to reduce travel needs, switch modes of transport, increase the use of environmentally friendly vehicles and renewable fuels:

- In Norway, the climate goal is to reduce greenhouse gases by at least 50% and up to 55% by 2030 compared to 1990 levels[9]. To achieve this goal in the transport sector, it is assumed[10]:
- gradual replacement of personal vehicles, trucks and buses with zero-emission vehicles. For example, by 2025, all new passenger car sales must be zero-emissions. First of all, the emphasis is on the distribution of electric vehicles, for which tax incentives are provided;
- reducing the need for transport use and ensuring the transition to more environmentally friendly modes of transport (increased use of environmentally friendly public transport, walking and cycling);
- a significant increase in freight traffic by rail and sea transport due to a decrease in road transport (by 2030, at least 30% of road transport at distances over 300 km should be transferred to rail transport and sea transport);
- expanding the use of biofuels. The admixture of biofuels to petrol and diesel sold in Norway is mandatory.
- In Sweden, the climate goal is to reduce greenhouse gases by 2030 to at least 63% lower than emissions in 199011. To achieve this goal in the transport sector, it is assumed[12]:

[9]https://www.regjeringen.no/no/tema/klima-og-miljo/innsiktsartikler-klima-miljo/klimaendringer-og-norsk-klimapolitikk/id2636812/

[10]Eco-friendly transport in the Barents Region. Report 03/27/2020

[11]https://www.regeringen.se/artiklar/2017/06/det-klimatpolitiska-ramverket/

[12]Eco-friendly transport in the Barents Region. Report 03/27/2020

- transition to environmentally friendly and energy efficient vehicles. To do this, economic incentives are used to accelerate the transition to more environmentally friendly vehicles. In particular, a system of bonuses is provided for the purchase of electric and hydrogen fuel vehicles (60,000 kronor) and natural gas vehicles (10,000 kronor);
- increase in the share of transportation by rail and sea. This is facilitated by a number of measures aimed at increasing the competitiveness of rail and sea transport;
- moving towards a society with more public transport, walking and cycling;
- promotion of renewable fuels. Sweden has programs to support renewable fuels. The Climate Change Program (Klimatklivet)[13] aims to support investment in innovative technologies to reduce greenhouse gas emissions. Another program "Charging the car" (Ladad bilen)[14] aims to support investments in the development of vehicle charging infrastructure. In addition, in Sweden the addition of biodiesel to gasoline and diesel sold is mandatory.

- In Finland, the climate goal is to achieve carbon neutrality by 2035. For the transport sector, the goal is to reduce emissions by 50% by 2030 compared to 2005 levels. To achieve this goal in the transport sector, it is assumed[15]:
  - improving the energy efficiency of the transport system. The main tool to achieve this goal is mobility as a service (MaaS) with the aim of reducing the number of car trips alone. It is planned to create conditions for walking, cycling and public transport;
  - improving the energy efficiency of vehicles. The emphasis is on accelerating the pace of renewal of the vehicle fleet, increasing electric vehicles;
  - replacing oil-based fossil fuels with renewable and/or low-emission fuel alternatives. The addition of biofuels to refuel vehicles is one of the measures to replace oil-based fossil fuels. The goal is that in 2030, 30% of all fuels sold will be energy from biofuels. Also, much attention is paid to the construction of filling infrastructure (gas and hydrogen stations and chargers for electric vehicles). The transition to environmentally friendly vehicles should be based largely on market conditions. Despite this, there are also economic incentives in Finland to switch to environmentally friendly vehicles.

In Russia, in accordance with the Decree of the President of the Russian Federation "On the reduction of greenhouse gas emissions" as part of the implementation of the Paris Climate Agreement (dated December 12, 2015), it is planned to reduce greenhouse gas emissions by 70% by 2030 compared to the 1990 level, taking into account the maximum possible absorption capacity of forests and other ecosystems and subject to sustainable and balanced socio-economic development of the Russian Federation. In pursuance of the Decree of the President of the Russian Federation, a Strategy was developed for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050. For its implementation in the transport sector it is expected:

[13]https://www.naturvardsverket.se/bidrag/klimatklivet/
[14]https://www.naturvardsverket.se/bidrag/ladda-bilen/
[15]Eco-friendly transport in the Barents region. Report 03/27/2020

- the use of new energy-efficient vehicles, large-scale electrification and gasification of public transport, the transfer of road transport to hybrid power plants, stimulating the use of public transport;
- construction of gas engine and electric charging infrastructure for various categories of transport;
- introduction of new transport and information technologies for control and positioning, development, and implementation of intelligent information systems for monitoring and control in transport. (For more details, see paragraph 1.1.).

In order to reduce greenhouse gas emissions in the transport sector of the Russian Federation, road transport is considered a priority through the use of alternative fuels, namely liquefied natural gas, batteries, hydrogen fuel and fuel cells. At the same time, the greatest attention is paid to the expansion of the use of natural gas vehicles, which is confirmed both by the analysis of strategic planning documents and by the actual practice of implementing regional projects. The expansion of the use of electric transport is expected mainly in the field of urban public rather than personal transport. For a significant expansion of the use of electric vehicles in the Russian Federation, there are currently significant limitations in the form of an underdeveloped production of electric vehicles and an underdeveloped charging infrastructure. This is one of the key differences from the environmental policy in the transport sector of the Nordic countries (Norway, Sweden, Finland), in which more emphasis is placed on the widespread use of electric vehicles, as well as a significant reduction in freight transport by road transport towards an increase in rail and sea transport to reduce greenhouse gas emissions.

8. Development of recommendations for the Joint Transport Plan for the Barents Region

Based on the experience of implementing projects in the field of transport, identified relevant technological directions for the development of ITS and transport carbon footprint reduction in the Russian segment of the Barents Region, and taking into account the possible directions for the development of trade, industrial and social ties, the development of tourist routes in the East-West direction, it is advisable to recommend the following projects and plans for integration into the Joint Transport Plan for the Barents Region:

1) Developing the connectivity of national transport systems and improving the safety and convenience of "seamless" cross-border trips and cargo transportation by organizing data exchange between ITS and ensuring better awareness of traffic participants about the traffic situation based on the Datex protocol II, including data export to government and commercial online services of local and international providers for use in MaaS solutions and logistics services.
2) The development of macro-regional MaaS solutions in the Barents Region for a wide range of users by supplementing local or national MaaS solutions with full information about the traffic situation and its forecast on all major roads in the Barents Region (within the framework of data exchange between local ITS) will allow implementing MaaS solutions (services in native language) the possibility of providing services for routing, planning trips, choosing cross-border transport services for organizing transportation, convenient use of public transport in neighboring countries, finding gas stations, incl. on environmentally friendly types of fuel (electricity, gas motor fuel, hydrogen, etc.).

3) Thus, the technological maturity of the transport system of the region will grow, new opportunities will be created for creating new types and directions of transport services (including carsharing, cargo delivery, taxis, transfers, etc.), the organization of the multimodal movement of passengers and goods across the region will be simplified, with new markets and audiences for national online services and ecosystems in the field of transport (transport services + fintech + local services + navigation).
4) Harmonization of frequency bands in the field of cellular communications of the 5G standard and standards for V2X solutions
5) The development of V2X solutions within the framework of ITS, including for ensuring the interaction of vehicles on the road with each other (Vehicle-to-Vehicle) and the interaction of vehicles with road infrastructure facilities (Vehicle-to-Infrastructure), is among the strategic plans and projects implemented throughout the Barents Region. An additional development driver is pilot projects for the movement of highly automated vehicles.
6) On the way to the implementation of effective and universal V2X solutions for the entire region, there are national differences in frequency bands for 5G cellular communications, as well as the lack of a single standard for the development of road infrastructure in relation to the V2X solution, the choice is made between ITS-G5 (based on WiFi) and C- v2x (based on 5G cellular).
7) Thus, the use of the globally harmonized frequency range for 5G – 4,8–4,9 GHz in the Russian Federation in the border areas requires legal approval from Finland and Norway due to their use in the military sphere, similarly, the use of standard 5 G frequency spectra 3,4 -3,8 GHz is limited in the Russian Federation to their use for military and special needs.
8) As part of the implementation of transport projects for the development of V2X solutions on the transport infrastructure of the Barents Region, it is advisable to ensure cross-border compatibility of vehicle equipment and road infrastructure in accordance with common standards and 5G frequency spectra , forming common supranational requirements for connected cars and roadside V2X communication devices. This will make it possible to achieve a single infrastructure space, get new opportunities for the movement of highly automated vehicles (unmanned vehicles), reduce the costs of countries for building digital road infrastructure using standardized equipment.
9) Development of digital tools to increase the speed of passage of border crossing points for goods and passengers, including the development of cross-border cooperation in relation to the development of the use of digital customs services and the implementation of coordinated upgrades of checkpoints using new solutions for the digitalization of customs, including IoT , artificial intelligence, tools accelerated inspection of vehicles (using machine vision technologies, electronic cargo tracking devices and other technologies).
10) Harmonization of policies to ensure refueling of environmentally friendly modes of transport in cross-border traffic in the Barents Region (electric vehicles, vehicles running on natural gas fuel without constraints on traffic routes within the main highways of the region.

The above set of recommendations provides key areas of action that allow integrating initiatives and projects that are implemented in the Russian Federation in relation to ITS and transport carbon footprint reduction into a single transport fabric of the Barents Region, can be effectively replicated in other countries or agreed with them in terms of the main parameters, implementation timeframes, technical specifications, and standards. In addition, these recommendations are aimed

at eliminating the main technological, infrastructural, climatic, and other constraints that negatively affect the possibilities of seamless multimodal cross-border movement of goods and the organization of business and personal trips for residents and guests of the region.

1. Analysis of Russian federal and regional strategic planning documents, national projects and corporate plans (including ESG strategies) in terms of developing ITS and reducing the carbon footprint in the constituent entities of the Russian Federation belonging to the Barents Region, including related industries of communications and energy

The issues of the development of transport systems and their digitalization, the introduction of international principles of sustainable development and reduction of the carbon footprint into the practice of the transport industry in recent years have become one of the mainstream areas of work of federal and regional authorities and leading corporations in the Russian Federation to provide this discourse with strategic plans, road maps of their implementation and specific funded initiatives.

Over the past 3-4 years, these issues have fully spread from international conventions and agreements signed by the Government of the Russian Federation to federal and sectoral strategic planning documents, and then to the regional and local levels, including in the Russian segment of the Barents Region.

In the context of significant changes that have taken place in the macroeconomics and the military-political sphere in 2020-2022, some of the previously approved plans may lose their relevance and require adjustment.

1.1. Determination of the list of priority strategic directions of development, their regional and sectoral structure

This section analyzes legal documents related to strategic planning in order to identify priority areas for the development of intelligent transport systems and opportunities for transport carbon footprint reduction within the framework of ongoing international plans in the Russian segment of the Barents Region, national projects of the Russian Federation, state strategies, programs and other documents strategic and sectoral planning.

As part of the analysis of the regulatory framework for strategic planning, the following groups of documents were considered, providing the main structure of data on strategic plans in the Russian segment of the Barents Region for the development of ITS and transport carbon footprint reduction:

- Documents of international cooperation in the Barents Region;
- National projects;
- Federal strategic planning documents (federal projects, state programs and strategies);
- Industry and corporate strategic planning documents;
- Regional strategic planning documents (regional projects, regional state programs).

In each group of documents, key strategic planning documents were analyzed, within which goals, objectives, strategic directions were determined that determine the development of intelligent transport systems and opportunities for transport carbon footprint reduction.

The list of analyzed documents is given in Appendix 1.

1.1.1. Documents of international cooperation in the Barents Region

In terms of international cooperation in the Barents Region, it is necessary to highlight 2 key documents:

- Joint Transport Plan for the Barents Region (draft). Published April 15, 2020;
- Priorities of the Chairmanship of the Russian Federation in the Arctic Council in 2021–2023.

✓ **Joint Transport Plan for the Barents Region (draft). Published on 15 April 2020**

The Barents Joint Transport Plan notes that in the face of climate change and the need to adapt the global economy, the Barents Region must be competitive in this transition period. The overall development goal of the Barents Region is to create a transport system that creates new opportunities for the key sectors of the economies of Norway, Sweden, Finland, and Russia, with good internal communication between the countries of the region and with a good channel of communication with world markets. In addition to national goals, the development of the transport system should be consistent with the global sustainable development goals of the United Nations (Agenda 2030), including road safety.[16]

The Joint Barents Transport Plan also highlights the need to develop intelligent transport systems in the context of cooperation between the countries of the Barents Region. The countries of the Barents Region should strive for common intelligent transport systems. At the same time, they must be adapted to the climate of the Arctic.[17] An example of cooperation is the cooperation between the Norwegian Road Administration (NPRA) and the Swedish Transport Administration on the implementation of Datex II (the European standard for presenting and exchanging real-time road and traffic information), and there is now an effective exchange of information between the two countries.

In the Russian part of the Barents Region, ITS are used, the main task of which is to improve road safety (the state system of emergency response in case of accidents "ERA GLONASS", which is technologically compatible with the pan-European system "eCall"), as well as control over the safety of roads ("Platon", a system for collecting tolls from freight vehicles on federal highways)[18].

As recommendatory measures in terms of ITS, the Joint Transport Plan for the Barents Region indicates the need to[19]:

- increasing the availability of information on road and weather conditions on the roads in the Barents Region for tourists and freight forwarders by taking measures such as increasing the exchange of such information between countries, increasing mobile coverage along the roads, and, for example, developing an application for mobile devices that allows you to receive up-to-date information about the state of roads in the Barents Region. Creation of a unified system providing real-time information on road conditions on international highways in the Barents Region
- development of intelligent transport systems, as well as an emergency response system in case of accidents

[16] Joint Transport Plan for the Barents Region (draft). Published on 15 April 2020
[17] Joint Transport Plan for the Barents Region (draft). Published on 15 April 2020
[18] Joint Transport Plan for the Barents Region (draft). Published on 15 April 2020
[19] Joint Transport Plan for the Barents Region (draft). Published on 15 April 2020

– directing efforts towards the use of new technologies in the Barents Region with the expansion of the possibilities offered by GPS/GLONASS systems.

The Joint Transport Plan for the Barents Region also notes that one of the objectives of the development of the Barents Region is to reduce the harmful impact of transport on the climate. In this regard, the countries of the Barents Region should strive to[20]:

– redistribution of passenger and cargo flows to more environmentally friendly modes of transport;
– rationalization of transport and economic relations, by improving logistics, developing intermodal and combined transport;
– creation of incentives for improving the energy efficiency of transport, both through the modernization of the fleet of automobile and railway rolling stock, the fleet of aircraft, sea and river vessels, and by improving the transport infrastructure (in order to reduce the time of transportation of passengers, vehicles and goods). In railway transport, this can also be achieved through the electrification of lines, the construction of second main tracks, the transition to heavy traffic on a number of freight -intensive directions, etc.;
– stimulating the transition to new types of fuel.

✓ **Priorities of the Chairmanship of the Russian Federation in the Arctic Council in 2021–2023**

The document "Priorities of the Russian Federation Chairmanship of the Arctic Council in 2021–2023" presents the main theses of the Comprehensive Program of the Russian Chairmanship of the Arctic Council.

The following were announced as the main priority areas for the implementation of multilateral cooperation within the framework of the Comprehensive Program of the Russian Chairmanship in the Arctic Council[21]:

– *The population of the Arctic, including indigenous peoples*. Priority attention is planned to work to maintain the sustainability and viability of the peoples of the North, promote measures to adapt them to climate change, improve the well-being, health, education and quality of life of people, ensure sustainable socio-economic development throughout the region
– *Environmental protection, including climate change issues***.** Given the rapid climate change in the Arctic, the main tasks within this area of multilateral cooperation are to mitigate the negative effects of climate change, increase the adaptation of life and ensure resilience to its consequences, preserve and restore the environment, rational use of natural resources, maintain the health of Arctic ecosystems, including marine environment, conservation of biodiversity, in particular migratory bird species. In the context of the further development of the Barents Region, it is planned to take into account the promising contribution (due to natural, energy and transport resources) in facilitating the transition to a low emission economy and, accordingly, in meeting the goals and objectives of the Paris Climate Agreement. It is also considered a significant task to promote the introduction of advanced innovative

[20] Joint Transport Plan for the Barents Region (draft). Published on 15 April 2020

[21] Priorities of the Chairmanship of the Russian Federation in the Arctic Council in 2021-2023. https://oaarchive.arctic-council.org/bitstream/handle/11374/2646/%d0%90%d1%80%d0%ba%d1%82%d0%b8%d0%ba%d0%b0%20%d0%bf%d1%80%d0%b8%d0%be%d1%80%d0%b8%d1%82%d0%b5%d1%82%d1%8b%2021.06.2021.pdf?sequence=12&isAllowed =y

technologies in the region in the transport sector, industry, infrastructure, energy, including the expansion of the use of renewable energy sources.

- *Socio-economic development.* The key task of economic cooperation in the Barents Region is the development of reliable energy infrastructure, sustainable transport routes, including maritime navigation, telecommunications systems, food sector, improving the conditions for investment, promoting innovation, entrepreneurship, business financing.
- *Strengthening the Arctic Council.* The key task for the development of this area is to consolidate the Arctic Council as a key format for international Arctic cooperation, as well as to increase the efficiency of the Working and Expert Groups. Assistance is expected to further intensify the interaction of the Arctic Council with the Arctic Economic Council, the Arctic Coast Guard Forum, the University of the Arctic and other specialized structures.

1.1.2. National goals and national projects that determine the development of ITS and transport carbon footprint reduction in the Russian Federation

The key priorities and goals of the state policy of the Russian Federation, which determine the strategic planning documents - national projects, federal projects, as well as development strategies, state programs, sectoral strategic planning documents, documents of the regional and local levels - were formulated by Decree of the President of the Russian Federation of July 21, 2020. No. 474 "On the national development goals of the Russian Federation for the period up to 2030". In total, by this decree of the President of the Russian Federation, 5 key national development goals of the Russian Federation for the period up to 2030 were defined[22]:

- a) the preservation of the population, the health and well-being of people;
- b) opportunities for self-realization and development of talents;
- c) comfortable and safe environment for life;
- d) decent, efficient work and successful entrepreneurship;
- e) digital transformation.

Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the national goals of the development of the Russian Federation for the period until 2030" develops and corrects Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period until 2024", which initially defined the national goals of the Russian Federation and certain strategic directions (demography, healthcare, education, housing and the urban environment, ecology, safe and high-quality roads, labor productivity and employment support, science, digital economy, culture, small and medium business and support of individual entrepreneurial initiative, international cooperation and export) in accordance with which the President was entrusted with the development of national projects[23]. A total of 14 national projects have been developed and are currently being implemented.

As a result, the following national projects were developed, within the framework of which federal projects are being developed and implemented that determine the development of ITS and transport carbon footprint reduction:

[22] Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the national development goals of the Russian Federation for the period up to 2030"

[23] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

- National project "Safe quality roads" (Federal project "System-wide measures for the development of the road sector", Federal project "Modernization of passenger transport in urban agglomerations");
- National Program "Digital Economy of the Russian Federation" (Federal Project "Information Infrastructure");
- National project "Ecology" (Federal project "Clean Air").

✓ **National project "Safe quality roads" (implementation period 03.12.2018 - 31.12.2024)**

To achieve the national goals "Decent, efficient work and successful entrepreneurship", "Comfortable and safe environment for life", "Preservation of the population, health, and well-being of people", the National project "Safe quality roads" was developed[24].

The goals for the national project "Safe High-Quality Roads" were defined in the Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"[25]:

- an increase in the share of highways of regional significance that meet regulatory requirements in their total length, as well as the approval by state authorities of the constituent entities of the Russian Federation of such standards based on the safety requirements for highways established at the federal level[26];
- reduction in the share of federal and regional highways operating in overload mode in their total length;
- reduction in the number of places of concentration of road accidents (accidentally hazardous areas);
- reducing deaths from road traffic accidents (by 2030 - aiming for zero deaths).

National project "Safe quality roads" is aimed at solving the following main tasks[27]:

- an increase in the share of roads in the largest urban agglomerations that meet regulatory requirements;
- application of new mechanisms for the development and operation of the road network, including the use of infrastructure mortgages, life cycle contracts, the best technologies and materials;
- bringing the standard for crediting tax revenues to the budgets of the constituent entities of the Russian Federation from excises on fuels and lubricants to 100 percent;
- introduction of a publicly available information system for monitoring the formation and use of road funds at all levels (in 2019);
- creation of mechanisms for economic incentives for the preservation of roads of regional and local importance;

[24] Passport of the National project "Safe quality roads".

[25] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

[26] Targets are specified in section 1.1.2. "Analysis of the planned target results of the implementation of the plans and their impact on the development of ITS and reduction of the carbon footprint, determination of the prospective state of the transport and logistics operating environment and its connectivity with the transport systems of other countries of the Barents region"

[27] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

- introduction of new technical requirements and standards for the arrangement of roads, including those based on digital technologies, aimed at eliminating the places of concentration of road accidents;
- introduction of automated and robotic technologies for organizing traffic and monitoring compliance with traffic rules;
- strengthening the responsibility of drivers for violation of traffic rules, as well as increasing the requirements for the level of their professional training.

This national project determines the vector of development of both ITS and the policy of transport carbon footprint reduction in the Russian Federation. The development of ITS is determined by the Federal project "System-wide measures for the development of the road sector". The policy of transport carbon footprint reduction is determined by the Federal project "Modernization of passenger transport in urban agglomerations".

✓ **National project "National Program "Digital Economy of the Russian Federation"**

To achieve the national goal of "national transformation", including in order to solve the problem of ensuring the accelerated introduction of digital technologies in the economy and social sphere, the Government of the Russian Federation has formed the national program "Digital Economy of the Russian Federation" approved by the Protocol of the meeting of the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects dated June 4, 2019, No. 7.[28]

The goals for the national project "The National Program "Digital Economy of the Russian Federation" were defined in the Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"[29]:

- increase in internal costs for the development of the digital economy from all sources;
- creation of a sustainable and secure information and telecommunications infrastructure for high-speed transmission, processing and storage of large amounts of data, accessible to all organizations and households;
- the use of predominantly domestic software by state bodies, local governments and organizations.

The main objectives of the national project "National Program "Digital Economy of the Russian Federation" are[30]:

- creation of a system of legal regulation of the digital economy, based on a flexible approach in each area, as well as the introduction of civil circulation based on digital technologies;
- creation of a global competitive infrastructure for data transmission, processing and storage, mainly based on domestic developments;
- ensuring the training of highly qualified personnel for the digital economy;

[28]https://digital.gov.ru/ru/activity/directions/858/?ysclid=l0wjke7to6

[29] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

[30] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

- ensuring information security based on domestic developments in the transmission, processing and storage of data, which guarantees the protection of the interests of the individual, business and the state;
- creation of end-to-end digital technologies mainly based on domestic developments;
- introduction of digital technologies and platform solutions in the areas of public administration and the provision of public services, including in the interests of the population and small and medium-sized businesses, including individual entrepreneurs;
- transformation of priority sectors of the economy and social sphere, including healthcare, education, industry, agriculture, construction, urban economy, transport and energy infrastructure, financial services, through the introduction of digital technologies and platform solutions;
- creation of an integrated system for financing projects for the development and (or) implementation of digital technologies and platform solutions, including venture financing and other development institutions;
- development and implementation of a national mechanism for the implementation of a coordinated policy of the member states of the Eurasian Economic Union in the implementation of plans for the development of the digital economy.

One of the key goals of this project is the availability of new digital services for [31]:

- improving the comfort and quality of life of citizens;
- cost reduction and business development, formation of competition.

This national project determines the vector of development of ITS in the Russian Federation within the framework of the subordinate Federal project "Information Infrastructure".

✓ **National project "Ecology"**

To achieve the national goal "Comfortable and safe environment for life", the National Project "Ecology" was developed[32].

Key goals of the National project "Ecology"[33]:

- efficient management of production and consumption waste, including the elimination of all unauthorized dumps identified as of January 1, 2018, within city boundaries;
- a radical reduction in the level of atmospheric air pollution in large industrial centers;
- improving the quality of drinking water for the population, including for residents of settlements not equipped with modern centralized water supply systems;
- environmental rehabilitation of water bodies, including the Volga River, and the preservation of unique water systems, including lakes Baikal and Teletskoye;
- conservation of biological diversity, including through the creation of at least 24 new specially protected natural areas.

National project "Ecology" is aimed at solving the following tasks[34]:

[31]Presentation "National projects. Digital Economy. Ministry of Digital Development of Russia. https://digital.gov.ru/ru/activity/directions/858/?ysclid=l0wjke7to6

[32]http://government.ru/info/35569/

[33] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

[34] Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024"

- formation of an integrated system for handling municipal solid waste, including the elimination of landfills and the reclamation of the territories where they are located, the creation of conditions for the recycling of all production and consumption waste prohibited for burial;
- creation and effective functioning in all subjects of the Russian Federation of a system of public control aimed at identifying and eliminating unauthorized dumps;
- creation of a modern infrastructure that ensures the safe handling of waste of hazard classes I and II, and the elimination of the most dangerous objects of accumulated environmental damage;
- implementation of comprehensive action plans to reduce emissions of pollutants into the atmosphere in large industrial centers;
- application by all facilities that have a significant negative impact on the environment, an environmental regulation system based on the use of the best available technologies;
- improving the quality of drinking water through the modernization of water supply systems using advanced water treatment technologies, including technologies developed by organizations of the military-industrial complex;
- environmental rehabilitation of water bodies, including the implementation of a project aimed at reducing by a factor of three the share of polluted wastewater discharged into the Volga River, the sustainable functioning of the Lower Volga water management complex and the preservation of the ecosystem of the Volga-Akhtuba floodplain;
- preservation of unique water bodies, including the implementation of a project to preserve Lake Baikal, as well as measures to clean up debris from the shores and coastal waters of Baikal, Teletskoye, Ladoga, Onega lakes and the Volga, Don, Ob, Yenisei, Amur, Ural, Pechora rivers;
- conservation of biological diversity, including an increase in the area of specially protected natural areas by 5 million hectares, the reintroduction of rare species of animals, the creation of infrastructure for ecological tourism in national parks, as well as the conservation of forests, including through their reproduction in all areas of cut down and dead forest plantations.

The tasks of reducing the level of atmospheric air pollution in large industrial centers are being solved within the framework of the Federal Clean Air Project, which is subordinate to this national project.

1.1.3. Federal projects and documents of strategic planning in terms of intelligent transport systems

✓ **Federal project "Common system measures for the development of the road sector"** (December 3, 2018 - December 31, 2024)

Within the framework of the national project "Safe High-Quality Roads", the federal project "Common-system measures for the development of the road sector" is being implemented, which determines the introduction of ITS in the Russian Federation.

The purpose of this federal project is to provide[35]:

[35] Passport of the federal project "System-wide measures for the development of the road sector". Approved by the Protocol of the meeting of the project committee for the national project "Safe and high-quality roads" dated December 20, 2018, No. 4

- application of new mechanisms for the development and operation of the road network, including the use of infrastructure mortgages, the principles of life cycle contracts, the best technologies and materials;
- bringing the standard for crediting tax revenues to the budgets of the constituent entities of the Russian Federation from excises on fuels and lubricants to 100 percent;
- introduction of a public information system for monitoring the formation and use of road funds at all levels (in 2019);
- creating mechanisms for economic incentives for the preservation of roads of regional and local importance;
- introduction of new technical requirements and standards for the arrangement of roads, including those based on digital technologies, aimed at eliminating the places of concentration of road accidents;
- introduction of automated and robotic technologies for organizing traffic and monitoring compliance with traffic rules.

As part of the implementation of ITS within the framework of this federal project, the following tasks are solved[36]:

- Implementation of new technical requirements and standards for the development of roads, including those based on digital technologies, aimed at eliminating the concentration of traffic accidents. Adoption of the necessary regulatory legal acts, including:
    - Implementation of intelligent transport systems on public roads, focused, among other things, on ensuring the movement of unmanned vehicles
    - Evaluation of the effectiveness of intelligent transport systems, focused, among other things, on ensuring the movement of unmanned vehicles, decision-making in terms of increasing the number of sections of public roads on which these systems are used
    - Implementation of intelligent transport systems focused on the use of energy-saving technologies for road lighting
    - Evaluation of the effectiveness of intelligent transport systems focused on the use of energy-saving technologies for road lighting, decision-making in terms of increasing the number of sections of public roads where these systems are used

- Implementation of automated and robotic technologies for organizing traffic and monitoring compliance with traffic rules, including:
    - The introduction of intelligent transport systems that provide for the automation of traffic control processes in urban agglomerations, including cities with a population of over 300 thousand people
    - Equipping individual sections of highways and artificial structures of federal significance with elements of intelligent transport systems focused on automating traffic control processes
    - Equipping individual sections of highways and artificial structures of regional importance with elements of intelligent transport systems focused on automating traffic control processes

[36] Passport of the federal project "System-wide measures for the development of the road sector". Approved by the Protocol of the meeting of the project committee for the national project "Safe and high-quality roads" dated December 20, 2018, No. 4

✓ **Federal project "Information infrastructure"** (30.06.2019 - 31.12.2024)

The national program "Digital Economy of the Russian Federation" includes the federal project "Information Infrastructure", the main goal of which is to create a global competitive infrastructure for the transmission, processing and storage of data, mainly based on domestic developments, accessible to all citizens, businesses and authorities.[37]

Among the tasks to be solved that directly affect the development of ITS, one can single out [38]:

- Formation of the concept and technical requirements for covering the transport infrastructure with communication networks for data transmission systems, including GLONASS coordinate-time information, differential corrections, automatic dependent surveillance and multi-position surveillance systems;
- Coverage of priority transport infrastructure facilities (including railway and road infrastructure) with communication networks with broadband wireless data and voice transmission capabilities necessary for the development of modern intelligent logistics, transport technologies and narrow-band communication networks for collecting telemetric information built using LPWAN technology;
- Ensuring radiotelephone communication coverage of federal highways (with emergency calls) in accordance with the schedule.

✓ **Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021, No. 3363-r)**

The transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 was developed in accordance with the Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On national goals and strategic objectives for the development of the Russian Federation for the period until 2024", Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the national development goals of the Russian Federation for the period up to 2030", the national program "Digital Economy of the Russian Federation", approved by the Protocol of the meeting of the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects dated June 4, 2019, No. 7 and other strategic planning documents[39].

One of the long-term goals of the development of the transport system of this Strategy is the digital transformation of the industry, the transformation and accelerated introduction of new technologies, to achieve which the following tasks are defined:

- "Digitalization of passenger transportation";
- "Digitalization of Freight Transportation";
- "Digitalization of the life cycle of infrastructure and vehicles";
- "Digitalization of transport complex management";

[37]https://digital.gov.ru/ru/activity/directions/870/

[38]https://digital.gov.ru/ru/activity/directions/870/

[39] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

Based on the goals and objectives of this Strategy, digital transformation is planned, in particular, in the following main areas[40]:

- introduction of integrated transport services that allow digitalization of processes for transportation participants and increase the efficiency of interaction between participants, the Mobility as a Service / MaaS service model, electronic platforms for ordering cargo, logistics services and e-commerce services (in the format "cargo as a service" (Freight - as -a-Service), as well as the introduction of digital transport corridors;
- digitalization of cargo flows, providing for:
    - systems for tracking the movement of goods, the infrastructure for reading and monitoring the passage of goods through transport hubs and logistics terminals;
    - intelligent analytics of cargo flows and planning of transport corridors;
- digitalization of vehicles, including the introduction of:
    - advanced driver assistance systems, highly automated and unmanned vehicles in all modes of transport (unmanned vehicles, autonomous rail transport, autonomous water transport, unmanned aircraft, autonomous vehicles and forklifts for transport terminals, unmanned wheeled vehicles for delivery over the road network);
    - vehicle monitoring and predictive maintenance and repair;
- digitalization of transport infrastructure, providing for:
    - intelligent transport systems (all types of transport, including the urban public transport network);
    - digital twins of transport infrastructure facilities;
    - predictive repairs of transport infrastructure facilities;
    - digital (intelligent) terminals (passenger, cargo, checkpoints across the state border of the Russian Federation).

As part of the digital transformation direction for the introduction of integrated transport services that allow digitalization of processes for transportation participants, the development of service models in the Mobility as a Service / MaaS format will provide the possibility of selling single tickets for paying for multimodal transportation, purchasing discount tickets throughout the country by the relevant categories of citizens, the selection of optimal tickets for multimodal transportation, and will also create a tool for monitoring passenger flows in order to redistribute vehicles on routes and ensure the connectivity of urban and suburban areas.

The use of service models will ensure the exchange of data and the implementation of services for companies, the conditions for collecting and aggregating data on transport services, transportation and cargo in real time, as well as the conditions for issuing permits for transportation in digital form in the "single window" mode. The "freight-as-a-Service" model has particular importance in the task of providing small and medium-sized businesses with transport services on competitive terms, reduces transaction costs and ensures that there is a constant supply of such services for small and medium-sized businesses.

As part of the digitalization of vehicles, in accordance with the Strategy, it is planned to stimulate the introduction and use by companies and the population of vehicle driver assistance systems, including personal mobility tools (control of fatigue and condition of the driver of the vehicle, keeping in the lane, control and limiting the speed of movement, automatic braking, cruise

[40] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

control, automatic parking, emergency calls, warning drivers about other road users). Improved driver assistance systems will improve the safety of transportation, as well as reduce the cost of road transport. Highly automated and unmanned transport will increase the efficiency and safety of freight and passenger transportation, as well as the satisfaction of end users of services, will help reduce costs and increase infrastructure capacity.

Within the direction of digitalization of transport infrastructure, in order to ensure reliable information exchange and digital management of transport infrastructure facilities, it is meant to create a single closed, secure digital environment built on the basis of secure cloud technologies and including distributed storage and computing centers, network infrastructure, infrastructure of intelligent sensors and integration interfaces for communication with digital-mobile systems of organizations operating transport infrastructure facilities, rolling stock and vehicles, as well as the cybersecurity infrastructure.

Management of intelligent transport systems using artificial intelligence tools implies the implementation of solutions for automated efficient management of transport infrastructure, including monitoring weather conditions, distribution of flows, monitoring the state of transport infrastructure, predicting possible emergencies, and determining the speed limit.

Intelligent transport systems are supposed to be used at infrastructure facilities of all types of transport in the following formats of interaction using V2X technology[41]:

- vehicle - infrastructure;
- vehicle - a vehicle;
- vehicle - any elements and objects significant for the purpose of transportation.

Intelligent transport systems will be implemented on all modes of transport to solve the following tasks[42]:

- traffic control on highways;
- traffic control in railway transport, including end-to-end automated control of the execution modes of technological processes for managing operational work, the use of artificial intelligence functions in the planning and implementation of approved work plans for railway routes, the use of intelligent algorithms for generating a train passing plan implemented in the dispatch control of railway routes, as well as the implementation a full-scale set of measures to ensure information security;
- air traffic control and optimization of airspace management of air hubs through the implementation of a joint decision-making system;
- monitoring and control of water transport, including monitoring of current speed, fuel spills, dangerous approaches, as well as the introduction of automated ship navigation on approaches to the port;
- management of the urban public transport network, including the carrier control system, ensuring the priority of public transport traffic - managing urban flows, implementing an on-demand bus transportation system, monitoring the state of urban transport infrastructure, administering parking spaces.

[41] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

[42] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

The introduction of digital twins of the infrastructure created and operated at the expense of the budgetary system of the Russian Federation will help reduce the cost of designing, maintaining and operating transport infrastructure facilities of all types of transport. Within the framework of the direction, the following activities will be implemented[43]:

- purchase and commissioning of mobile measuring laboratories;
- application of information modeling technologies (BIM-technologies) in the design, construction, repair and maintenance of transport infrastructure facilities, taking into account pricing and estimated rationing;
- application of artificial intelligence technologies for monitoring and analysis of work (costs) for the design, construction, repair and maintenance of transport infrastructure facilities for all types of transport;
- creation of a digital twin of the Unified Core Network and the introduction of systems for analyzing and modeling the capacity of transport infrastructure facilities, static and dynamic modeling of traffic flows.

✓ **State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017, No. 1596)**

The State program of the Russian Federation "Development of the transport system" is a tool for implementing the state transport policy, its priorities correspond to the strategic priorities of the Transport Strategy of the Russian Federation for the period up to 2030 with a forecast up to 2035, approved by the Order of the Government of the Russian Federation of November 27, 2021, No. 3363-r; the main tasks of state administration in the field of the transport complex until 2024 and for the period until 2030 are determined taking into account the Transport Strategy of the Russian Federation[44].

The purpose of this Program is to improve the integrated safety and sustainability of the transport system in order to reduce the number of transport accidents per unit of vehicles (the Program implementation period is up to 2030).

The implementation of comprehensive measures to reduce the number and severity of traffic accidents and the negative impact of transport on the environment should become one of the priorities of the state transport policy and will ensure the achievement of the national goal "Preservation of the population, health and well-being of people".

In accordance with this Program, the achievement of "digital maturity" of key sectors of the economy, the social sphere and public administration will be ensured on the basis of the digital transformation of the transport industry (which is also one of the national development goals of the Russian Federation). One of the priorities of the state policy of the constituent entities of the Russian Federation in the field of the transport complex is the digitalization of the transport complex in order to achieve the "digital maturity" of the transport industry and the development of new management technologies[45].

[43] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

[44] State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

[45] State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

Goal No. 1 of public administration and ensuring the national security of the Russian Federation is to accelerate the movement of goods based on improving the quality of the transport infrastructure, the achievement of which includes, in particular, the digital transformation of the industry and the accelerated introduction of new technologies, including the development of unmanned transport systems on cargo transport[46].

The achievement of national goals within the framework of this Program will be ensured by solving the problems of federal projects of the national project "Safe High-Quality Roads" and the transport part of the comprehensive plan for the modernization and expansion of the main infrastructure, as well as other federal and departmental projects.

The achievement of the national goal "Preservation of the population, health and well-being of people" within the framework of this Program will be ensured, among other things, by solving the problem of introducing automated and robotic technologies for organizing traffic and monitoring compliance with traffic rules, as well as solving the problem of the functioning of automated information system for tachographic monitoring of compliance by drivers of vehicles with work and rest regimes.

Achievement of the national goal "Digital transformation", within the framework of this Program, is ensured by the solution, including the following tasks[47]:

- digital transformation of the industry and the accelerated introduction of new technologies, including the development of biometric identification services at airports and ground public transport;
- creation of a line of cargo unmanned aerial systems with ground infrastructure of autonomous take-off and landing sites, hardware complexes for transport network management, reimbursement of costs incurred in the procurement of radio-technical flight support and aviation telecommunications for unmanned aircraft flights;
- organization of the movement of unmanned vehicles on the public highway of federal significance M-11 "Neva" (Moscow - St. Petersburg).

✓ **Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r)**

The road safety strategy in the Russian Federation for 2018 - 2024 was developed in pursuance of subparagraph "a" of paragraph 3 of the list of instructions of the President of the Russian Federation dated April 11, 2016, N Pr-637GS following the meeting of the Presidium of the State Council of the Russian Federation, held on March 14, 2016[48].

The goals of this Strategy are to improve road safety, as well as to achieve zero deaths in road traffic accidents by 2030 (the Strategy's implementation period is until 2024).

Directions for the implementation of this Strategy include, among other things:[49]

- improvement of the road network in terms of road safety, including the development of work on the organization of traffic;

[46] State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

[47] State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

[48] Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r

[49] Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r

- improvement of the road safety management system;
- development of a system of assistance and rescue of victims of road traffic accidents.

One of the main tasks for the implementation of the direction related to the improvement of the road network in terms of road safety, including work on the organization of traffic, is the development of the principles of automation of traffic control based on high-tech electronic and mobile technology, the integration of traffic control systems into intelligent transport systems[50].

In order to achieve the task of improving the road safety management system, the implementation of practical measures to improve road safety, primarily on the basis of federal, regional and municipal programs.

One of the main tasks for the implementation of the direction related to the development of the system of assistance and rescue of victims of road accidents is the development of regulations for the interaction of interested services when receiving a signal about the occurrence of a road accident, on the coordination of actions when leaving the scene of a road accident and directly at the scene of the accident. It is planned to actively use information systems for these purposes, including the State Automated Information System ERA-GLONASS.

One of the principles for the implementation of this Strategy is the priority of using modern technologies in activities to ensure road safety, including intelligent transport systems, as well as global navigation systems, automation systems for the control process, active and passive vehicle safety, and other promising systems that allow qualitatively influence the prevention and reduction of the severity of the consequences of road traffic accidents[51].

This Strategy is being implemented in the period 2018–2024.

✓ **Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020, No. 1388-r)**

The strategy for the development of the customs service of the Russian Federation until 2030 defines the targets, priority areas and tasks for the development of the customs service for the long term.[52]

In accordance with this Strategy, the strategic goal of the development of the Federal Customs Service is the formation by 2030 of a qualitatively new, saturated with "artificial intelligence", quickly reconfigurable, informationally connected with internal and external partners, "smart" customs service, invisible to law-abiding business and effective for the state.

One of the targets of the Federal Customs Service is "full-scale digitalization and automation of the activities of customs authorities", which includes, among other things[53]:

- digital transformation of customs clearance and customs control technologies before and after the release of goods using artificial intelligence methods and processing of large amounts of data;
- application of a self-learning intellectual risk management system;

[50] Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r

[51] Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r

[52] Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020 No. 1388-r)

[53] Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020 No. 1388-r)

- introduction of technologies that ensure the automatic performance of customs operations without the participation of officials at the places of movement of goods across the customs border of the Union;
- application of international electronic systems for verification and certification of the origin of goods;
- automating the process of monitoring the correctness of the classification of goods and identifying violations related to the statement of false information about the classification code of goods in accordance with the unified Commodity Nomenclature for Foreign Economic Activity of the Eurasian Economic Union;
- application of integrated mechanisms of interdepartmental information interaction;
- participation in the creation of the national "single window" mechanism, its development and modernization, ensuring interfacing with the "single window" systems of foreign states;
- use in the performance of customs operations of transport, commercial and other documents created and used in business in the form of electronic documents.

One of the main strategic directions for the development of the customs service of the Russian Federation is, in the context of limited funding for checkpoints, the modernization and construction of checkpoints in accordance with the fixed standards for maximum automation of customs operations using elements of artificial intelligence - the model of an "intelligent" checkpoint. The main element of the functioning of the "intelligent" checkpoint model should be a single information system[54].

1.1.4. Industry and corporate documents of strategic planning in terms of ITS

✓ **Order of the Ministry of Transport of Russia dated March 21, 2022, N AK-74-r. "On approval of the Guidelines for the development of applications (including local projects for the creation and modernization of intelligent transport systems) of the constituent entities of the Russian Federation for receiving other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation in order to implement the measure "Implementation of intelligent transport systems that provide for the automation of road management processes traffic in urban agglomerations, including cities with a population of more than 300 thousand people" within the framework of the federal project "System-wide measures for the development of the road sector" of the State program of the Russian Federation "Development of the transport system"**

These Methodological Recommendations define the requirements for applications from the constituent entities of the Russian Federation for other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation in order to implement the measure "Implementation of intelligent transport systems that provide for the automation of traffic control processes in urban agglomerations, including cities with a population of over 300 thousand people" as part of the federal project "System-wide measures for the development of the road sector" of the State program of the Russian Federation "Development of the transport system".

[54] Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020 No. 1388-r)

In addition, these Guidelines contain recommendations on the creation, development and operation of ITS in urban agglomerations.[55] In accordance with the developed methodological recommendations, the main strategic goal of creating ITS in urban agglomerations is to meet the growing demand for passenger and freight traffic, achieve a transport balance between the capacity of the road network and its actual load, ensure the safety of transportation and traffic in general, as well as reduction of pollutant emissions.

According to the Methodological Recommendations, the typified composition of tasks solved by the introduction of ITS and / or its elements in urban agglomerations includes[56]:

- reducing delays and increasing the speed of transport communication based on the creation of a real-time traffic management system;
- reducing the number and severity of road accidents, as well as reducing the time for eliminating their consequences;
- provision of operational automated traffic control and operational management of transport;
- development of electronic payment systems, including those based on positioning and navigation systems;
- improvement of information support for the management of the road network of the urban agglomeration;
- improvement of information support for traffic participants;
- improving the efficiency of managing the fleet of public transport vehicles, as well as special, repair, operational and accident services, including using positioning systems;
- reducing the negative consequences of failures in the sustainable functioning of the urban agglomeration;
- ensuring an integrated approach to the creation of technical, informational and software support for the development of the agglomeration road network;
- prompt provision of up-to-date information on changes in traffic of the road network of the urban agglomeration to interested parties.

The most promising areas for the development of ITS in the urban agglomeration are:

- spatial development and expansion of the functionality of all major ITS subsystems;
- integration development of ITS;
- improving road safety;
- introduction of new ITS subsystems;
- reduction of harmful impact on the environment.

Achieving the goals of ITS is ensured by the services and services that ITS provides to users. The Guidelines note that in the long term, the ITS of an urban agglomeration should ensure

[55] "On Approval of Methodological Recommendations for the Development of Applications (Including Local Projects for the Creation and Modernization of Intelligent Transport Systems) of the Russian Federation Subjects for Other Interbudgetary Transfers from the Federal Budget to the Budgets of the Russian Federation Subjects for the Purpose of the Implementation of the Measure "Implementation of Intelligent Transport Systems, Providing for the Automation of Road Traffic Management Processes traffic in urban agglomerations, including cities with a population of over 300 thousand people" within the framework of the federal project "System-wide measures for the development of the road sector" of the State program of the Russian Federation "Development of the transport system". APPENDIX No. 3. "Recommendations for the creation, development and ensuring the effective functioning of intelligent transport systems in urban agglomerations."

[56] The same document.

the implementation of all the functions provided for by international and domestic requirements for the functional architecture of ITS. However, in the short and medium term, the implementation of all ITS functions and the simultaneous development of all functional areas without taking into account their priority is impossible and inappropriate due to resource constraints and the insufficiency of the domestic regulatory and legal framework in the field of ITS. In this regard, the Guidelines emphasize the need to build services that are guaranteed to have a significant effect on the quality of transport services, reduce travel time, improve reliability and safety. The experience of implementing ITS subsystems has shown that the main reason for failures is the neglect of the end result for the sake of market and commercial interests, the idealization of operating conditions.

According to the Methodological Recommendations, the implementation of the following priority ITS services will contribute to the fastest achievement of the goals and main directions of the functioning of the ITS[57]:

- ITS data management in the traffic control center of the agglomeration and the public transport control center (software, data directories, including the development, registration, safekeeping of various ITS operation scenarios, reports of incidents and emergencies, data of control centers in terms of registration, storage and exchange traffic information.
- Traffic management (traffic monitoring, ground traffic control on the streets of urban agglomerations, adaptive control of traffic signal operation modes, incident management, demand management for transport system services)
- Informing road users through the development of technical means for collecting data on traffic parameters:
    - Pre-transport information about:
        - traffic situation on the road network,
        - the state of functioning of road facilities,
        - public transport schedule,
        - availability of free parking spaces in the destination area.
    - Informing during the movement about:
        - locations of roadside facilities,
        - congestion of the road network along the proposed route,
        - availability of parking spaces at the destination.
- Monitoring weather conditions (road weather) by deploying weather monitoring equipment (road weather information management, road weather forecasting).

✓ **Decree of the Ministry of Transport of the Russian Federation dated May 31, 2021, No. VS-105-r "On approval of the Digitalization Program in the road sector in the Russian Federation" (until 2030)**

[57] "On Approval of the Methodological Recommendations for the Development of Applications (including Local Projects for the Creation and Modernization of Intelligent Transport Systems) of the Russian Federation Subjects for Receipt of Other Interbudgetary Transfers from the Federal Budget to the Budgets of the Russian Federation Subjects for the Purpose of the Implementation of the Measure "Implementation of Intelligent Transport Systems, Providing for the Automation of Road Traffic Management Processes traffic in urban agglomerations, including cities with a population of more than 300 thousand people" within the framework of the federal project "System-wide measures for the development of the road sector" of the State program of the Russian Federation "Development of the transport system". APPENDIX No. 3. "Recommendations for the creation, development and ensuring the effective functioning of intelligent transport systems in urban agglomerations."

The digitalization program in the road sector of the Russian Federation includes 5 main areas of action:

- Information modeling in the road sector;
- Implementation of intelligent transport systems;
- Digitization of licensing functions;
- Control and supervisory activities;
- Accounting functions.

As part of the direction "Implementation of intelligent transport systems" in this Program, the following activities were approved[58]:

- Development of a concept for the creation and operation of a national network of intelligent transport systems on public roads;
- Creation of a legal basis for the functioning of the national network of intelligent transport systems on public roads;
- Creation of a federal platform for a network of intelligent transport systems;
- Implementation of intelligent transport systems that provide for the automation of traffic management processes in urban agglomerations, including cities with a population of over 300 thousand people (at least 64 agglomerations);
- Creation of regional platforms of intelligent transport systems and their integration with the federal platform.

✓ **Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads"**

The concept of ensuring road safety with the participation of unmanned vehicles on public roads was developed in accordance with the federal project "System-wide measures for the development of the road economy» and is intended to promote the development of road transport infrastructure that ensures the introduction of unmanned road traffic, as well as to develop policies government authorities in this area.

The concept was developed, in particular, for the implementation of the following goals[59]:

- improving road safety and creating a safe transport environment by reducing the role of the human factor and the impact of errors made by drivers;
- improving the quality of life of citizens by comprehensively meeting the needs for transport mobility, developing the related services market, creating comfortable conditions for people with disabilities, improving the environmental situation;
- reducing the load on the road network through its more efficient use and dissemination of technologies for connecting vehicles to the road transport infrastructure, increasing the controllability of vehicles and the predictability of their behavior in the traffic flow;

New technologies introduced in vehicles may create additional risks for road safety, so the objective of this Concept is to minimize risks. Since at present, vehicles moving in unmanned mode are not able to independently provide the necessary level of safety, the need to organize

[58] Decree of the Ministry of Transport of the Russian Federation dated May 31, 2021, No. VS-105-r "On approval of the Digitalization Program in the road sector in the Russian Federation".

[59] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads".

network interaction between vehicles and road infrastructure is becoming important. Intelligent road transport infrastructure can solve some of the tasks of ensuring road safety with the participation of unmanned vehicles. In this case, the unmanned mode of vehicles moving in the traffic flow will be supported and provided by the road transport infrastructure.

According to this Concept, highly and fully automated vehicles operating in an unmanned mode should be gradually included in the already established transport system without endangering other road users and ensuring full compliance with the established traffic rules.[60]

The formation of a telecommunications road transport infrastructure for controlling connected and unmanned vehicles includes the creation of a linear and station infocommunication and facility instrumental infrastructure on the road network, the creation and development of a technological platform that includes application software modules, means of protecting data channels, as well as ensuring the functioning of the entire infrastructure based on unified open protocols as a single digital ecosystem.

In accordance with this Concept, the following requirements are imposed on the road transport infrastructure to ensure the movement of highly automated vehicles[61]:

- on the presence of an intelligent transport system;
- on the presence of a service platform as part of the intelligent transport system that ensures the interaction of the vehicle with any objects that may affect the vehicle;
- on the availability of an accurate positioning system operating on the basis of satellite technologies and a network of ground reference base stations that provide differential correction;
- on the availability of a digital road model based on high-precision digital dynamic road maps;
- on sustainable road coverage with high-speed communication channels.

According to this Concept, it is advisable to include the following complex subsystems in the physical architecture of an intelligent transport system[62]:

- traffic flow control subsystem (directive and indirect traffic flow control);
- payment subsystem (if necessary);
- subsystem for monitoring compliance with traffic rules;
- subsystem of user services and services;
- road condition management subsystem;
- control and diagnostic subsystem.

To improve the road safety of vehicles (including unmanned vehicles), achieve mobility and comfort for road users, according to this Concept, it is necessary to form a system of high-precision positioning of the road based on methods of determining the location of objects based on signals from global satellite navigation systems as part of the road transport infrastructure. It is also necessary to develop and implement a digital road model based on reliable high-precision

[60] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads".

[61] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads".

[62] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads".

spatial data about the road and traffic conditions. A digital road model is being developed for all roads intended for the use of highly automated vehicles[63].

Currently, the focus in the development of automated driving technologies is focused on several key areas, which include passenger transportation in cities and freight transportation on highways.

✓ **Decree of the Federal Road Agency (Rosavtodor) dated March 3, 2021, No. 773-r "On approval of the strategy for the development of innovative activities in the field of road infrastructure for the period 2021–2025"**

The strategy for the development of innovative activities in the field of road infrastructure for the period 2021–2025 aims to support the main directions of development of the Russian road industry, including ensuring road safety, creating a comfortable road infrastructure, and increasing the durability of road structures. One of the priority areas of innovative activity of Rosavtodor is the digitalization of the road industry[64].

Among other initiatives of the plan for the development of innovative activities of Rosavtodor, this Strategy includes the initiative "Research in the field of integrated implementation of ITS". The goal of this initiative is[65]:

- Methodological and regulatory support for the integrated implementation of intelligent transport systems;
- Formation and application of a list of relevant technological solutions for ITS subsystems and creation of conditions for their implementation;
- Development of road infrastructure requirements for connected and highly automated transport.

The main activities of the initiative "Research in the field of integrated implementation of ITS" include[66]:

- Development and adoption of requirements, regulations, standards, guidelines and other legal documents in the field of ITS;
- Gradual improvement of the methodology for the integrated implementation of intelligent transport systems and methods for assessing the effectiveness of the implementation of ITS;
- Testing, approbation and piloting of technological solutions in the field of ITS;
- Creation of new and updating of current advanced training programs in the field of ITS.

✓ **Decree of the Government of the Russian Federation dated March 19, 2019, No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"**

The long-term development program of the open joint-stock company "Russian Railways" until 2025 is aimed at implementing the tasks stipulated by the message of the President of the Russian Federation to the Federal Assembly of the Russian Federation and Decree of the President

[63] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads".

[64] Passport of the strategy for the development of innovative activities in the field of road infrastructure for the period 2021-2025. Approved by the Order of the Federal Road Agency dated March 03, 2021 No. 773-r.

[65] https://rosavtodor.gov.ru/storage/app/media/uploaded-files/2-strategiya.pdf

[66]https://rosavtodor.gov.ru/storage/app/media/uploaded-files/2-strategiya.pdf

of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period until 2024" and is based on the Transport Strategy of the Russian Federation for the period up to 2030, approved by the Order of the Government of the Russian Federation of November 22, 2008, No. 1734-r.[67]

Within the framework of this Program, by 2025, a transition to a digital railway is envisaged.

Key areas of development of information systems in the open joint-stock company "Russian Railways" include[68]:

- creation of a single information space for freight transportation and logistics to increase the profitability of freight transportation and logistics business;
- creation of a single information space of the passenger complex to increase the profitability of passenger transportation;
- formation of end-to-end digital technologies for organizing the transportation process ("Digital Railway") to improve the efficiency of rail transportation and infrastructure;
- creation of a unified integrated automated management system, optimization of corporate enterprise management systems, analysis and development of reporting to increase the profitability of foreign activities, increase the efficiency of the social sphere and corporate governance.

According to the Program, by 2025, the following target state of information technologies of the open joint-stock company "Russian Railways" will be achieved[69]:

- platform solutions integrated with the production systems of the open joint-stock company "Russian Railways" were implemented, their coordination and interaction with digital solutions of the transport complex and the ability to build digital services on this basis were ensured within the framework of the departmental project of the Ministry of Transport of the Russian Federation "Digital Transport and Logistics", electronic channels of interaction with the market (passengers, shippers, service companies), federal executive authorities and within the framework of cross-border interaction (transport corridors) have been created;
- the technological processes of the open joint-stock company "Russian Railways" are integrated with the systems of the Internet of things, big data processing, distributed registry, digital modeling and artificial intelligence;
- a new generation of mobile jobs and electronic document management in production and management processes have been created;
- the computing and telecommunications infrastructure has been modernized to ensure a guaranteed level of availability of information services;
- implemented centralized information security tools based on import -independent solutions;
- systematic work with new technologies (search, approbation, prototyping, implementation) has been built and a high-tech business has been developed in the holding.

[67] Decree of the Government of the Russian Federation of March 19, 2019 No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"

[68] Decree of the Government of the Russian Federation of March 19, 2019 No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"

[69] Decree of the Government of the Russian Federation of March 19, 2019 No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"

The transition to the target state of information technology will create the basis for new services based on the use of digital technologies and will ensure a reduction in the share of operating costs of the Open Joint Stock Company "Russian Railways" on information systems. Improving the information technology management operating model is aimed at ensuring effective information technology management, ensuring cost transparency and increasing labor productivity, which will optimize staff and achieve savings in procurement.

✓ **Development Strategy for the Air Navigation System of the Russian Federation until 2030 (developed by FSUE State ATM Corporation)**

The Development Strategy of the Air Navigation System of the Russian Federation until 2030 defines several key areas (including 32 initiatives)[70]:

- Efficient flight trajectories (maximum approximation of real trajectories to optimal ones);
- Optimum capacity and flexibility of actual flight paths (Providing the necessary capacity and optimal actual flight paths);
- Efficient airport operations (Ensuring optimal taxiing, increasing throughput and security on the airfield);
- Interoperable systems and data (Use of digital communication channels and satellite technologies);
- Internal efficiency of the air navigation system (ensuring the level of investment and operating costs of the system, adequate to the volume and quality of services).

This Strategy is aimed at reducing the costs of operators and the operating costs of the air navigation system while maintaining the achieved level of flight safety and meeting national security requirements. The strategy determines the formation of efficient flight trajectories (at flight levels above 9000 m), optimization of airspace capacity and increasing the efficiency of air navigation operations at airports.

✓ **The concept of implementing automatic dependent surveillance based on a single standard with the development to the functionality of multi-position surveillance systems in the Russian Federation for 2017-2022. (Decree of the Ministry of Transport of the Russian Federation dated April 25, 2018, No. MS-68-r)**

The concept of introducing automatic dependent surveillance based on a single standard with the development to the functionality of multi-position surveillance systems in the Russian Federation for 2017-2022 is the basic document for planning the implementation of a surveillance system based on a single standard for automatic dependent surveillance with its development to the functionality of multi-position surveillance systems, as one of the key elements in improving the air traffic services surveillance system in the Russian Federation[71].

The purpose of implementing this Concept is to create in the Russian Federation an air traffic services surveillance system based on a single standard for automatic dependent surveillance with its development to the functionality of multi-position surveillance systems in the upper and lower airspace.

[70] Development Strategy for the Air Navigation System of the Russian Federation until 2030 (developed by FSUE State ATM Corporation)

[71] The concept of introducing automatic dependent surveillance based on a single standard with the development to the functionality of multi-position surveillance systems in the Russian Federation for 2017–2022. (Decree of the Ministry of Transport of the Russian Federation dated April 25, 2018 No. MS-68-r)

Achieving the goal of this Concept is possible subject to the implementation of the following tasks[72]:

- Development of a top-level system project for the creation in the Russian Federation of a surveillance system based on a unified standard for automatic dependent surveillance with its development to the functionality of multi-position surveillance systems in the upper and lower airspace (hereinafter referred to as the MPSN system based on the unified ADS-B standard).
- Implementation of the ground infrastructure of the MPSN system based on the unified ADS-B standard with the provision of surveillance of long-range, medium- and short-haul aircraft, aircraft of local airlines, general aviation, unmanned aircraft and vehicles admitted to the maneuvering zone of airfields.
- Legislative, regulatory legal and regulatory technical support for the implementation of the MPSN system based on the unified ADS-B standard, including the phased equipping of manned and unmanned aircraft, as well as special vehicles admitted to the aerodrome maneuvering zone with the installed MPSN, with airborne transponders.
- Carrying out measures to ensure the technical equipment of manned and unmanned aircraft, as well as special vehicles admitted to the aerodrome maneuvering zone with the installed MPSN, with on-board transponders.

✓ **Decree of the Government of the Russian Federation of December 22, 2020, No. 2216 "On approval of the rules for equipping vehicles of categories M2, M3 and vehicles of category N used for the transport of dangerous goods with satellite navigation equipment"**

Decree of the Government of the Russian Federation of December 22, 2020, No. 2216 establishes the procedure for equipping vehicles classified in accordance with the technical regulation of the Customs Union "On the safety of wheeled vehicles" (TR CU 018/2011) (hereinafter referred to as the technical regulation) to vehicles of categories M2, M3, and vehicles of category N used for the carriage of dangerous goods (hereinafter referred to as vehicles), satellite navigation equipment in order to improve the efficiency of vehicle traffic control and the level of safety of transportation of passengers, dangerous goods.

In accordance with Decree 3 of the Russian Federation of December 22, 2020, No. 2216, vehicles must be equipped with operable satellite navigation equipment that meets the following requirements:

- meets the requirements of technical regulations;
- provides determination by signals of at least 2 active global navigation satellite systems, one of which is the global navigation satellite system GLONASS, transmission of information about the geographic latitude and longitude of the vehicle location, its ground angle and speed, time and date of fixing the location of the vehicle with an interval transmission of no more than 30 seconds through the State automated information system "ERA-GLONASS" to the Federal Service for Supervision in the Sphere of Transport, as well as to regional, municipal and other information systems

[72] The concept of introducing automatic dependent surveillance based on a single standard with the development to the functionality of multi-position surveillance systems in the Russian Federation for 2017–2022. (Decree of the Ministry of Transport of the Russian Federation dated April 25, 2018 No. MS-68-r)

- provides for the presence of a personal universal subscriber identification card containing a profile of a mobile radiotelephone communication network that ensures the operation of the system.

✓ **Action plan ("road map") "EnergyNet" of the National Technology Initiative. Approved by the Presidium of the Council under the President of the Russian Federation for the Modernization of the Economy and Innovative Development of Russia (Protocol No. 4 dated September 28, 2016)**

The goal of the Action Plan ("road map") of the "EnergyNet" of the National Technology Initiative is to achieve by 2035 the volume of revenue of Russian companies in the global market (priority - BRICS and developing countries) of multi-scale integrated systems and services of smart energy at least 40 billion dollars a year, including taking market shares in priority segments[73]:

- reliable and flexible distribution networks - 10–12%;
- intelligent distributed energy - 3-6%;
- consumer services - 3-6%.

In the medium term, based on the solutions obtained in the field of smart energy, it will ensure readiness to enter the global market for adjacent segments of the systems and services market - utility and resource services of housing and communal services.

The objectives of the roadmap include[74]:

- Development of the architecture of multi-scale integrated systems of intelligent energy, development and implementation of standards, regulations and rules;
- Development of a set of technologies in the priority areas of EnergyNet (unattended cyber-physical devices for medium and low voltage, integrated solutions for digital substations and digital networks of medium and low voltage, microgrids, cheap energy storage devices, lug & play interfaces for a wide class of energy equipment and power receiving devices, Internet technologies things for use in the energy sector, open platforms for technological and commercial services, etc.)
- Development of a set of state support tools:
    - formation of open databases (information portals) of experts, catalogs of actually applied technologies and equipment, services, best available technologies for market participants of integrated systems and services of smart energy
    - formation of an open service platform
    - development of tax incentives;
    - development of financing measures, including on the basis of development institutions, companies with state participation;
    - development of measures to stimulate demand for products of national suppliers in the field of integrated systems and services of smart energy
- Preparation and implementation of priority projects with the use of state support;

[73] Action plan ("road map") "EnergyNet" of the National Technology Initiative. Approved by the Presidium of the Council under the President of the Russian Federation for the Modernization of the Economy and Innovative Development of Russia (Protocol No. 4 dated September 28, 2016)

[74] Action plan ("road map") "EnergyNet" of the National Technology Initiative. Approved by the Presidium of the Council under the President of the Russian Federation for the Modernization of the Economy and Innovative Development of Russia (Protocol No. 4 dated September 28, 2016)

– Personnel training for successful market development.

✓ **Urban Digitalization Project "Smart City"**

The Smart City project is being implemented as part of the Housing and Urban Environment national project and the Digital Economy national program and is aimed at increasing the competitiveness of Russian cities, creating an effective urban management system, and creating safe and comfortable living conditions for citizens.

The goal of the Smart City is not only to digitally transform and automate processes, but also to comprehensively improve the efficiency of urban infrastructure.

The National Competence Center of the Smart City project has been established, which will develop, implement and popularize technologies, equipment, programs aimed at increasing the level of digitalization of the urban economy, as well as preparing and assisting international cooperation projects on housing policy, urban development and management natural resources, primarily related to the creation and operation of "smart cities"[75].

Among the tasks to be solved is the replication of digital and engineering solutions of the Smart City that have proven their effectiveness, aimed at improving the efficiency of the city economy[76].

1.1.5. Regional documents of strategic planning in terms of intelligent transport systems

Arkhangelsk Region

✓ **Regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)" (03.12.2018 - 31.12.2024)**

The goal of the regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)" corresponds to the goal of the Federal project "General-system measures for the development of the road sector". Within the framework of the regional project, the tasks of introducing ITS in the capital of the region are being solved, and individual sections of federal and regional roads are being equipped with ITS elements - namely, stationary cameras for photo and video recording of traffic violations. On the roads of regional, intermunicipal, local importance, it is planned to place automatic points for the weight and size control of vehicles.

The regional project in the Arkhangelsk Region is linked by the State program of the Arkhangelsk Region "Development of the transport system of the Arkhangelsk Region", Subprogram "Improving road safety in the Arkhangelsk Region[77].

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Arkhangelsk Region for the period up to 2024. Decree of the Government of the Arkhangelsk Region dated August 10, 2021, No. 344-rp**

[75] https://www.minstroyrf.gov.ru/trades/gorodskaya-sreda/proekt-tsifrovizatsii-gorodskogo-khozyaystva-umnyy-gorod/

[76] Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation dated October 31, 2018 No. 695 p. "On approval of the passport of the departmental project of digitalization of the urban economy "Smart City".

[77] Passport of the regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)"

Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Arkhangelsk Region was developed in pursuance of Decree of the President of the Russian Federation of July 21, 2020 No. 474 "On the national development goals of the Russian Federation for the period until 2030", paragraph 2 of the list of instructions of the President of the Russian Federation, approved President of the Russian Federation on December 31, 2020 N Pr-2242, following the results of the Journey into the World of Artificial Intelligence conference held on December 4, 2020.[78]

While implementing the digital transformation strategy for key sectors of the economy, social sphere and public administration of the Arkhangelsk Region, the following technologies will be introduced:

- cloud technologies;
- artificial intelligence;
- Big Data;
- VR/AR technologies.

The goal of the Strategy is to ensure sustainable growth in the quality of life of the inhabitants of the Arkhangelsk Region and favorable conditions for doing business and other activities using digital technologies.

One of the tasks of digital transformation of economic sectors in the Arkhangelsk Region is the introduction of intelligent transport systems.

Within the framework of this Strategy, 4 projects (directions) have been identified in the field of transport and logistics of the Arkhangelsk Region[79]:

- Initiative "Digital management of the transport complex of the Russian Federation"
- Initiative of the Digital Transformation Project
- Initiative "Digital Twins of Transport Infrastructure Objects of the Digital Transformation Project"
- Intelligent transport system of the Arkhangelsk Region / OG-02

The Table below highlights the goals, objectives, and description of 4 projects in the field of transport and logistics, indicated by the Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Arkhangelsk Region.

Table 1. Description of projects (directions) in the field of transport and logistics from the Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Arkhangelsk Region[80]

Project name	Project goal	Project objectives	Project description
"Digital management of the	Creation of a federal situational information center of the Ministry of Transport of Russia, as	Operational management of the transport complex from a single	Reducing the annual material damage from emergencies in transport. Annual cost reduction in the implementation of control and supervision activities.

[78] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Arkhangelsk Region for the period up to 2024. Decree of the Government of the Arkhangelsk Region dated August 10, 2021 No. 344-rp

[79] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Arkhangelsk Region for the period up to 2024. Decree of the Government of the Arkhangelsk Region dated August 10, 2021 No. 344-rp

[80] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Arkhangelsk Region for the period up to 2024. Decree of the Government of the Arkhangelsk Region dated August 10, 2021 No. 344-rp

Project name	Project goal	Project objectives	Project description
transport complex of the Russian Federation"	well as the development of predictive maintenance and repair of transport infrastructure using artificial intelligence technologies.	center depending on the situation	Increasing the speed of decision-making to resolve emergency and crisis situations.
"Digitalization for Transport Security" of the "Digital Transformation" project	Improving transport security	Improving the reliability and safety of transport infrastructure facilities	Reduction of material damage from acts of unlawful interference. Reduction of threats and the number of acts of illegal interference at transport infrastructure facilities. Reduction of the duration of coordination of security measures at transport infrastructure facilities. Reduction of time spent during the trip on the passage of pre-trip procedures. Reduction of financial losses of Russian carriers associated with the forced return to the host country of foreign citizens-passengers who are denied the right to enter the Russian Federation
Project Initiative "Digital Twins of Transport Infrastructure Objects of the Digital Transformation Project"	Launching a system for monitoring road funds, creating 3D models of all transport infrastructure facilities, developing an information system for accounting and planning work / costs for the design, construction, repair and maintenance of transport infrastructure facilities, creating mobile measuring laboratories	Reducing the cost and terms of design and construction of transport infrastructure facilities	Reduction of costs for the construction of transport infrastructure facilities. Decline construction time (including design) of transport infrastructure facilities. Reducing the number of incidents of destruction of transport infrastructure and collateral damage. Extending the service life of transport infrastructure facilities. Reducing the cost of technical support and repair of transport infrastructure facilities
Intelligent transport system of the Arkhangelsk Region / OG-02	Increase in average speed in the city and on regional roads	Increasing the speed of delivery of passengers and cargo; Reducing the number of road accidents, injuries and deaths; Increasing the capacity of highways and the urban street and road network; Increasing the speed of response of emergency and emergency services; Collection of data on passing transport and the state of transport infrastructure; Increasing the role of public transport; Increasing population mobility; Development of multimodal transportation.	Intelligent traffic control; monitoring of traffic flows and the condition of roads, structures; introduction of a system of automatic photo and video recording of violations of traffic rules; creation of a parking space administration system; intelligent management of public transport; creation of safe and comfortable waiting areas for public transport

Murmansk Region

✓ **Regional project "System-wide measures for the development of the road sector (Murmansk Region)" (01.01.2019 – 31.12.2024)**

Within the framework of the regional project "System-wide measures for the development of the road sector (Murmansk Region), it is planned to place ITS elements in the Murmansk Region. On the roads of regional and local importance, it is planned to place elements of automatic points for weight and size control of vehicles. On roads of federal, regional, and local importance, it is planned to increase the number of stationary cameras for photo and video recording of violations of traffic rules.

The regional project in the Murmansk Region is linked to the State Program "Development of the transport system", Subprogram 1. "Roads of the Murmansk Region"[81].

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Murmansk Region. Approved by the Governor of the Murmansk Region on 20.08.2021**

"The Strategy in the field of digital transformation of the economy, social sphere and public administration of the Murmansk Region" (implementation period 2024) was developed on the basis of the List of instructions of the President of the Russian Federation following the results of the conference "Journey into the World of Artificial Intelligence" on December 4, 2020 N Pr-2242, Decree of the President of the Russian Federation dated May 7, 2018, No. 204 "On national goals and strategic objectives of the development of the Russian Federation for the period up to 2024", Decree of the President of the Russian Federation No. 474 of July 21, 2020 "On National Development Goals of the Russian Federation for the Period up to 2030", Strategy for the Development of Information Society in the Russian Federation for 2017-2030, approved by the Decree of the President of the Russian Federation No. 203 of May 9, 2017, the National Program "Digital Economy Of the Russian Federation", approved by the Protocol of the meeting of the Presidium of the Council under the President of the Russian Federation on Strategic Development and National Projects dated June 4, 2019 No. 7, etc.

Among the main tasks of the digital transformation of the sectors of the economy, social sphere and public administration of the Murmansk Region, we can distinguish [82]:

- Increasing the level of digital maturity of key sectors of the economy, social sphere and public administration of the Murmansk Region
- Transition to a data-driven regional governance system by increasing the level of sectoral digitalization
- Eliminating the digital divide by creating a sustainable and secure information and telecommunications infrastructure, including in remote areas of the Murmansk Region
- Improving the level of safety and comfort of the urban environment of the territories of the Murmansk Region using "Smart City" technologies
- Increasing the level of safety and comfort in the provision of transport services to the population of the Murmansk Region based on digital technologies.

[81] Passport of the regional project "System-wide measures for the development of the road sector (Murmansk Region)"

[82] Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Murmansk Region"

The Table below highlights the goals, objectives, and description of the main digital projects in the field of transport and logistics, indicated by the Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Murmansk Region.

Table 2. Description of the main digital projects (directions) in the field of transport and logistics from the Strategy in the field of digital transformation of the sectors of the economy, social sphere, and public administration of the Murmansk Region[83]

Project name	Project goal	Project objectives	Project description
Initiative "Digital management of the transport complex of the Russian Federation"	Creation of a federal situation and information center of the Ministry of Transport of Russia, as well as the development of predictive maintenance and repair of transport infrastructure using artificial intelligence technologies	Ensuring the priority of traffic and (or) pedestrian safety by means of digital technologies; Implementation of digital technologies to address the issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	1. Reducing the annual material damage from emergencies in transport 2. Annual cost reduction in the implementation of control - supervisory activities 3. Increasing the speed of decision-making to resolve emergency and crisis situations
Digitalization for Transportation Security Initiative of the Digital Transformation Project	Creation of a single digital security space in transport, digitalization of public services in the field of transport security using restricted access information, introduction of an interactive system for preliminary information about passengers, as well as information support for biometric control (BMC) as part of the technical means of ensuring transport security at transport infrastructure facilities	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of traffic and (or) pedestrian safety by means of digital technologies; Implementation of digital technologies to address the issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	1. Reducing material damage from acts of unlawful interference 2. Reducing the threats and the number of acts of unlawful interference at transport infrastructure facilities 3. Reducing the duration of coordination of security measures at transport infrastructure facilities 4. Reducing the time spent during a trip to go through pre-trip procedures 5. Reducing financial losses Russian carriers associated with the forced return to the host country of foreign citizens-passengers who are denied the right to enter the Russian Federation
Implementation of public transport coordination subsystems	Ensure smooth coordination of public transport traffic	Improving the comfort of the transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of traffic and (or) pedestrian safety by means of digital technologies; Implementation of digital technologies to address the issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	Implementation of a subsystem for managing public transport routes Implementation of a subsystem for managing "smart stops" Implementation of a subsystem for monitoring the movement of public transport
Implementation of transport security subsystems	Improving the level of transport security	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of traffic and (or) pedestrian safety by means of digital technologies; Implementation of digital technologies to address the	Implementation of a subsystem for video surveillance, detection of accidents and emergencies Implementation of a subsystem for ensuring anti-icing conditions

[83] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Murmansk region

Project name	Project goal	Project objectives	Project description
		issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	
Implementation of services for connected and highly automated transport (V2X)	Improving the safety and efficiency of traffic management, as well as ensuring the movement of highly automated vehicles	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of traffic and (or) pedestrian safety by means of digital technologies; Implementation of digital technologies to address the issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	Implementation of a smart road facility management subsystem Implementation of a V2X service platform to ensure the movement of highly automated vehicles
Implementation of the "Digital Twin" module of the Unified Management Platform for the Transport System of the Murmansk Region	Launching a system for monitoring road funds, creating 3D models of all transport infrastructure facilities, developing an information system for accounting and planning work / costs for the design, construction, repair, and maintenance of transport infrastructure facilities, creating mobile measuring laboratories	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of traffic and (or) pedestrian safety by means of digital technologies; Implementation of digital technologies for solving the issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	1. Reduction of costs for the construction of transport infrastructure facilities 2. Reduction of construction time (including design) of transport infrastructure facilities 3. Reducing the number of incidents of destruction of transport infrastructure and collateral damage 4. Extending the service life of transport infrastructure facilities 5. Reducing the cost of maintenance and repair of transport infrastructure facilities
Implementation of the module of the electronic integrated scheme of traffic management of the Unified platform for managing the transport system of the Murmansk Region	Implementation of the module of the electronic integrated scheme of traffic management of the Unified platform for managing the transport system of the Murmansk Region	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport	Implementation of a module of an electronic integrated scheme for organizing traffic of the Unified Management Platform for the Transport System of the Murmansk Region in order to provide information on the current parameters of traffic in the territory of the Murmansk Region and its constituent municipalities with the ability to analyze and predict the traffic situation when changing schemes for organizing traffic, taking into account the interconnectedness of the relevant sections with the scheme of traffic organization on the entire road network of individual settlements
Implementation of the efficiency control module of the Intelligent	Ensuring continuous monitoring of the functioning of complex subsystems, individual subsystems and local ITS projects with the	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of traffic and (or) pedestrian	Implementation of the efficiency control module of the Intelligent Transport System of the Murmansk Region

Project name	Project goal	Project objectives	Project description
Transport System of the Murmansk Region	possibility of setting up ITS operation at different levels depending on changes in the road transport situation, as well as in case of emergency or emergency situations in the functioning of individual subsystems and ITS modules	safety by means of digital technologies; Implementation of digital technologies to address the issues of maintenance of roads and artificial structures, control of traffic violations, traffic management, parking space management	
Implementation of the road works management module of the Unified Management Platform of the Transport System of the Murmansk Region	Ensuring the consolidation of data on ongoing and planned road works to minimize the negative effects on traffic flows with the ability to monitor the condition of roads and transport infrastructure	Improving the comfort of the public transport system using modern digital technologies and automating the coordination of public transport; Ensuring the priority of road traffic and (or) pedestrian safety by means of digital technologies violations of traffic rules, traffic control, parking space management	Implementation of the road works management module of the Unified Management Platform of the Transport System of the Murmansk Region

Republic of Karelia

✓ **Regional project "System-wide measures for the development of the road sector (Republic of Karelia)" (03.12.2018 - 31.12.2024)**

Within the framework of the regional project "System-wide measures for the development of the road sector (Republic of Karelia)", the tasks of introducing ITS in the capital of the region, as well as increasing stationary cameras for photo and video recording of violations of traffic rules on certain sections of federal and regional roads are being solved. On the roads of regional, inter-municipal, local significance, it is planned to place automatic points for the weight and size control of vehicles[84].

The regional project in the Republic of Karelia relates to the State Program of the Republic of Karelia "Development of the transport system".

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Karel**ia" **(2022–2024). Approved by the Order of the Government of the Republic of Karelia dated August 19, 2021, No. 607r-P**

The strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Republic of Karelia was developed on the basis of the Decree of the President of the Russian Federation of July 21, 2020 No. 474 "On the national development goals of the Russian Federation for the period up to 2030", the Decree of the President of the Russian Federation of May 7, 2018 No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024", Decree of the President of the Russian Federation dated 09.05.2017 No. 203 "On the Strategy for the Development of the Information Society in the Russian Federation for 2017 - 2030", Order of the Ministry of Digital Development, Communications and Mass Communications of the Russian Federation dated 18.11.2020, No. 601 "On approval of methods for calculating the forecast values of target indicators of the national development goal of the Russian Federation "Digital Transformation", Passport of the national project "National Program "Digital Economy of the Russian Federation", approved by the Protocol of the meeting of the Presidium Council under the President of the Russian Federation on strategic development and national projects dated June 4, 2019, No. 7, Decree of the Government of the Republic of Karelia dated June 20, 2014, No. 197-P "On approval of the State program of the Republic of Karelia "Development of the transport system" and other documents.[85]

The tasks of digital transformation of the sectors of the economy, social sphere and public administration of the Republic of Karelia, include[86]:

- achievement of "digital maturity" of key sectors of the economy and social sphere
- increased mobility (increased average vehicle speed)
- improving the quality and availability of transport services
- improving the safety of passenger transportation by buses.

[84] Passport of the regional project "System-wide measures for the development of the road sector (Republic of Karelia)".

[85] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Karelia. Approved by the Order of the Government of the Republic of Karelia dated August 19, 2021, No. 607r-P

[86] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Karelia. Approved by the Order of the Government of the Republic of Karelia dated August 19, 2021, No. 607r-P

The Table below highlights the goals, objectives, and description of digital projects in the field of transport and logistics, indicated by the Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Republic of Karelia.

Table 3. Description of the main digital projects (directions) in the field of transport and logistics from the Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Karelia[87]

Project name	Project goal	Project objectives	Project description
Initiative "Digital Twins of Transport Infrastructure Objects" of the "Digital Transformation" project (recommended by federal executive authorities)	Launching a system for monitoring road funds, creating 3D models of all transport infrastructure facilities, developing an information system for accounting and planning work / costs for the design, construction, repair, and maintenance of transport infrastructure facilities, creating mobile measuring laboratories	Reducing the cost of transport companies for fuel; reducing the number of accidents, injuries, and deaths from road accidents; reducing the cost of maintaining roads	1. Reducing the cost of construction of transport infrastructure facilities 2. Reducing the construction time (including design) of transport infrastructure facilities 3. Reducing the number of incidents of destruction of transport infrastructure and related damage 4. Extending the life of transport infrastructure facilities 5. Reducing the cost of maintenance and repair of transport infrastructure facilities
Intelligent Transport System	Improving road safety	Reducing the number of accidents, injuries, and deaths from road accidents; reducing the cost of transport companies for fuel; increasing the speed of response of emergency services. reducing the cost of maintaining roads; increasing the capacity of urban roads	The introduction of modern systems of intelligent traffic control and monitoring of compliance with the rules established in the field of traffic will improve the performance of roads
Digitalization of passenger transportation	Introduction of digital services in public transport	Increasing the environmental friendliness of transport (reducing CO2 emissions); reduction in the number of accidents, injuries and deaths from road accidents	With an increase in the level of control and accounting in the process of passenger transportation, it becomes possible to optimize resource allocation, which allows increasing the number of flights and the quality of the client component

[87]Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Karelia

Republic of Komi

✓ **Regional project "System-wide measures for the development of the road sector (Republic of Komi)". Decree of the Government of the Republic of Komi dated August 19, 2021, No. 402-rg. (03.12.2018 – 31.12.2024)**

Within the framework of the regional project "System-wide measures for the development of the road sector (Republic of Komi)" in the Republic of Komi in the period up to 2024, the tasks of introducing individual elements of the ITS are being solved. On highways of regional or intermunicipal, local importance, it is planned to place automatic points for weight and size control of vehicles. On federal, regional or intermunicipal roads, it is planned to increase the number of stationary cameras for photo and video recording of traffic violations.

The regional project in the Republic of Komi relates to the State Program of the Republic of Komi "Development of the transport system", Subprogram "Improving the quality of management of the development of the transport system"[88].

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Komi**

The strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Komi was developed on the basis of the Decree of the President of the Russian Federation dated May 09, 2017 No. 203 "On the Strategy Development of the Information Society in the Russian Federation for 2017-2030", Decree of the President of the Russian Federation of 07.05.2018 No. 204 "On National Goals and Strategic Objectives for the Development of the Russian Federation for the period up to 2024", Decree of the President of the Russian Federation of 21.07.2020 No. 474 "On the National Development Goals of the Russian Federation for the period up to 2030", Order of the Ministry of Digital Development, Telecommunications and Mass Media of the Russian Federation of November 18, 2020 No. 600 "On Approval of Methods for Calculating Target Indicators of the National Development Goal of the Russian Federation "Digital Transformation". The implementation period of the strategy is up to 2024 inclusive.

The tasks of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Komi, include:

- Increasing the share of state and municipal services provided electronically;
- Integration of existing systems creation of a single digital landscape, elimination of duplication;
- Introduction of modern digital technologies;
- Data driven management;
- Information Security;
- Modeling of activities and situations, forecasting.

In the field of transport and logistics in the Republic of Komi, unlike other Russian regions of the Barents Region, 1 digital project has been singled out - "Digitalization of Passenger Transportation". Its goal is to provide quality services to the population in the field of passenger transportation by road and increase control over the fulfillment of contractual obligations by carriers.

[88] Passport of the regional project "System-wide measures for the development of the road sector (Republic of Komi)"

The main project objectives are to create a unified infrastructure for transport participants and improve the quality of passenger transportation services. As part of the implementation of the project "Digitalization of Passenger Transportation", GPS / GLONASS technologies are being introduced. These technologies will be used for online monitoring of the movement of passenger transport, control over the fulfillment of contractual obligations by carriers.

1.1.6. Federal projects and strategic planning documents in terms of transport carbon footprint reduction

✓ **Federal project "Modernization of passenger transport in urban agglomerations" (01.01.2021 – 31.12.2024)**

Within the framework of the national project "Safe quality roads" the federal project "Modernization of passenger transport in urban agglomerations" is being implemented.

This federal project is aimed at improving the quality of transport services for the population in urban agglomerations, including[89]:

- Increasing the share of the length of the linear infrastructure of urban ground electric transport (contact network, tracks) in urban agglomerations, brought to the normative state within the framework of the federal project;
- Increasing the share of vehicles in urban agglomerations (buses, trams, trolleybuses, suburban railway rolling stock) upgraded under the federal project and having a service life no older than the standard;
- Increased satisfaction with the quality of transport services by public passenger transport in urban agglomerations (the share of users who indicated an improvement in the quality of transport services, for 2021–2024, the baseline is 2020, for 2025–2030, the baseline is 2024).

✓ **Federal project "Clean Air" (November 1, 2018 - December 31, 2024)**

The national project "Ecology" includes the federal project "Clean Air".

The main goal of the project is to reduce the level of atmospheric air pollution in large industrial centers, including a reduction of at least 20 percent of the total volume of pollutant emissions into the atmospheric air in the most polluted city[90].

Key goals of the federal project[91]:

- Reduction in total emissions for the reporting year
- Reducing the number of cities with high and very high levels of air pollution
- Growth in consumption of natural gas as motor fuel
- Achieving a high proportion of citizens who are satisfied with the quality of atmospheric air in large industrial centers.

It is expected to implement comprehensive action plans to reduce emissions of pollutants into the atmosphere in large industrial centers, including the cities of Bratsk, Krasnoyarsk, Lipetsk,

[89] Passport of the federal project "Modernization of passenger transport in urban agglomerations"

[90] Passport of the federal project "Clean Air". Annex to the Protocol of the meeting of the project committee for the national project "Ecology" dated December 21, 2018, No. 3.

[91] Passport of the federal project "Clean Air". Annex to the Protocol of the meeting of the project committee for the national project "Ecology" dated December 21, 2018, No. 3.

Magnitogorsk, Mednogorsk, Nizhny Tagil, Novokuznetsk, Norilsk, Omsk, Chelyabinsk, Cherepovets and Chita, taking into account consolidated calculations of the permissible these cities of a negative impact on the environment, including: the implementation of investment projects to reduce emissions into the atmosphere by mobile sources in the territories of the cities participating in the federal project on the basis of public-private partnerships - public transport, road infrastructure, fuel alternatives.

✓ **Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021, No. 3052-r)**

The Strategy for the Socio-Economic Development of the Russian Federation with Low Greenhouse Gas Emissions until 2050 was developed in pursuance of Decree of the President of the Russian Federation of November 4, 2020, No. 666 "On the Reduction of Greenhouse Gas Emissions", as well as to implement Article 4 of the Paris Agreement dated November 4, 2020. December 12, 2015, signed on behalf of the Russian Federation in New York on April 22, 2016, and adopted by Decree of the Government of the Russian Federation of September 21, 2019, No. 1228 "On the adoption of the Paris Agreement"[92].

This Strategy defines measures to ensure the reduction of greenhouse gas emissions by 2030, considering the maximum possible absorption capacity of forests and other ecosystems and subject to sustainable and balanced socio-economic development of the Russian Federation, and also determines the directions and measures for development with a low level of greenhouse gas emissions up to 2050.[93]

The priority of this Strategy is the fulfillment of the task set in the Message of the President of the Russian Federation to the Federal Assembly of the Russian Federation dated 21.04. 2021 to reduce cumulative net greenhouse gas emissions in the Russian Federation to below those of the European Union between 2021 and 2050, as this will help keep global average temperature rise well below 2 degrees Celsius above pre-industrial levels and efforts to limit temperature rise to 1,5 degrees Celsius.

The Strategy considered 2 scenarios – inertial and target (intensive) scenarios. The inertial scenario provides for the implementation of decisions already made to achieve national goals and objectives of sectoral strategic planning documents. Additional measures, the direct or indirect result of which is the reduction of greenhouse gas emissions, are not considered as a business-as-usual scenario. The inertial scenario does not allow achieving "carbon neutrality" on the planning horizon, while the target (intensive) scenario provides for additional measures to decarbonize economic sectors and increase the absorptive capacity of managed ecosystems[94].

The key task of the target (intensive) scenario is to ensure global competitiveness and sustainable economic growth of the Russian Federation in the context of the global energy transition. Various tools are used to reduce greenhouse gas emissions in various sectors (electricity, carbon - intensive industries, housing and communal services and housing construction, agriculture, industrial and consumer waste management). In the transport sector, it is planned to switch to electric

[92] Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021 No. 3052-r)

[93] Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021 No. 3052-r)

[94] Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021 No. 3052-r)

turbines, a comprehensive electrification of transport is being carried out, and a charging infrastructure is being developed.

To implement this Strategy in the transport sector, it is planned to implement the following measures[95]:

- a large-scale change in the structure of freight and passenger traffic in favor of less carbon -intensive modes of transport;
- the use of new energy-efficient vehicles, large-scale electrification and gasification of public transport, the transition of road transport to hybrid power plants, the promotion of the transition to the use of models with zero emissions of greenhouse gases and pollutants, the promotion of the use of public transport;
- construction of a gas engine and electric charging infrastructure for various categories of transport, providing simplified access for vehicles to fuel with a lower carbon footprint;
- reducing the volume of natural gas consumed in power generation, increasing energy efficiency in technological operations, reducing losses;
- introduction of new transport and information technologies for monitoring and positioning, development and implementation of intelligent information systems for monitoring and managing transport;
- development of transport infrastructure and logistics, which makes it possible to optimize the management of traffic flows, increase the capacity of the transport infrastructure, and increase the average speed of movement [96].

✓ **Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021, No. 3363-r)**

The transport strategy, one of the long-term goals for the development of the transport system until 2030 and for the forecast period until 2035, provides for a low-carbon transformation of the industry. To achieve this goal, the task of increasing the level of technological development and decarbonization of the transport complex has been defined.

According to this Strategy, the State, in the presence of economic and social expediency, will facilitate the transition of transport to alternative energy sources and fuels. The key conditions for the introduction of new types of fuel in transport are[97]:

- development of the production of fuel, fuel cells and engines, providing a cost below the classic internal combustion engines;
- creation of a distribution system for new types of fuel;
- formation of charging infrastructure.

To reduce greenhouse gas emissions in the Russian transport sector, road transport is a priority. Air transport, rail transport, inland waterway and sea transport are also important sectors for subsequent decarbonization, although they have a relatively small specific contribution to greenhouse gas emissions. An important tool for reducing greenhouse gas emissions from the

[95] Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021 No. 3052-r)

[96] Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021 No. 3052-r).

[97] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

transport industry will be the creation of stimulating and regulatory conditions for a large-scale change in the structure of freight and passenger traffic in favor of less carbon -intensive modes of transport.[98]

To reduce the negative impact on the environment in the transport sector, the use of alternative fuels, namely liquefied natural gas, batteries, hydrogen fuel and fuel cells, will be more widely used. In the Russian Federation, the introduction of such energy technologies takes place as part of the development of the energy industry as a whole and is planned by the Energy Strategy of the Russian Federation for the period up to 2035.[99]

To introduce the operation of electric vehicles, it is planned to develop a charging infrastructure, conduct an incentive policy in coordination with the industrial complex and with the participation of legislative bodies.

✓ **State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017, No. 1596)**

The State program of the Russian Federation "Development of the transport system", in addition to solving problems in terms of digital transformation, is also one of the tools to reduce the carbon footprint. One of the priorities for achieving the strategic goals of this program is the renewal of vehicles of all modes of transport. The most important strategic goal of the Program is to improve the integrated security and sustainability of the transport system. Transport must be safe for the life and health of the population. The impact of transport as a source of increased technogenic and environmental hazards should be minimized. The implementation of comprehensive measures to reduce the number and severity of traffic accidents and the negative impact of transport on the environment is one of the priorities of the state transport policy and will ensure the achievement of the national goal "Preservation of the population, health and well-being of people."[100]

In order to achieve one of the goals of public administration and ensuring the national security of the Russian Federation, indicated as increasing the availability of high-quality transport services to ensure the transport mobility of the population, it is planned, in particular, to implement programs to update the fleet of vehicles using various mechanisms (leasing, subsidies, recycling fees), purchase by the constituent entities of the Russian Federation of buses running on natural gas fuel, trams and trolleybuses.

✓ **Decree of the Government of the Russian Federation of April 15, 2014, No. 321 (as amended on December 24, 2021, No. 2352) "On Approval of the State Program of the Russian Federation "Energy Development". Subprogram "Development of the gas motor fuel market" (implementation period December 31, 2024)**

The goal of the State program of the Russian Federation "Energy Development" is a reliable, high-quality, and economically justified supply of the needs of the domestic market for energy carriers, energy and raw materials on the principles of energy saving and energy efficiency, as well as the fulfillment of obligations under foreign contracts. Among the main objectives of the State

[98] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

[99] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

[100] State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

program of the Russian Federation "Energy Development" is to promote the development of the domestic market for natural gas as a motor fuel.

One of the subprograms of the State program of the Russian Federation "Energy Development" is the subprogram "Development of the Gas Motor Fuel Market". In pursuance of the list of instructions of the President of the Russian Federation, as well as in order to stimulate the development of the gas motor fuel market, increase its consumption, expand infrastructure and spread transport using natural gas, in September 2018 the State program of the Russian Federation "Development of Energy" was supplemented by the subprogram "Development of the gas motor fuel market" and the corresponding task to promote the development of the domestic market for natural gas as a motor fuel, as well as measures to develop the gas motor fuel market[101].

The objectives of the subprogram "Development of the gas motor fuel market" are[102]:

- stimulating the expansion of the infrastructure for refueling vehicles with natural gas;
- encouraging the spread of vehicles running on natural gas;
- stimulating an increase in the consumption of natural gas as a motor fuel.

To achieve the strategic goal of developing the gas motor fuel market, it is planned to address the following key issues[103]:

- multiple increase in the number of facilities for refueling vehicles with natural gas and vehicles running on natural gas;
- increase in the available range of natural gas vehicles, comparable in price to analogues on liquid motor fuel.

As part of the implementation of the task to promote the development of the domestic market for natural gas as a motor fuel, within the framework of the subprogram "Development of the gas motor fuel market", it is planned to provide[104]:

- development of gas filling infrastructure for compressed and liquefied natural gas;
- increase in demand for transport equipment using natural gas as motor fuel;
- natural gas transport equipment available in the market, as well as filling equipment;
- regulatory and information support for the development of the gas motor fuel market, including the promotion of natural gas as a motor fuel, and other measures aimed at stimulating demand.

The above directions, in accordance with the subprogram "Development of the gas motor fuel market", refer to the market of both compressed and liquefied natural gas in all major modes of transport to which they are applicable.

✓ **Long-term program for the development of liquefied natural gas production in the Russian Federation, approved by the Decree of the Government of the Russian Federation dated March 16, 2021, No. 640-r**

[101]https://minenergo.gov.ru/node/13792?
[102]https://minenergo.gov.ru/system/download/323/173550
[103]https://minenergo.gov.ru/system/download/323/173550
[104]https://minenergo.gov.ru/system/download/323/173550

The Long -Term Program for the Development of Liquefied Natural Gas Production in the Russian Federation includes an action plan to realize the potential of liquefied natural gas production in the Russian Federation.

The main directions of the Action Plan for the implementation of a long-term program for the development of liquefied natural gas production in the Russian Federation (Appendix No. 3[105]) form:

- Development of large-tonnage LNG production projects;
- Equipment (import substitution) and technologies for the implementation of projects for the production of liquefied natural gas;
- The use of liquefied natural gas for the purpose of autonomous gasification, as well as the creation and modernization of thermal and electric power generation facilities;
- The use of liquefied natural gas as a natural gas motor fuel.

Within the framework of the direction "Use of liquefied natural gas as gas motor fuel" in this Program, the following activities are indicated[106]:

- Improving state regulation aimed at developing filling infrastructure and stimulating the use of transport on liquefied natural gas;
- Stimulating manufacturers of vehicles, special equipment, railway, sea and river transport to produce products that allow the use of liquefied natural gas.

According to this Program, the total potential demand for liquefied natural gas in the gas motor fuel segment by 2035 is estimated at 5,5 million tons (by 2024 - up to 0,8 million tons), and the main share falls on long-haul commercial transportation (up to 1,5 million tons). It is also estimated as a promising direction for mining equipment (up to 1,4 million tons) and bunkering in the main sea areas (Northern Sea Route, Baltic, Black and Sea of Japan) and river transport (together up to 1.2 million tons)[107].

Economically acceptable distances from production points to retail refueling of gas-powered commercial vehicles under existing conditions can be no more than 150-200 km, depending on the level of production capacity utilization. At the same time, this indicator may increase manifold if state support measures are implemented, which will ensure the possibility of reducing capital costs associated with the creation of distribution chains for the sale of liquefied natural gas in the form of natural gas motor fuel by 35 percent. For a qualitative growth in the pace of development of the domestic market for liquefied natural gas, it is planned to simultaneously multiply the number of vehicles running on natural gas fuel, reduce capital costs for the construction of factories and gas stations by more than 35 percent, and significantly increase the production of equipment for the domestic engineering infrastructure to meet domestic orders[108].

✓ Action plan ("Roadmap") for the development of the market for small tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025.

[105] Long-term program for the development of liquefied natural gas production in the Russian Federation, approved. Decree of the Government of the Russian Federation dated March 16, 2021 No. 640-r

[106] Long-term program for the development of liquefied natural gas production in the Russian Federation, approved. Decree of the Government of the Russian Federation dated March 16, 2021 No. 640-r

[107] Long-term program for the development of liquefied natural gas production in the Russian Federation, approved. Decree of the Government of the Russian Federation dated March 16, 2021 No. 640-r

[108] Long-term program for the development of liquefied natural gas production in the Russian Federation, approved. Decree of the Government of the Russian Federation dated March 16, 2021 No. 640-r

Approved by the Decree of the Government of the Russian Federation of February 13, 2021, No. 350-r.

The purpose of the action plan for the development of the market for small-tonnage liquefied natural gas and gas motor fuel in the Russian Federation is to increase the volume of production and use of small-tonnage liquefied natural gas for gasification and as a motor fuel. The main tasks include stimulating investment activities in the field of small-tonnage production and consumption of liquefied natural gas, stimulating investment activities in the development of gas filling infrastructure[109].

The plan includes, among other things, the following main activities:

- Economic measures to stimulate the transition of municipal and regional transport to liquefied natural gas;
- Removal of administrative barriers for the construction of low-tonnage facilities for the production, storage and use of liquefied natural gas and the operation of vehicles running on natural gas;
- Development of Russian technologies for low tonnage liquefied natural gas;
- Stimulating the production of vehicles using liquefied natural gas as a motor fuel, and their components;
- Stimulation of demand for natural gas as a natural gas motor fuel in the public sphere[110].

✓ **Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 (Decree of the Government of the Russian Federation of August 23, 2021, No. 2290-r)**

The Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 is a document synchronized with other program documents of the Russian Federation, aimed at creating regulatory, investment, infrastructure, and technological conditions to ensure competitiveness in the global market of electric road transport and its components created in the Russian Federation.

In this Concept, electric road transport means vehicles of categories M1, M2, M3, N1, N2, N3, L7 with improved energy efficiency and environmental friendliness, operating on alternative energy sources (traction battery and hydrogen fuel cell) (hereinafter referred to as the electric vehicle), and the infrastructure that ensures their functioning.

The purpose of this Concept is to determine the key areas of state policy in the field of development of production and use of electric vehicles in the Russian Federation, which will ensure the achievement of the target indicator to produce electric vehicles established by the Concept[111].

The objectives of the Concept are[112]:

[109] Action plan ("Roadmap") for the development of the market for small-tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025. Approved by the Decree of the Government of the Russian Federation of February 13, 2021, No. 350-r.

[110] Action plan ("Roadmap") for the development of the market for small-tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025. Approved by the Decree of the Government of the Russian Federation of February 13, 2021, No. 350-r.

[111] Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 (Decree of the Government of the Russian Federation of August 23, 2021 No. 2290-r)

[112] Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 (Decree of the Government of the Russian Federation of August 23, 2021 No. 2290-r)

- development on the territory of the Russian Federation of a production base for the production of electric motor vehicles;
- building up the technological competencies of national manufacturers of automotive equipment and components by deepening the localization of the production of electric vehicles;
- bringing to the market products with fundamentally new properties in the field of electric propulsion, stimulating demand for them, as well as organizing after-sales service;
- creation on the territory of the Russian Federation of the necessary engineering and transport infrastructure;
- removal of existing regulatory barriers to the use of electric road transport.

The term for the implementation of the Concept is 2021–2030.

✓ **The Concept for the Development of Hydrogen Energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021, No. 2162-r)**

The concept for the development of hydrogen energy in the Russian Federation (hereinafter referred to as the Concept) defines the goals, objectives, strategic initiatives, and key measures for the development of hydrogen energy in the Russian Federation for the medium term until 2024, the long term until 2035, as well as the main guidelines for the future until 2050. This Concept was developed in accordance with the action plan "Development of hydrogen energy in the Russian Federation until 2024", approved by the Order of the Government of the Russian Federation of October 12, 2020, No. 2634-r.

To achieve the goals of the Paris Agreement on Climate Change, the Russian Federation is implementing a state climate policy aimed at reducing and preventing anthropogenic emissions of greenhouse gases, including by expanding the scope of energy carriers with a low carbon footprint and introducing the best available technologies. Hydrogen can be used for the accumulation, storage and delivery of energy and is considered as a promising energy carrier and a tool for solving the problems of developing a low-carbon economy and reducing anthropogenic impact on the climate. The main advantages of hydrogen are the possibility of obtaining it from various sources and the absence of carbon dioxide emissions when it is used as an energy carrier[113].

The use of hydrogen in the domestic market of the Russian Federation will help attract investment, remove external economic risks, and fulfill obligations in the field of combating climate change. First of all, the use of hydrogen technologies can be carried out at export-oriented industrial enterprises, since the use of hydrogen will help reduce the risks associated with cross-border carbon regulation and reduce the carbon footprint of exported products.

In addition, priority areas should be the development of hydrogen transport, robotics, local production, and use of hydrogen.

The composition of strategic initiatives and key measures for solving the problems of developing hydrogen energy in the Russian Federation, among others, includes "production and implementation in various sectors of the economy of the Russian Federation of industrial products for hydrogen energy, including installations for the production of hydrogen and energy mixtures based on it, electrolyzers, systems storage, liquefaction and transportation, fuel cells, gas turbines, hydrogen power plants, hydrogen filling stations, hydrogen transport and robotics"[114].

[113] The Concept for the Development of Hydrogen Energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021 No. 2162-r)

[114] The Concept for the Development of Hydrogen Energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021 No. 2162-r)

As promising industries for the introduction of domestic hydrogen energy technologies, this Concept considers not only the metallurgical industry, housing and communal services, the production of materials and components for fuel cells, gas turbines and hydrogen power plants based on them, but also transport and robotics.

As hydrogen energy technologies, the development of which in this Concept is planned to be organized as a priority and which should be brought to industrial implementation on the basis of the established scientific and technological infrastructure, technologies for the use of hydrogen energy carriers are highlighted, among other things - alkaline, solid polymer and solid oxide fuel cells, internal combustion engines and gas turbines, hydrogen power plants for transport (automobile, railway, water, air), stationary and mobile power plants on fuel cells, hydrogen shut-off stations, hydrogen transport, robotics.

To solve the problem of creating local (regional) markets for the use of hydrogen, along with the creation of hydrogen clusters, among other things, the following are provided[115]:

- creation of prototypes of hydrogen automobile (primarily buses and trucks) and rail transport, followed by the implementation of pilot projects for the use of hydrogen transport in large cities in order to reduce the environmental burden;
- creation of the necessary infrastructure for hydrogen transport (gas stations).

1.1.7. Industry and corporate strategic planning documents in terms of carbon footprint reduction

✓ **Order of JSC Russian Railways dated May 12, 2014, No. 1143r "Environmental Strategy of JSC Russian Railways for the period up to 2017 and for the perspective up to 2030"**

The environmental strategy of JSC Russian Railways was developed in order to minimize the negative impact of JSC Russian Railways on the environment and improve the environmental management system.

The assessment of prospects and strategic alternatives for the development of environmental activities of JSC Russian Railways in this Environmental Strategy is formed on the basis of three development scenarios - "optimistic" (with a sufficient level of investment in environmental activities, significant improvements in environmental protection), "conservative" (lower level of funding, determines gradual improvement in environmental performance), "pessimistic" (lack of opportunities for the necessary funding contributes to maintaining current performance). The environmental strategy is oriented towards the conservative development scenario as the most probable one[116].

As part of the implementation of this Strategy in the field of atmospheric air protection, the following tasks should be solved:

- reduction of emissions of harmful substances into the atmosphere from stationary sources, including greenhouse gas emissions;
- reduction of emissions of harmful substances into the atmosphere from mobile sources, including greenhouse gas emissions.

[115] The Concept for the Development of Hydrogen Energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021 No. 2162-r)

[116] Order of JSC Russian Railways dated May 12, 2014, No. 1143r Environmental strategy of JSC Russian Railways for the period up to 2017 and for the future up to 2030 »

The main emissions of pollutants into the atmosphere from railway transport occur as a result of the combustion of fossil fuels by boilers, diesel locomotives, motor vehicles, and self-propelled special rolling stock. In this regard, this Strategy provides for the following solutions for rolling stock[117]:

- expansion of the area for the use of electric traction;
- development and implementation of new economically and environmentally efficient power plants;
- development and implementation of locomotives using alternative fuels to diesel (gas turbine locomotives, gas diesel locomotives, etc.).

The technical re-equipment of JSC Russian Railways, which ensures a reduction in environmental impact, includes, among other things, the following main activities:

- replacement of obsolete engines with modern, energy-efficient and more eco-logical ones during the overhaul of diesel locomotives;
- introduction of new, energy-efficient, and environmentally friendly traction rolling stock.

In this Strategy it is noted that JSC Russian Railways pays great attention to the issue of updating the rolling stock fleet and, accordingly, increasing its environmental friendliness. JSC Russian Railways together with leading machine-building plants and transport institutes have developed models of locomotives recommended for production using gas motor fuel, two- and three-diesel shunting locomotives. In addition, the Strategy notes that a promising sample of a shunting locomotive with a full hybrid power plant is being tested for further mass use.

✓ **Decree of the Government of the Russian Federation of March 19, 2019, No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"**

By 2025, within the framework of the Long-term Development Program of the open Joint Stock Company "Russian Railways", among other general corporate tasks, the renewal of the rolling stock fleet, including traction, is being set, considering the conclusion of life cycle contracts with manufacturers.

The choice of priorities for JSC Russian Railways in the field of rational environmental management and improving environmental safety until 2025 is determined by the Fundamentals of State Policy in the field of environmental development of the Russian Federation for the period until 2030, approved by the President of the Russian Federation on April 30, 2012, and by Presidential Decree of the Russian Federation dated May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024".

Taking into account the priorities of state policy in the field of environmental protection, the goal of JSC Russian Railways in the field of environmental protection is to increase the level of environmental safety, environmental management and conservation of natural systems[118].

✓ **Environmental policy of PJSC Gazprom**

[117] Order of JSC Russian Railways dated May 12, 2014, No. 1143r Environmental strategy of JSC Russian Railways for the period up to 2017 and for the future up to 2030»

[118] Decree of the Government of the Russian Federation of March 19, 2019 No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"

Key strategic documents of PJSC Gazprom in terms of environmental protection[119]:

- Environmental policy of PJSC Gazprom;
- PJSC Gazprom Comprehensive Environmental Program for 2020–2024;
- Policy of PJSC "Gazprom" in the field of energy efficiency and energy saving;
- PJSC Gazprom Energy Saving and Energy Efficiency Program;
- Roadmap for the greenhouse gas emission management system in Gazprom Group companies for the period up to 2030;
- Innovative Development Program of PJSC Gazprom until 2025

PJSC Gazprom, as part of its environmental policy, declares its commitment to the principles of sustainable development, which means a balanced and socially acceptable combination of economic growth and preservation of a favorable environment for future generations. The Environmental Policy defines obligations and mechanisms for ensuring environmental safety, including in the development of hydrocarbon deposits on the continental shelf and in the Arctic zone of the Russian Federation. One of the mechanisms of PJSC Gazprom's environmental policy is the comprehensive development of the gas motor fuel market in the Russian Federation and abroad[120].

A significant role in low-carbon development is played by the transition of the transport sector to natural gas. PJSC Gazprom is implementing a large-scale project to increase the use of natural gas as a motor fuel. Currently, PJSC Gazprom, together with the administrations of the constituent entities of the Russian Federation, is implementing a number of pilot projects to accelerate the development of the gas filling network in the Belgorod, Kaliningrad, Leningrad, Rostov Regions and in St. Petersburg. Along with the construction of new stations for refueling with natural gas, the projects involve the development of a fleet of gas-powered vehicles, the creation of new service centers for the re-equipment and maintenance of such equipment. In 2020, the Company built more than 30 new gas filling facilities: modern CNG filling stations, modules for filling gas at existing gas stations, as well as sites for accommodating mobile gas filling trucks.

Gazprom Group continues to convert its own equipment to natural gas. As part of Gazprom's Program to expand the use of natural gas as motor fuel in its own transport in 2020, subsidiaries of the main activity of PJSC Gazprom (excluding LLC Gazprom Kyrgyzstan, CJSC Gazprom Armenia, OJSC Gazprom Transgaz Belarus) purchased 863 units of gas-powered vehicles and 8 units of mobile gas refueling infrastructure (mobile CNG, mobile automobile gas refueling). For the current period, vehicles running on methane in Gazprom Group companies account for almost 60% of the vehicle fleet. An important area of Gazprom's work is the use of liquefied natural gas (LNG) for rail and water transport. The company has started implementing a project for the construction of a gas locomotive refueling point at the Voynovka station of the Sverdlovsk railway. It is planned to create such facilities on the Obskaya-Bovanenkovo-Karskaya railway. In 2020, in the water area of the Volga River in Zelenodolsk, the country's first gas-powered pleasure-excursion passenger ship "Chaika-LNG" was launched. Projects in the field of bunkering of sea vessels are planned[121].

[119] Gazprom Group Sustainability Report 2020. https://www.gazprom.ru/f/posts/57/982072/sustainability-report-ru-2020.pdf

[120] Ecological policy of OAO "Gazprom". Approved by the Resolution No. 21 of the Gazprom Management Committee dated May 25, 2015

[121] PJSC Gazprom Environmental Report 2020

Switching transport to natural gas significantly reduces emissions both at the stage of fuel use and throughout the entire technological chain of its production.

PJSC Gazprom establishes environmental targets based on annually determined significant environmental aspects, develops, and implements programs of environmental protection measures. The company's corporate environmental goals are set for a three-year period.

Activities aimed at achieving the Corporate Environmental Goals 2020–2022 are implemented in accordance with the Comprehensive Environmental Program of PJSC Gazprom for the period 2020–2024. This Program is a medium-term planning document that allows systematizing the entire list of measures and activities aimed at improving the efficiency of environmental protection management, ensuring environmental safety, rational use of natural resources and energy saving. One of the goals of this program is to reduce greenhouse gas emissions from natural gas transportation[122].

One of the main goals determined by the updated Program of Innovative Development of PJSC Gazprom until 2025 is to reduce the negative impact on the environment during production activities. To assess the results achieved the indicator of reduction of specific natural gas emissions in CO2-equivalent (KPI) is used[123].

In the Roadmap of the greenhouse gas emissions management system in Gazprom Group companies for the future up to 2030, one of the company's goals is also to reduce specific greenhouse gas emissions.

Regarding the development of hydrogen energy, PJSC Gazprom plans to take part in the implementation of pilot projects in the medium term as part of the action plan "Development of hydrogen energy in Russian Federation to 2024"[124]. At present, PJSC Gazprom is implementing projects to develop innovative technologies to produce hydrogen from natural gas without CO2 emissions based on plasma pyrolysis of methane, pyrolysis of methane in a metal melt, as well as a project for the production and use of methane-hydrogen mixtures for its own energy needs[125].

✓ **Environmental policy of PJSC Gazprom Neft**

The main corporate documents of PJSC Gazprom Neft in the field of the company's environmental policy are:

- Corporate Standard for Monitoring and Accounting for Greenhouse Gas Emissions;
- Energy policy in the field of development and production of oil and gas;
- Technical policy in the field of energy efficiency;
- Block of logistics, processing and marketing;
- Biodiversity Conservation Program;
- Program for the utilization and improvement of the efficiency of the use of associated petroleum gas;
- Policy in the field of industrial, fire, transport, environmental safety, labor protection and civil protection.

[122] Gazprom Group Sustainability Report 2020. https://www.gazprom.ru/f/posts/57/982072/sustainability-report-ru-2020.pdf

[123] Gazprom Group Sustainability Report 2020. https://www.gazprom.ru/f/posts/57/982072/sustainability-report-ru-2020.pdf

[124] Gazprom Group Sustainability Report 2020. https://www.gazprom.ru/f/posts/57/982072/sustainability-report-ru-2020.pdf

[125] PJSC Gazprom Environmental Report 2020

PJSC Gazprom Neft in its activities relies on the following principles of sustainable development, which it consistently integrates its strategy and operations[126].

- Respect for natural ecosystems;
- Improving the quality of life in the regions of presence;
- Safe production;
- Consumer care;
- Employee health protection.

«The strategic goals in the field of environmental policy of the company are[127]:

- consistent reduction of environmental impact (including climate);
- organization of safe production based on the analysis and management of production risks to ensure a minimum level of their impact;
- consistent implementation of the best world practices in the field of environmental safety.

The main areas of work of "Gazprom Neft" in terms of environmental safety:

- Risk management in the field of environmental safety;
- Environmental monitoring and industrial environmental control;
- Management of the system for warning and localization of emergencies;
- Commissioning of environmental facilities;
- Commissioning of facilities for saving and increasing the efficiency of resource use;
- Implementation of environmental programs;
- Development and implementation of environmental technologies;
- Staff training and development of a culture of environmental safety.

The company strives to operate in an environmentally friendly manner with a stated goal of 9,7% reduction in greenhouse gas emissions (direct emissions + indirect emissions)[128].

Priorities of Gazprom Neft in the field of climate impact management:

- Reducing greenhouse gas emissions and APG utilization;
- Increasing the share of low- carbon projects;
- Use of new renewable energy sources (RES).

Gazprom Neft is implementing the Development Strategy until 2030, which involves the development of the infrastructure of producing assets and the modernization of oil refineries with the introduction of energy efficient technologies, which will reduce resource consumption and reduce greenhouse gas emissions. The Company is constantly looking for technically feasible and economically feasible tools to reduce greenhouse gas emissions, primarily through the implementation of projects to increase the level of APG utilization. The Company's goal is to increase the level of useful use of associated gas (at least 95% in 2022) in the face of growing production[129].

✓ **Environmental policy of PJSC MMC Norilsk Nickel**

In 2020, after a large-scale accident at the emergency fuel storage facility and its leakage on May 29, 2020, PJSC MMC Norilsk Nickel developed a new "Comprehensive Environmental

[126] Sustainability Report. 2020 PJSC Gazprom Neft.
[127] Sustainability Report. 2020 PJSC Gazprom Neft.
[128] Sustainability Report. 2020 PJSC Gazprom Neft.
[129] Sustainability Report. 2020 PJSC Gazprom Neft. https://www.gazprom-neft.ru/files/documents/PDF_2020.pdf

Strategy (Strategy in the field of ecology and climate change), which contains the following goals and objectives in the field of climate change and improve air quality, the solution of which by 2030 should ensure the leadership of PJSC MMC Norilsk Nickel among other metallurgical companies in the field of sustainable development[130]:

- In terms of climate change, the goal of the environmental strategy is to increase the production of metals necessary for the transition to a green economy around the world, while keeping greenhouse gas emissions at a minimum level for the mining and smelting industry. To achieve the goal, it is planned:
  - retention of production greenhouse gas emissions while increasing production volumes,
  - maintaining its position in the first quartile of the global nickel industry in terms of specific greenhouse gas emissions per ton of Ni equivalent,
  - promoting an increase in the share of low-carbon energy consumption,
  - climate risk management through the development of appropriate strategies and the promotion of energy-efficient low-carbon technology strategies by local communities in the Norilsk industrial region and the Murmansk Region,
  - supporting the transition to a low-carbon paradigm by promoting innovative developments and scaling up new solutions;
- In terms of improving air quality, the goal of the environmental strategy is to protect the environment and public health from pollutants in the atmosphere with strict compliance with legislative norms and rules in terms of established emission standards. To achieve the goal, it is planned:
  - reduction of the absolute level of SO2 emissions by 2025 at the Kola Division and the Polar Division (from the values of 2015),
  - maintaining other atmospheric emissions at one of the lowest levels in the industry,
  - implementation of an air quality monitoring system to assess and ensure its purity, as well as taking measures to reduce dust emissions generated during mining,
  - compliance with the best world practices and standards for disclosure of information on emissions into the atmosphere.

As part of the updated strategic vision, PJSC MMC Norilsk Nickel revised approaches to environmental risk management. In addition to climate change and improving air quality, PJSC MMC Nornickel's comprehensive environmental policy includes water resources, tailings and waste, land resources, biodiversity[131].

✓ **Environmental policy of PJSC Phosagro**

Priority areas of the environmental strategy of PJSC Phosagro in accordance with the Environmental Policy of PJSC Phosagro (approved by the decision of the Board of Directors of PJSC PhosAgro dated April 14, 2021):

- reduction of negative impact on the environment;
- preservation of natural ecological systems;
- continuous improvement of the environmental management system.

[130] Strategy in the field of ecology and climate change. Norilsk Nickel Group. June 2021
[131] https://www.nornickel.ru/sustainability/environment/air/

In 2020, PJSC Phosagro approved the Climate Strategy (until 2028), which includes the analysis of climate scenarios, the identification of climate risks, the determination of science-based target levels of greenhouse gas emissions, as well as measures to achieve them.

The climate strategy of PJSC Phosagro defines the following goals[132]:

- reduction (stabilization) of greenhouse gas emissions with an increase in production;
- improving the energy and environmental efficiency of the main technological processes;
- reduction of energy and carbon intensity of manufactured products;
- entering new emerging markets for green products;
- maintaining and expanding existing market niches by ensuring the competitiveness of PhosAgro products in terms of their energy and carbon intensity.

When implementing the Climate Strategy of PJSC Phosagro, the following priorities have been identified[133]:

- Monitoring greenhouse gas emissions, setting target levels of greenhouse gas emissions at all stages of production and achieving targets;
- Expansion of the zone of climate-responsible business in the Russian Federation and globally, as a result of responsible selection of suppliers;
- Reduction of climate risks of production and business processes, use of emerging climate opportunities;
- Increasing the openness and transparency of the company, including by expanding interaction with stakeholders and international platforms in order to promote the climate agenda;
- Inclusion of climate issues in all internal management and decision-making processes in the company.

Measures for the implementation of the climate strategy are formed as part of the Low-Carbon Transition Plan and the plan for interaction with participants in the value chain. The plan (priority areas) of the low-carbon transition is aimed at the economic development of PhosAgro with the priority of minimizing greenhouse gas emissions. The plan of interaction with participants in the value chain is a structure of interaction with all stakeholders in the process of business operation - from the provision of raw materials and materials, the production of a product to its sale and after-sales service. The main goal of the value chain engagement plan is to manage greenhouse gas emissions along the value chain[134].

[132] Disclosure of Phosagro information related to climate change. TCFD report 2020. https://www.phosagro.ru/upload/iblock/35c/35c2ee0bc879eb911cb2aa1a4dddf722.pd f

[133] Disclosure of Phosagro information related to climate change. TCFD report 2020. https://www.phosagro.ru/upload/iblock/35c/35c2ee0bc879eb911cb2aa1a4dddf722.pd f

[134] Disclosure of Phosagro information related to climate change. TCFD report 2020. https://www.phosagro.ru/upload/iblock/35c/35c2ee0bc879eb911cb2aa1a4dddf722.pd f

1.1.8. Regional strategic planning documents in part in terms of carbon footprint reduction

Arkhangelsk Region

✓ **Regional program for gasification of housing and communal services, industrial and other organizations in the Arkhangelsk Region for 2021–2030. Approved by the Decree of the Government of the Arkhangelsk Region of February 11, 2021, No. 65-pp**

The purpose of the regional program of gasification of housing and communal services, industrial and other organizations in the Arkhangelsk Region for 2021-2030 is a comprehensive solution to economic, environmental, energy and social problems for the sustainable development of municipalities of the Arkhangelsk Region through gasification, introduction and expansion of the use of a highly efficient and safe energy resource - natural gas[135].

The objectives of this Program are:

- ensuring the availability of natural gas as a type of fuel for the municipalities of the Arkhangelsk Region;
- reconstruction of existing and construction of new boiler houses for the use of natural gas as a type of fuel;
- expanding the use of natural gas.

In terms of expanding the scope of the use of natural gas, one of the measures is the transfer of motor vehicles to natural gas[136].

Murmansk Region

Documents of the regional level in the Murmansk Region regarding the expansion of the use of natural gas and the transition of vehicles to natural gas are under development. The slowdown in strategic planning processes in this area in the Murmansk Region is due to infrastructural limitations (lack of a main network, high cost of transporting liquefied natural gas).

Republic of Karelia

✓ **Regional program "Gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2022-2030". Approved by the Order of the Government of the Republic of Karelia dated February 15, 2022, No. 120r-P.**

The goal of the regional program for gasification of housing and communal services, industrial and other organizations in the Republic of Karelia is a comprehensive solution of economic, environmental, energy and social problems for the sustainable development of municipalities of the Republic of Karelia through gasification, introduction, and expansion of the use of a highly efficient and safe resource - natural gas[137].

The objectives of the regional program are[138]:

[135] Decree of the Arkhangelsk Region of February 11, 2021, No. 65-pp "On Approval of the Regional Program for Gasification of Housing and Communal Services, Industrial and Other Organizations in the Arkhangelsk Region for 2021–2030"

[136] Decree of the Arkhangelsk Region of February 11, 2021, No. 65-pp "On Approval of the Regional Program for Gasification of Housing and Communal Services, Industrial and Other Organizations in the Arkhangelsk Region for 2021–2030"

[137] https://gov.karelia.ru/upload/iblock/c56/120r_P.pdf

[138] Passport of the regional program "Gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2022-2030". Approved by the Order of the Government of the Republic of Karelia dated February 15, 2022, No 120r-P

- ensuring the availability of natural gas as a type of fuel for the municipalities of the Republic of Karelia;
- reconstruction of existing and construction of new boiler houses for the use of natural gas as a type of fuel;
- expanding the use of natural gas.

One of the measures to achieve the goals of this regional program is the conversion of vehicles in the Republic of Karelia to natural gas[139].

Republic of Komi

✓ **Decree of the Government of the Republic of Komi No. 467-r dated October 8, 2021 "On approval of the action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)".**

The action plan ("road map") "Use of gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021-2025)" was developed to ensure a sustainable reduction in the negative impact of road transport on the environment in the Republic of Komi.

The purpose of the action plan is to expand the use of compressed natural gas in the Republic of Komi to improve the energy efficiency of the economy (reducing the unit costs of transport enterprises for fuels and lubricants, increasing the engine life of engines and the overhaul mileage of vehicles) and reducing the negative impact on the environment (reducing harmful man-made emissions into the atmosphere due to the introduction of CNG in transport as a motor fuel)[140].

The main objectives of the action plan are[141]:

- Expansion of the fleet of vehicles running on compressed natural gas;
- Development of gas filling infrastructure on the territory of the Republic of Komi;
- Expansion of the network and scope of services of service centers for the maintenance of vehicles running on compressed natural gas.

1.1.9. List of priority strategic directions of development, their regional and sectoral structure

As a result of the analysis of the regulatory framework for strategic planning, the documents in its composition were ranked according to their importance (according to the criteria for the compliance of plans with real project initiatives in the regions) and key documents were identified that determine the development of ITS and transport carbon footprint reductio in the Russian segment of the Barents Region and priority strategic directions for specified areas at the federal, regional and sectoral levels:

3) In terms of strategic directions for the development of ITS:

[139] Passport of the regional program "Gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2022-2030". Approved by the Order of the Government of the Republic of Karelia dated February 15, 2022, No 120r-P

[140] Decree of the Government of the Republic of Komi No. 467-r dated October 8, 2021 "On approval of the action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)"

[141] Decree of the Government of the Republic of Komi dated October 8, 2021, No. 467-r "On approval of the action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)"

- ***The transport strategy of the Russian Federation until 2030 with a forecast for the period up to 2035*** defines such strategic directions as the introduction of integrated transport services (Mobility as a Service / MaaS, Freight - as -a-Service), digitalization of cargo flows (tracking the movement of goods, intelligent analytics of cargo flows), digitalization of vehicles (implementation of advanced driver assistance systems, unmanned vehicles), digitalization of transport infrastructure, including ITS, digital twins of transport infrastructure facilities, predictive repairs of transport infrastructure facilities, digital terminals (passenger, cargo, checkpoints across the state border RF).
- ***The federal project "System-wide measures for the development of the road sector" (until 2024), implemented within the framework of the National project "Safe quality roads"*** defines strategic guidelines and targets across the Russian Federation in terms of solving the problems of introducing ITS in urban agglomerations of over 300 thousand people, equipping individual sections of highways and artificial structures of federal significance with elements of ITS, equipping individual sections of highways and artificial structures of regional significance with elements.
- ***The federal project "Information Infrastructure" (until 2024) as part of the national program "Digital Economy of the Russian Federation"*** is aimed at solving the problems of forming the concept and technical requirements for covering the transport infrastructure with communication networks for data transmission systems, including GLONASS coordinate-time information, and multi-position surveillance systems, the implementation of measures to cover priority transport infrastructure facilities with communication networks with broadband wireless data and voice transmission capabilities necessary for the development of ITS and narrow-band communication networks for collecting telemetry information built using LPWAN technology, providing coverage of federal highways with radiotelephone communications.
- ***Methodological recommendations for the development of applications (including local projects for the creation and modernization of intelligent transport systems) of the constituent entities of the Russian Federation for receiving other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation in order to implement the measure "Implementation of intelligent transport systems that provide for the automation of traffic control processes in urban agglomerations, including cities with a population of more than 300,000 people"*** defines the requirements for applications from the constituent entities of the Russian Federation for other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation for the purpose of introducing ITS, and also contains recommendations for the creation, development and operation of ITS in urban agglomerations (including priority ITS services).
- ***The digitalization program in the road sector in the Russian Federation (until 2030)*** includes activities to create the concept of a national ITS, a federal platform for the ITS network, to introduce ITS in urban agglomerations, to create regional platforms and integrate them with the federal ITS platform.
- ***Regional projects "System-wide measures for the development of the road sector in the Arkhangelsk Region, Murmansk Region, the Republic of Karelia, the Republic of Komi (until 2024)"*** are aimed at solving the problems of introducing the ITS system in the capitals of the regions, as well as individual elements of the ITS on roads of federal and regional significance (stationary cameras for photo and video recording of violations, automatic points for weight and size control of vehicles).

- ***Strategies in the field of digital transformation of sectors of the economy, social sphere and public administration of the Arkhangelsk Region, Murmansk Region, the Republic of Karelia, the Republic of Komi for the period up to 2024*** **solve** the problems of digital transformation of economic sectors, including the implementation of ITS, as well as the implementation of individual subsystems and modules. The strategies include such projects as "Digital management of the transport complex of the Russian Federation", "Digitalization for transport security", "Digital twins of transport infrastructure facilities", "Intelligent transport system, etc.

4) In terms of strategic directions for the development of the transport carbon footprint reduction:

- **Strategy for socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050** defines measures to ensure the reduction of greenhouse gas emissions by 2030 the use of new energy-efficient vehicles, the transfer of road transport to hybrid power plants, the promotion of public transport, the construction of a gas engine and electric charging infrastructure.
- **The federal project "Modernization of passenger transport in urban agglomerations" (until 2024)** is aimed at updating the fleet of vehicles in urban agglomerations (buses, trams, trolleybuses, suburban railway rolling stock).
- **Federal project "Clean Air" (until 2024)** as part of the national project "Ecology" determines the implementation of investment projects to reduce emissions into the atmosphere from mobile sources in urban areas based on public-private partnerships - public transport, road infrastructure, fuel alternatives (in particular, measures to renew the urban electric transport fleet).
- **The subprogram "Development of the gas motor fuel market" (until 2024)**[142], developed within the framework of the State Program of the Russian Federation "Energy Development", is aimed at expanding the infrastructure of the gas filling infrastructure for compressed and liquefied natural gas, popularizing and increasing demand for natural gas vehicles, increasing the available range of natural gas vehicles.
- **Environmental strategy of JSC Russian Railways for the period up to 2017 and for the future up to 2030** has been developed to reduce emissions of harmful substances into the atmosphere from mobile sources, including greenhouse gas emissions, provides for the development and introduction of new economically and environmentally efficient power plants, locomotives using alternative diesel fuels (gas turbine locomotives, gas-thermal locomotives, etc.).
- **Regional programs for gasification of housing and communal services, industrial and other organizations for 2021 - 2030 in the Arkhangelsk Region, the Republic of Karelia** are aimed at expanding the scope of natural gas use, including through the conversion of motor vehicles to natural gas in these regions**.**
- **The action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)"** is aimed at expanding the fleet of vehicles running on compressed natural gas, developing gas filling infrastructure, as well as a network of service centers in the Republic of Komi.

[142]Now, the program has been temporarily canceled and is being reformatted by the Government of the Russian Federation for the purposes of a larger implementation.

1.1.10. Logic of development and transport carbon footprint reduction in the Russian segment of the Barents Region

In accordance with these plans, it is advisable to indicate the following as a general systemic logic for the development of ITS and transport carbon footprint reduction regarding the Russian segment of the Barents Region:

Regarding the development of ITS

1. The Russian Federation consistently ensures a large-scale digital transformation of the transport industry and related areas of activity (communications, roads, navigation, public administration, security, customs, etc.) to achieve multiplication of the effects of predominantly budgetary financing of projects at the expense of the federal budget within the framework of National projects. Digitalization is a priority for all regions, they have developed appropriate strategies, including in relation to transport and logistics.
2. Digital transformation involves the development of tools that provide the accumulation and analysis of big data on traffic flows and their use to optimize the functioning of transport systems to ensure their safe and sustainable operation, reduce transaction costs and losses of road users, prioritize public transport, reduce the burden on the environment, ensure effective management of the life cycle of road infrastructure.
3. In the context of objective budgetary, technological, infrastructural, geographic and personnel constraints, the priorities in building ITS are to cover the largest urban agglomerations with a population of more than 300 thousand people (mainly the capitals of regions with suburbs) with such systems. This makes it possible to ensure the maximum return from the introduction of systems, measured in technical and economic indicators, including the impact on the growth of the regional gross product, the quality of life of the population, the efficiency and safety of transportation.
4. The development of ITS in the urban agglomerations of the Russian segment of the Barents Region implies, in accordance with the architecture approved by the Ministry of Transport of the Russian Federation, the potential for transition from the creation of subsystems in functional areas (weight and dimension control, digital twins of the road network, photo and video recording of violations, etc.) to the creation of platform solutions in the region and their integration into the federal network. This potential has not yet been fully realized, including due to existing budgetary, personnel and technological constraints.
5. The architecture and standardization of ITS solutions in the Russian segment of the Barents Region allows in the future to develop interaction and data exchange between national and regional transport systems using the Datex protocol II, the use of standardized solutions based on ITS - G 5 will allow the development of solutions for connected cars and "smart" roads throughout the Barents Region, harmonized emergency communication systems Glonass / eCall will reduce the consequences of accidents and emergencies on transport routes. The braking factor for increasing the connectivity of national transport systems is the difference in the frequencies of the promising cellular communication standard 5 G, systemic differences will lead to constraints in the use of v2x-solutions in the Barents Region.

6. State and corporate solutions are being widely implemented (including in companies with state participation, infrastructure managers)[143] in terms of industry and local ITS in the field of sea transport and railways, aviation transport, which provide digital transformation of the processes of managing the movement of vehicles and cargo and passengers, optimization of navigation, safety and speed control, traceability of traffic parameters and cargo condition. Due to the scale, these decisions form the main positive effect on the main transport corridors for the movement of goods in the East-West, North-South directions.

In terms of transport carbon footprint reduction

1. The Russian Federation, as one of the world leaders in natural gas production, sets priorities in the field of sustainable development in transport using natural gas as a source of reducing greenhouse gas emissions. Practical solutions in this area are widely presented for automobile (passenger, freight and public) transport and sea vessels, tests of railway equipment for main and industrial routes are being carried out. The development of filling stations infrastructure within the framework of regional gasification programs remains one of the key priorities of the sustainable development policy. The greatest effect for the transport carbon footprint reduction is expected from the development of the movement of LNG-powered ships along the Northern Sea Route.
2. The development of the movement of modern comfortable public transport with low floor rolling stock within the framework of the Transport Reform in the Russian Federation is being implemented in the Barents Region in accordance with the implementation of the National Goals and relevant federal projects. The modernization of the rolling stock to models with a higher environmental class and the development of a network of electric transport routes (trolleybuses) are combined with solutions in the field of ITS and transport planning focused on traffic optimization, comfortable intervals, and traffic regularity. Taken together, the logic of public transport development is focused on reducing the number of regular trips by cars and small-capacity commercial buses (route taxis) with a corresponding effect in the form of reducing CO2 emissions and improving the quality of life of the population.
3. The development of vehicles using hydrogen fuel and electric vehicles is declared as a priority in the Russian Federation, but is limited by macroeconomic realities and sanctions, the physical and technical characteristics of fuel and batteries for such vehicles, the lack of mass production of such vehicles within the Russian Federation with a high degree of localization, as well as the lack of filling infrastructure. It is expedient to expect the development of transport on such types of fuel after the natural cycle of modernization of equipment on gas motor fuel and the provision of infrastructural and technical conditions for the operation of equipment.
4. Development of ITS (including industry solutions) and MaaS services based on them, as well as commercial systems in the field of Fleet management (including connected vehicles with telematics sensors and other solutions) are practically built into the logic of implementing the UN sustainable development principles in the Russian segment of the Barents Region. This is done by providing through the ITS economic incentives for

[143]Among them are FSUE Rosmorport, JSC Russian Railways, FSUE State Corporation for Air Traffic Management in the Russian Federation

the population and enterprises to optimize the modes of use of various modes of transport to reduce transport costs, fuel consumption and travel time, the cooperative use of vehicles, and the wider use of public transport.

1.2. Analysis of the planned target results of the implementation of the plans and their impact on the development of ITS and carbon footprint reduction, determination of the prospective state of the transport and logistics operating environment and its connectivity with the transport systems of other countries of the Barents Region

1.2.1. Target results for national projects

The planned target results of the implementation of the plans and their impact on the development of ITS and transport carbon footprint reduction are formed in accordance with Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the national development goals of the Russian Federation for the period up to 2030" (hereinafter - Decree No. 474).

In accordance with Decree of the President of the Russian Federation No. 474, the following results of the development of the Russian Federation are planned for the period up to 2030:

- a) within the framework of the national goal "Comfortable and safe environment for life", this is to reduce emissions of dangerous pollutants that have the greatest negative impact on the environment and human health by two times;
- b) within the framework of the national goal to achieve "digital maturity" of key sectors of the economy and social sphere, including healthcare and education, as well as public administration, these are:
  - achievement of "digital maturity" of key sectors of the economy and social sphere;
  - increase in the share of mass socially significant services available in electronic form, up to 95%;
  - increase in investments in domestic solutions in the field of information technology four times compared to 2019.

In accordance with Decree of the President of the Russian Federation of May 7, 2018, No. 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024" (as amended and supplemented)[144], as noted above, the following national projects were developed, within which federal projects are being developed and implemented, and strategic planning documents that determined the development of ITS and carbon footprint reduction:

- National project "Safe quality roads";
- National program "Digital Economy of the Russian Federation";
- National project "Ecology".

✓ **National project "Safe quality roads" (implementation period 03.12.2018 - 31.12.2024)**

[144] https://www.garant.ru/products/ipo/prime/doc/71837200/

Planned target results of the national project "Safe High-Quality Roads" from the Decree of the President of the Russian Federation No. 204 (compared to indicators as of December 31, 2017):

- increase in the share of regional roads that meet regulatory requirements in their total length to at least 50%;
- reduction in the share of federal and regional highways operating in overload mode in their total length by 10%;
- reduction in the number of places of concentration of road accidents (accidentally dangerous sections) on the road network by half;
- a 3,5-fold reduction in deaths from road traffic accidents to a level not exceeding four people per 100,000 population (by 2030, aiming for a zero death rate);
- bringing in the largest urban agglomerations the share of roads that meet regulatory requirements in their total length to 85%.

✓ **National project "National Program "Digital Economy of the Russian Federation"**

One of the significant planned target results of the national project "National Program "Digital Economy of the Russian Federation" from Decree of the President of the Russian Federation No. 204 (compared to indicators as of December 31, 2017) is[145]:

- increase in domestic costs for the development of the digital economy from all sources (by share in the country's gross domestic product) by at least three times.

✓ **National project "Ecology"**

One of the significant planned target results of the national project "Ecology" from Decree of the President of the Russian Federation No. 204 (compared to indicators as of December 31, 2017) is:

- a radical reduction in the level of atmospheric air pollution in large industrial centers, including a reduction of at least 20% of the total volume of emissions of pollutants into the atmospheric air in the most polluted cities.

1.2.2. Federal projects and documents of strategic planning in terms of intelligent transport systems

✓ **Federal project "System-wide measures for the development of the road sector"** (December 3, 2018 - December 31, 2024)[146]

The planned results of the project "System-wide measures for the development of the road sector" in terms of the introduction of ITS are:

- introduction of intelligent transport systems that provide for the automation of traffic management processes in urban agglomerations, including cities with a population of over 300 thousand people (64 cities in total);

[145]Presentation "National projects. Digital Economy. Ministry of Digital Development of Russia". https://digital.gov.ru/ru/activity/directions/858/?ysclid=l0wjke7to6

[146]Passport of the federal project "System-wide measures for the development of the road sector". Approved by the Protocol of the meeting of the project committee for the national project "Safe and high-quality roads" dated December 20, 2018, No. 4 (https://mintrans.gov.ru/documents/8/9759?)

- equipping 120 sections of highways and artificial structures of federal significance with elements of intelligent transport systems focused on automation of traffic management processes (accumulated total);
- equipping 60 sections of highways and artificial structures of regional importance with elements of intelligent transport systems focused on automating traffic control processes (cumulative total).

Also, one of the target results of the national project is the achievement of the share of contracts for the implementation of road activities within the framework of the national project, providing for the use of new technologies and materials included in the Register of new and best technologies, materials, and technological solutions for reuse, % in the total volume of new state contracts for execution of works on capital repairs, repair, and maintenance of highways[147].

Table 4. Shares of contracts for road activities by constituent entities of the Russian Federation in the Barents Region

Name of the subject of the Russian Federation	Base value		Execution period, year					
	Present value	The current date	2019	2020	2021	2022	2023	2024
Northwestern Federal District								
Republic of Karelia	0	31.12.2017	ten	20	40	53	66	80
Arkhangelsk Region	0	31.12.2017	ten	20	40	53	66	80
Murmansk Region	0	31.12.2017	ten	20	40	53	66	80

✓ **Federal project "Information infrastructure"** (30.06.2019 - 31.12.2024)

Within the framework of the federal project "Information Infrastructure" it is supposed creation of a global competitive infrastructure for data transmission, processing, and storage, mainly based on domestic developments, accessible to all citizens, businesses and authorities[148].

In terms of the development of ITS, the planned target results of the federal project "Information Infrastructure" indicated in the Table below:

Table 5. Planned results in terms of the development of ITS of the federal project "Information Infrastructure"

Result	Target indicator
Priority objects of transport infrastructure (including railway and road infrastructure) are covered with communication networks with broadband wireless data and voice transmission capabilities necessary for the development of modern intelligent logistics, transport technologies and narrow-band communication networks for collecting telemetry information built using LPWAN technology	as of 31.12.2019 - 0 CONV. UNIT as of 31.12.2020 - 0 CONV. UNIT as of 31.12.2021 - 1 CONV. UNIT as of 31.12.2022 - 1 CONV. UNIT as of 31.12.2023 - 1 CONV. UNIT as of 31.12.2024 - 1 CONV. UNIT
Ensuring radiotelephone communication coverage of federal highways (with emergency calls) in accordance with the schedule	as of 31.12.2019 - 97% as of 31.12.2020 – 97,5% as of 31.12.2021 - 98% as of 31.12.2022 – 98,5% as of 31.12.2023 - 99% as of 31.12.2024 - 100%

✓ **Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021, No. 3363-r)**

[147] APPENDIX No. 2 to the passport of the federal project "System-wide measures for the development of the road sector" https://mintrans.gov.ru/file/423981

[148] https://digital.gov.ru/ru/activity/directions/870/

Achieving one of the goals of the Transport Strategy of the Russian Federation until 2030, namely the digital transformation of the industry and the accelerated introduction of new technologies[149], creates the conditions for achieving the following forecast target results for all modes of transport[150]:

- increase in labor productivity by at least 2 times by 2035, primarily due to autonomous driving technologies, automation of management processes based on predictive analytics built on the use of artificial intelligence;
- increasing the speed of multimodal transportation by 4 times, including in terms of transit and domestic freight and passenger traffic, due to the digitalization of planning and management of freight and passenger flows and related document flow;
- reduction of waiting times and customs procedures by 10 times due to the digitalization of cross-border information exchange;
- reduction of waiting time and passage of control procedures on all modes of transport by 5 times due to the introduction of digital ticketing systems.

In terms of passenger transportation, as a result of the implementation of this Strategy, in particular, the following forecast target results will be achieved by 2035:

- 80 million people by 2035 - the population of large and largest agglomerations in which intelligent transport systems will be introduced in public transport and in traffic management;
- 80 percent - the share of commuter, intercity and international road, rail and air passengers identified through the use of biometric technologies.

In terms of freight transportation, as a result of the implementation of this Strategy, in particular, the following forecast target results by 2035 will be achieved:

- bringing at least 85 percent of the infrastructure of the Unified Core Network to a standard state;
- at least 100,000 kilometers of infrastructure of all types of transport will be adapted for autonomous transport by 2035, of which more than 5,000 kilometers are dedicated autonomous transport infrastructure;
- 100 percent - the share of transportation documents issued in electronic form;
- increase in the carrying capacity of railway sections in the export direction by 327 million tons.

✓ **State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017, No. 1596)**

The target results of the State program of the Russian Federation "Development of the transport system" related to the digital transformation of the transport industry are:

- Accelerating the movement of goods based on improving the quality of transport infrastructure by 5,7% compared to the level of 2021;

[149] The full name of the goal is the digital and low-carbon transformation of the industry and the accelerated introduction of new technologies.

[150] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021, No. 3363-r)

– Increasing the availability of quality transport services to ensure the transport mobility of the population at the level of 9,3 thousand passenger-km per 1 inhabitant.

To achieve the first target result, among other measures, it is planned to digitally transform the industry and accelerate the introduction of new technologies, including the development of unmanned transport systems in freight transport. To achieve the second target result, among other activities, it is planned to develop biometric identification services at airports and on land urban transport[151].

✓ **Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r)**

As a target result for 2024, the Road Safety Strategy in the Russian Federation for 2018–2024 sets a social risk indicator of no more than 4 deaths per 100,000 population[152].

At the same time, indicators of the state of road safety are:

– indicators characterizing the damage caused to the life and health of citizens as a result of traffic accidents;
– indicators characterizing traffic accidents involving pedestrians, children, cyclists, drivers of mopeds and motorcycles;
– indicators characterizing traffic accidents, in which shortcomings of the road network are recorded;
– indicators characterizing traffic accidents caused by drivers with up to 2 years of driving experience;
– indicators characterizing traffic accidents in which technical malfunctions of vehicles are recorded;
– indicators characterizing the effectiveness of state and municipal management in the field of road safety;
– indicators characterizing the timeliness of providing medical care to victims of road traffic accidents.

✓ **Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020, No. 1388-r)**

The key target result of the implementation of the Strategy for the Development of the Customs Service of the Russian Federation until 2030 is the formation by 2030 of a "smart" customs service, saturated with "artificial intelligence"[153].

The following Table shows the target indicators for the implementation of the Strategy, which must be achieved based on full digitalization and automation.

Table 6. Implementation indicators of the Customs Strategy until 2030

Name of indicator	Indicator values, %		
	2020	2024	2030
The share of customs operations performed automatically using information technology in relation to goods not identified as risky deliveries associated with the import	25	50	100

[151]State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

[152] Road safety strategy in the Russian Federation for 2018–2024 (Decree of the Government of the Russian Federation dated January 8, 2018, No. 1-r

[153]Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020 No. 1388-r)

Name of indicator	Indicator values, %		
	2020	2024	2030
(export) of goods to (from) the Russian Federation from states that are not member states of the Eurasian Economic Union			
The share of shipments for which customs declarations have been filed electronically in the total number of shipments in which goods purchased through international e-commerce moved	10	20	80
The share of documents in the reporting period used in electronic form when collecting customs payments, special, anti-dumping, countervailing duties, interest, and penalties	5	80	95
The share of licensed goods, the movement of which is controlled automatically	2	30	90
The share of objects with signs of declaring false information about the classification code or the origin of goods selected using automated selection	0	10	70
The share of objects of customs control after the release of goods, in respect of which selection using information technology is applied, in the total number of objects of customs control after the release of goods	5	20	50
The share of electronic files of customs control, for which documents and information were exchanged with controlled persons in electronic form, in the total number of electronic files of customs control	5	40	80
The share of complaints filed and reviewed electronically in the total number of complaints	-	25	55
The share of participants in foreign economic activity who positively assess the convenience and uninterrupted functioning of electronic services in the total number of participants in foreign economic activity who used electronic services in their activities	90	95	98

1.2.3. Industry and corporate documents of strategic planning in terms of intelligent transport systems

✓ **Order of the Ministry of Transport of Russia dated March 21, 2022, No. AK-74-r. "On approval of the Guidelines for the development of applications (including local projects for the creation and modernization of intelligent transport systems) of the constituent entities of the Russian Federation for receiving other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation in order to implement the measure "Implementation of intelligent transport systems that provide for the automation of road management processes traffic in urban agglomerations, including cities with a population of over 300 thousand people" within the framework of the federal project "System-wide measures for the development of the road sector" of the State program of the Russian Federation "Development of the transport system"**

These Guidelines define the requirements for applications, the procedure for sending applications from the constituent entities of the Russian Federation for other interbudgetary transfers from the federal budget to the budgets of the constituent entities of the Russian Federation to implement measures to introduce ITS in urban agglomerations with a population of over 300 thousand people. An indirect target result of these Guidelines will be the introduction of ITS in 64 urban agglomerations by December 31, 2030.

✓ **Decree of the Ministry of Transport of the Russian Federation dated May 31, 2021, No. VS-105-r "On approval of the Digitalization Program in the road sector in the Russian Federation"**

The planned target results of the Digitalization Program in the road sector in the Russian Federation are:

- Determination of the direction of development of intelligent transport systems on public roads, the formation of a list of tasks necessary for the implementation;
- Legislative consolidation of the concept of a national network of intelligent transport systems on public roads, which determines the possibility of its creation and operation on the territory of the Russian Federation;
- Ensuring the possibility of integrating intelligent transport systems of public roads (regional platforms of intelligent transport systems) into a single information space;
- Creation and functioning of intelligent transport systems;
- Ensuring the integration of intelligent transport systems on public roads of regional or intermunicipal and local importance with the federal information platform.

✓ **Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads"**

The planned target results of the implementation of this Concept are[154]:

- within the framework of the national project "Safe and High-Quality Roads", a decrease in the number of deaths in road accidents, the number of accident-hazardous sections on the road network and the proportion of federal and regional highways operating in overload mode;
- within the framework of the federal project "System-wide measures for the development of the road economy", the development of technologies that ensure the movement of unmanned vehicles on roads and the introduction of intelligent transport systems on public roads, focused, among other things, on ensuring the movement of unmanned vehicles.

In accordance with this Concept, the introduction of highly automated vehicles operating in unmanned mode will achieve[155]:

- saving fuel in the amount of 19–22% and increasing the speed of delivery of goods by 26–30% compared to human-driven vehicles;
- reduction of current costs of motor transport organizations by 25–33%;
- achieving the amount of prevented damage from road accidents in the Russian Federation will amount to hundreds of billions of rubles;
- reduction of harmful emissions into the atmosphere, contributing to the improvement of the environment and environmental protection.

One of the key target results of the implementation of this Concept may be the economic and social effect achieved from the introduction of autonomous transport from reducing accidents. According to the calculations of the specialists of the Federal State Autonomous Educational Institution of Higher Education "National Research University "Higher School of Economics", carried out as part of the implementation of the activities of the specified federal target program, the total socio-economic damage from road traffic accidents in the Russian Federation in 2013 amounted to 303,5 billion rubles, or 0,5 percent of gross domestic product. With the introduction

[154] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads"

[155] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads"

of highly automated vehicles, the amount of averted damage from traffic accidents in the Russian Federation will amount to hundreds of billions of rubles[156].

✓ **Decree of the Federal Road Agency (Rosavtodor) dated March 3, 2021, No. 773-r "On approval of the strategy for the development of innovative activities in the field of road infrastructure for the period 2021–2025"**

In accordance with the Passport, the Strategy for the development of innovative activities in the field of road infrastructure for the period 2021–2025, the expected target result of the implementation of this Strategy will be the fulfillment of the goals and objectives of the national project "Safe and high-quality roads", the State program of the Russian Federation "Development of the transport system"[157].

Among other target expected results by 2025 within the framework of the Strategy for the Development of Innovative Activities in the Field of road Management for the period 2021-2025[158]:

- The introduction of processes and tools for managing the innovation activities of Rosavtodor has been completed;
- Growth in the number of subordinated territorial institutions applying innovations (all FCIs at the end of 2025);
- Growth in the number of applied innovations;
- Increasing the number of innovation suppliers to Rosavtodor.

As part of the implementation of the initiative "Research in the field of integrated implementation of ITS", the target results of the implementation of the Strategy will be the adoption of regulatory documents in the field of ITS, the piloting of technological solutions in the field of ITS, the creation of advanced training programs in the field of ITS[159].

✓ **Decree of the Government of the Russian Federation of March 19, 2019, No. 466-r "Long-term development program of JSC Russian Railways until 2025"**

Within the framework of this Program, by 2025 it is planned to achieve the following target state of information technologies of Russian Railways[160]:

- implementation of platform solutions integrated with production systems with the ability to build digital services, with electronic channels of interaction with the market (passengers, shippers, service companies);
- organization of systematic work with new technologies (search, approbation, prototyping, implementation) and development of high-tech business of Russian Railways;
- introduction of centralized information security tools based on import-independent solutions;

[156] Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads"

[157] Passport strategy for the development of innovative activities in the field of road infrastructure for the period 2021-2025. Approved by the Order of the Federal Road Agency dated March 03, 2021, No. 773-r.

[158] Passport strategy for the development of innovative activities in the field of road infrastructure for the period 2021–2025. Approved by the Order of the Federal Road Agency dated March 03, 2021, No. 773-r.

[159] https://rosavtodor.gov.ru/storage/app/media/uploaded-files/2-strategiya.pdf

[160] Decree of the Government of the Russian Federation of March 19, 2019 No. 466-r "Long-term development program of JSC Russian Railways until 2025"

- creation of electronic channels of interaction with the market (passengers, shippers, service companies), federal executive authorities and within the framework of cross-border interaction (transport corridors) with neighboring countries;
- creation of a new generation of mobile jobs and electronic document management in production and management processes;
- modernization of computing and telecommunications infrastructure, providing a guaranteed level of availability of information services;
- reduction in the share of operating expenses of Russian Railways for information systems to 5% per year;
- savings in purchases by Russian Railways up to 1.2 billion rubles. in year.

The following Tables present performance indicators for information technology development and environmental safety.

Table 7. Indicators[161] of the effectiveness of the development of information technologies of JSC Russian Railways until 2025

Name of indicator	Indicator values by 2025, %
The share of e-tickets on long-distance trains	70
The share of freight transportation and related services available for registration in electronic form	75
The share of electronic documents when interacting with participants in the transportation process (including international transit traffic)	90
The percentage of operations in customer service business processes performed without human intervention	55
The number of users in the open joint-stock company "Russian Railways" and subsidiaries dependent companies that use domestic software included in the Unified Register of Russian Programs for Electronic Computers and Databases	At least 70

✓ **Development Strategy for the Air Navigation System of the Russian Federation until 2030 (developed by FSUE State ATM Corporation)**

The planned target results of the Development Strategy of the Air Navigation System of the Russian Federation until 2030 are[162]:

- in terms of safety - achievement of 120 thousand hours of flight per 1 violation of separation intervals and 120 thousand airborne weapons per 1 unauthorized occupation of the runway;
- in terms of optimizing air traffic - by 2030, aircraft trajectories will approach optimal trajectories: in terms of horizontal inefficiency at flight level up to 1,5%, in terms of average additional flight time with a decrease to 7,7 minutes, in terms of average length of horizontal flight to the airfield area up to 22 km.

✓ **The concept of introducing automatic dependent surveillance based on a single standard with the development to the functionality of multi-position surveillance systems in the Russian Federation for 2017–2022. (Decree of the Ministry of Transport of the Russian Federation dated April 25, 2018, No. MS-68-r)**

The target results of the implementation of this Concept, among other things, are:

- Expected increase in high intensity airspace capacity up to 20%;

[161]Annex No. 17 to the "Long-term development program of Russian Railways until 2025"
[162] https://gkovd.ru/upload/ans/Presentation_strategy_development_ANS.pdf

- Reducing the load on dispatching personnel and increasing labor productivity;
- Increasing the capacity of aerodromes with the introduction of reduced horizontal wake separations in strong headwinds by transmitting meteorological data from aircraft on the Mode S data link with a high update rate;
- Providing an integral and high-precision source of surveillance data for the implementation of the task of air traffic flow management (ATFM) in the Russian Federation based on space-time trajectories in a cost-effective way;
- Improving the accuracy of planning operations for servicing arriving aircraft at aerodromes through the use of high-precision aircraft position information with a high update rate;
- Creation of precision approach monitoring systems for parallel and/or closely spaced runways (PRM) and approach monitoring systems (FAM) at airfields with high field intensity on the basis of integrated MPSN in order to reduce horizontal intervals between aircraft and increase throughput;
- Improving the safety and efficiency of ground operations when using the components of the MPSN system based on the unified ADS-B standard as part of advanced surface movement control and monitoring systems (A-SMGCS);
- Creation using the components of the MPSN system based on the unified ADS-B standard of automated height keeping control systems (HMU) in conditions of reduced vertical separation intervals (RVSM);
- Subsequent integration of MSTS system data based on the unified ADS-B standard into the Unified Information and Telecommunications Environment (hereinafter - UITE), provision of data on the location of aircraft and their identification in real time for the purposes of Federal Air Space Intelligence and Control System.

✓ **Decree of the Government of the Russian Federation of December 22, 2020, No. 2216 "On approval of the rules for equipping vehicles of categories M2, M3 and vehicles of category N used for the transport of dangerous goods with satellite navigation equipment"**

The target result of this Government Decree is to equip vehicles of categories M2, M3 and vehicles of category N used for the transport of dangerous goods with satellite navigation equipment.

✓ **Action plan ("road map") "EnergyNet" of the National Technology Initiative. Approved by the Presidium of the Council under the President of the Russian Federation for the Modernization of the Economy and Innovative Development of Russia (Protocol No. 4 dated September 28, 2016)**

The expected target results of the EnergyNet Action Plan by 2026 are[163]:

- implementation of at least 30 pilot projects to test the effectiveness of digital networks, digital substations, smart metering, information management systems based on advanced technologies;
- implementation of projects of self-organizing infrastructures and services at at least 3 experimental (zones) sites.

[163] Action plan ("road map") "EnergyNet" of the National Technology Initiative. Approved by the Presidium of the Council under the President of the Russian Federation for the Modernization of the Economy and Innovative Development of Russia (Protocol No. 4 dated September 28, 2016)

✓ **Urban Digitalization Project "Smart City"**

The expected target results[164] of the Urban Digitalization Project "Smart City" are:

- selection and implementation of pilot projects for the implementation of the most promising replicated innovative solutions for the urban economy;
- development and launch of the online resource "Bank of Smart City Solutions";
- creation and commissioning of competence centers "Smart Cities".

1.2.4. Regional documents of strategic planning in terms of intelligent transport systems

Arkhangelsk Region

✓ **Regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)" (03.12.2018 - 31.12.2024)**

The Table below shows the target results of the regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)"[165].

[164] Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation dated October 31, 2018 No. 695 p. "On approval of the passport of the departmental project of digitalization of the urban economy "Smart City".

[165] Passport of the regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)"

Table 8. Tasks and results of the regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)"

Name of the task, result	Unit measurements	Base value		Period, year							Characteristics of the result	Result type
		Meaning	Date	2018	2019	2020	2021	2022	2023	2024		
Placement of automatic points of weight and size control of vehicles on highways of regional or intermunicipal, local significance (cumulative total). Cumulative total	Unit	0	-	-	-	-	4	4	4	4	A status report has been prepared on the placement of automatic points for the weight and size control of vehicles on roads of regional or intermunicipal, local significance	Provision of services (execution of works)
Increase in the number of stationary cameras for photo and video recording of violations of traffic rules on federal, regional or intermunicipal, local roads up to 211% of the base number in 2017. Cumulative total	Percent	0	-	-	156,25	200	222,58	245,16	267,74	290,32	A status report has been prepared on the installation of stationary cameras for photo and video recording and violations of traffic rules on highways of federal, regional or intermunicipal, local significance	Acquisition of goods, works, services
Implementation of intelligent transport systems that provide for the automation of traffic control processes in urban agglomerations, including cities with a population of over 300 thousand people (64 cities, cumulatively)	Conventional unit	0	31.12.2017	-	-	-	-	-	-	1	A status report has been prepared on the implementation of intelligent transport systems, which provide for the automation of traffic management processes in urban agglomerations, including cities with a population of over 300 thousand people (in 2024–27 c.u.)	Provision of services (execution of works)

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Arkhangelsk Region**

The Table below shows the target indicators for the implementation of the Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Arkhangelsk Region.

Table 9. Target indicators of the Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Arkhangelsk Region[166]

Name of the project	Responsible Regional Executive Authority	Name of indicator	Unit of measurement	Indicator values by years		
				2022	2023	2024
Initiative "Digital management of the transport complex of the Russian Federation"	Ministry of Transport of the Arkhangelsk Region	The share of data from the information resources of the regional control center in the field of roads and public transport transmitted to the situational information center of the Ministry of Transport of Russia	percent	50	100	100
		The share of electronic documents on the organization of traffic for newly commissioned objects of transport infrastructure, included in the information and analytical system of regulation in transport	percent	5	7	ten
Digitalization for Transportation Security Initiative of the Digital Transformation Project	Ministry of Transport of the Arkhangelsk Region	The number of transport infrastructure entities under the jurisdiction of the executive authorities of the Arkhangelsk Region, connected to a single closed secure information infrastructure in the field of transport security	units	0	0	1
Initiative "Digital Twins of Transport Infrastructure" of the "Digital Transformation" project	Ministry of Transport of the Arkhangelsk Region	The number of transport infrastructure facilities in the Arkhangelsk Region that use BIM/CIM technologies	units	1	1	1
Intelligent transport system of the Arkhangelsk Region	Ministry of Transport of the Arkhangelsk Region	The number of deaths in road traffic accidents, people per 100 thousand population	human	9,32	8,67	8.2
		The number of deaths in road traffic accidents, per 10 thousand vehicles	human	2,25	2,09	1,98

[166] Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Arkhangelsk Region

Name of the project	Responsible Regional Executive Authority	Name of indicator	Unit of measurement	Indicator values by years		
				2022	2023	2024
		The number of places where traffic accidents are concentrated (dangerous sections) on the road network	percent	66	56	50
		The share of buses that carry out regular transportation of passengers in urban, suburban, and intercity (within the Arkhangelsk Region) traffic, for which information about their actual movement along the route is provided in the public domain	percent	80	90	100
		The introduction of intelligent transport systems that provide for the automation of traffic management processes in urban agglomerations, including cities with a population of over 300 thousand people	units	1	1	1
		The share of buses carrying out regular transportation of passengers in urban, suburban, and intercity (within the Arkhangelsk Region) traffic, equipped with cashless fare payment systems	percent	80	90	100
		The share of buses that carry out regular transportation of passengers in urban, suburban, and intercity (within the Arkhangelsk Region) traffic, equipped with video surveillance systems for passenger compartments (with a recording function) that meet the requirements for the protection of personal data	percent	30	40	fifty

Murmansk Region

✓ **Regional project "System-wide measures for the development of the road sector (Murmansk Region)" (01.01.2019 – 31.12.2024)**

The Table below shows the target results of the regional project "System-wide measures for the development of the road sector (Murmansk Region)"[167].

Table 10. Tasks and results of the regional project "System-wide measures for the development of the road sector (Murmansk Region)"

Name of the task, result	Unit measurements	Period, year						Result characteristic	Result type
		2019	2020	2021	2022	2023	2024		
Placement of automatic points of weight and size control of vehicles on highways of regional or intermunicipal, local significance of the Murmansk Region (cumulative total)	Unit	0	1	1	1	1	2	A status report has been prepared on the placement of automatic points for the weight and size control of vehicles on highways of regional or intermunicipal, local significance in the Murmansk Region	Acquisition of goods, works, services
Increase in the number of stationary cameras for photo and video recording of violations of traffic rules on highways of federal, regional or intermunicipal, local significance in the Murmansk Region up to 211% of the base number in 2017	Percent	211	211	211	211	211	211	A status report has been prepared on the installation of stationary cameras for photo and video recording of violations of traffic rules on federal, regional or intermunicipal, local roads of the Murmansk Region	Acquisition of goods, works, services

[167] Passport of the regional project "System-wide measures for the development of the road sector (Murmansk Region)"

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Murmansk region"**

The Table below shows the target indicators for the implementation of the Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Murmansk Region[168].

Table 11. Target indicators of the Strategy in the field of digital transformation of the sectors of the economy, social sphere and public administration of the Murmansk Region

Name project	Responsible Regional Executive Authority	Name indicator	Unit measurements	2022	2023	2024
Initiative "Digital management of the transport complex of the Russian Federation"	Ministry of Transport and Road Management of the Murmansk Region	The percentage of readiness of the functionality of the regional intelligent transport system for the transmission of information in machine-readable format via the API	%	0	0	100
Digitalization for Transportation Security Initiative of the Digital Transformation Project	Ministry of Transport and Road Management of the Murmansk Region	The number of deaths in road accidents, people per 100 thousand population	per 100 thousand Human	6,2000	5,9300	5,4000
Subsystem Implementation traffic coordination public transport	Ministry of Transport and Road Management of the Murmansk Region	The share of buses carrying out regular passenger transportation in urban, suburban, and intercity (within the subject of the Russian Federation) communication, for which information about their real movement along the route is provided in open access	%	58	62	65
Implementation subsystems transport security	Ministry of Transport and Road Management of the Murmansk Region	The share of buses carrying out regular passenger transportation in urban, suburban, and intercity (within the subject of the Russian Federation) communication, equipped with video surveillance systems of salons (with recording function) that meet the requirements for the protection of personal data	%	44	49	54
Implementation services for connected and highly automated transport (V2X)	Ministry of Transport and Road Management of the Murmansk Region	The number of deaths in road accidents, people per 100 thousand population	per 100 thousand Human	6,2000	5,9300	5,4000

[168] Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Murmansk Region"

Name project	Responsible Regional Executive Authority	Name indicator	Unit measurements	2022	2023	2024
Implementation of the "Digital Twin" module of the Unified Transport System Management Platform of the Murmansk Region	Ministry of Transport and Road Management of the Murmansk Region	Availability of a high-precision digital model of the Murmansk Region and its constituent municipalities with information about the organization of traffic, transport infrastructure facilities, the capacity of highways and the possibility of automated data transmission to subsystems of the federal ITS tour	%	60	80	100
Implementation of the module of the electronic integrated traffic management scheme of the Unified Management Platform of the Transport System of the Murmansk Region	Ministry of Transport and Road Management of the Murmansk Region	Availability of information on current traffic parameters on the territory of the Murmansk Region and its constituent municipalities with the ability to analyze and predict the transport situation when changing traffic management schemes, taking into account the interconnectedness of the relevant sections with the traffic management scheme throughout the street and road network of individual settlements	%	0	50	100
Implementation of the module for monitoring the efficiency of the Intelligent transport System of the Murmansk Region	Ministry of Transport and Road Management of the Murmansk Region	Availability of an automated system for continuous monitoring of the functioning of complex subsystems, separate subsystems and local ITS projects with the possibility of adjusting the operation of ITS at different levels, depending on changes in the road traffic situation, as well as in the event of abnormal or emergency situations in the functioning of individual subsystems and ITS modules	%	0	0	100

Republic of Karelia

✓ **Regional project "System-wide measures for the development of the road sector (Republic of Karelia)" (03.12.2018 - 31.12.2024)**

The Table below shows the target results of the regional project "System-wide measures for the development of the road sector (Republic of Karelia)"[169].

Table 12. Tasks and results of the regional project "System-wide measures for the development of the road sector (Republic of Karelia)"

Name of the task, result	Unit measurements	base value		Period, year							Result characteristic	Result type
		Meaning	Date	2018	2019	2020	2021	2022	2023	2024		
Placement of automatic points of weight and size control of vehicles on highways of regional or intermunicipal, local significance (cumulative total). Cumulative total	Unit	0	31.12.2018	-	4	8	10	10	10	10	A status report has been prepared on the placement of automatic points for the weight and size control of vehicles on roads of regional or intermunicipal, local significance	Provision of services (execution of works)
Increase in the number of stationary cameras for photo and video recording of violations of traffic rules on federal, regional or intermunicipal, local roads up to 211% of the base number in 2017. Cumulative total	Percent	0	-	-	189,47	194,74	200,0	205,26	215,79		A status report has been prepared on the installation of stationary cameras for photo and video recording and violations of traffic rules on highways of federal, regional or intermunicipal, local significance	Acquisition of goods, works, services
Implementation of intelligent transport systems providing for the automation of traffic control processes in urban agglomerations, including cities with a population of over 300 thousand people (64 cities, cumulatively)	Conventional unit	0	31.12.2017	-	-	-	-	-	-	1	A status report has been prepared on the implementation of intelligent transport systems, which provide for the automation of traffic management processes in urban agglomerations, including cities with a population of over 300 thousand people (in 2024–27 c.u.)	Provision of services (execution of works)

[169] Passport of the regional project "System-wide measures for the development of the road sector (Republic of Karelia)"

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Karelia" (2022–2024)**

The Table below shows the target indicators for the implementation of the Strategy in the field of digital transformation of the sectors of the economy, social sphere, and public administration of the Republic of Karelia[170].

Table 13. Target indicators of the Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Karelia

Name of the project	Responsible Regional Executive Authority	Name of indicator	Indicator unit	Indicator values by years		
				2022	2023	2024
Initiative "Digital Twins of Transport Infrastructure Objects" of the "Digital Transformation" project (recommended by federal executive authorities)	Ministry of Road Facilities, Transport and Communications of the Republic of Karelia	The share of motor roads of regional significance of the Republic of Karelia, information about which is included in the IndorRoad geographic information system of motor roads	%	50	75	100
Intelligent Transport System	Ministry of Road Facilities, Transport and Communications of the Republic of Karelia	The share of lighting lines on regional roads equipped with an automated outdoor lighting control system	%	60	65	70
		The number of traffic light objects (intersection, pedestrian crossing) with intelligent control	units	2	4	6
Digitalization of passenger transportation	Ministry of Road Facilities, Transport and Communications of the Republic of Karelia	The share of buses carrying out regular transportation of passengers in urban, suburban, and intercity (within the subject of the Russian Federation) traffic, equipped with cashless fare payment systems	%	75	85	95
		The share of buses that carry out regular transportation of passengers in urban, suburban, and intercity (within the subject of the Russian Federation) traffic, for which information on their actual movement along the route is provided in the public domain	%	47	53	60
		The share of buses carrying out regular transportation of passengers in urban, suburban, and intercity (within the subject of the Russian Federation) traffic, equipped with interior video surveillance systems (with a recording function) that meet the requirements for the protection of personal data	%	70	80	90
		The percentage of passengers using a unified fare system in public transport:	%	0	5	10

[170] Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Karelia»

Republic of Komi

✓ **Regional project "System-wide measures for the development of the road sector (Republic of Komi)" (03.12.2018 - 31.12.2024)**

The Table below shows the target results of the regional project "System-wide measures for the development of the road sector (Republic of Komi)".[171]

Table 14. Tasks and results of the regional project "System-wide measures for the development of the road sector (Republic of Komi)"

Name of the task, result	Unit measurements	Base value		Period, year							Result characteristic	Result type
		Meaning	the date	2018	2019	2020	2021	2022	2023	2024		
Placement of automatic points of weight and size control of vehicles on highways of regional or intermunicipal, local significance. Cumulative total	Thing	0	31.12. 2018	-	6	6	6	6	6	6	A status report has been prepared on the placement of automatic points for the weight and size control of vehicles on roads of regional or intermunicipal, local significance	Provision of services (execution of works)
Increase in the number of stationary cameras for photo and video recording of violations of traffic rules on federal, regional or intermunicipal, local roads up to 211% of the base number in 2017. Cumulative total	Percent	0	-	-	142,86	485,71	485,71	485,71	485,71	485,71	The number of stationary complexes for photo and video recording of the number of traffic violations on roads of regional or intermunicipal significance of the Republic of Komi, local significance, road network increased to 485,71% of the base number in 2017	Acquisition of goods, works, services
Implementation of intelligent transport systems providing for the automation of traffic control processes in urban agglomerations, including cities with a population of over 300 thousand people (64 cities, cumulatively)	Conventional unit	0	31.12. 2017	-	-	-	-	-	-	0	The value of the result on 01.11.2024 is 0	Provision of services (execution of works)

[171] Passport of the regional project "System-wide measures for the development of the road sector (Republic of Komi)"

✓ **Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Komi**

The Table below shows the target indicators for the implementation of the Strategy in the field of digital transformation of the sectors of the economy, social sphere, and public administration of the Republic of Komi[172].

Table 15. Target indicators of the Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Republic of Komi

Name of the project	Responsible Regional Executive Authority	Name of indicator	Indicator unit	Indicator values by years		
				2022	2023	2024
Digitalization of passenger transportation	Ministry of Economic Development and Industry of the Republic of Komi	Connected routes in EAC (flight schedules are entered and updated)	%	10	50	100

1.2.5. Federal projects and strategic planning documents in terms of carbon footprint reduction

✓ **Federal project "Modernization of passenger transport in urban agglomerations" (**01.01.2021 – 31.12.2024**)**

Planned target results[173] of the federal project "Modernization of passenger transport in urban agglomerations" are given in the following Table.

Table 16. Indicators of modernization of passenger transport in urban agglomerations

Result name	Base value		Quantity or share by execution period			
	Present value	Present date	2021	2022	2023	2024
The share of vehicles in urban agglomerations (buses, trams, trolleybuses, suburban railway rolling stock) renovated under the federal project and having a service life no older than the standard	0%	2020	1	3	6	9
Optimized transport service system in urban agglomerations	2 units	2020	5 units	12 units	20 units	30 units
Measures were taken to upgrade mobile passenger transport as part of the acquisition on lease from PJSC State Transport Leasing Company	654 units	2020	460 units	360 units	440 units	420 units
Measures were taken to upgrade the rolling stock of passenger transport as part of comprehensive programs for the modernization of passenger transport in urban agglomerations	0 units	2020	280 units	730 units	860 units	83 units
The share of the length of the linear infrastructure of urban ground electric transport in urban agglomerations, brought to the standard state	0%	2020	0%	1%	3%	5%
The share of vehicles in urban agglomerations updated as part of a federal project	0%	2020	1%	3%	6%	9%

[172] Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Komi

[173]Passport of the federal project "Modernization of passenger transport in urban agglomerations"

✓ **Federal project "Clean Air"**

Planned target results of the federal project "Clean Air" are given in the following Table[174].

Table 17. Indicators of the Clean Air project

Result name	Base value		Quantity or share by execution period			
	Meaning	Date	2021	2022	2023	2024
The reduction in total emissions for the reporting year[175], %	100	31.12.2017	95	93	81	78
The number of cities with high and very high levels of air pollution[176], units	8	31.12.2017	5	3	2	0
The volume of consumption of natural gas as a motor fuel for the reporting year, million cubic meters	-	31.12.2017	85	112	153	219

✓ **Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021, No. 3052-r)**

The Table below shows the targets of the Strategy for the socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050[177].

Table 18. Mass indicators of emissions and removals of greenhouse gases

Name of indicator	Masses of emissions and removals of greenhouse gases, million tons of CO2 equivalent		
	Fact - 2019	Plan - 2030	Plan - 2050
Inertial scenario			
Greenhouse gas emissions	2119	2253	2521
Takeovers	-535	-535	-535
Net emissions	1584	1718	1986
Target (intensive) scenario			
Greenhouse gas emissions	2119	2212	1830
Takeovers	-535	-539	-1200
Net emissions	1584	1673	630

✓ **Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021, No. 3363-r)**

The implementation of the Transport Strategy of the Russian Federation until 2030 with a forecast for the period up to 2035 will provide a new level of quality of transport services for

[174]Passport of the federal project "Clean Air". Annex to the Protocol of the meeting of the project committee for the national project "Ecology" dated December 21, 2018, No. 3.

[175]The total volume of gross emissions is formed in accordance with the statistical data generated by the Federal Service for Supervision of Natural Resources in accordance with paragraphs 57.2, 57.6 of the Decree of the Government of the Russian Federation dated May 6, 2008, No 671-r "On Approval of the Federal Plan of Statistical Works"

[176]Reducing the level of atmospheric air pollution in cities with a very high, high level of atmospheric pollution (AP) - achieving a decrease in the level of atmospheric pollution, including the elimination of exceeding the maximum permissible concentrations for the most dangerous, toxic substances that form very high and high levels of atmospheric pollution (assessment of the level of air pollution is carried out by Roshydromet in accordance with "RD 52.04.667-2005. Guiding document. Documents on the state of air pollution in cities to inform government agencies, the public and the population. General requirements for the development, construction, presentation, and content")

[177]Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021, No. 3052-r)

consumers, including improving the quality of life due to higher availability of services, their safety and environmental friendliness.

The planned target results of this Strategy in terms of passenger transportation and vehicles, which determine carbon footprint reduction, are[178]:

- in terms of passenger traffic - a 70% reduction in the "carbon footprint" from the operation of public transport in large and largest agglomerations;
- in terms of vehicles - expanded use of alternative fuels with the transfer to them of up to 20 percent of the fleet of cars, up to 20 percent of diesel locomotives, up to 2 percent of aircraft, up to 10 percent of sea and river vessels.

By 2024, movement within the agglomerations will be accelerated, the environmental friendliness of the urban environment and its safety will be improved due to the growing popularity of public transport, regulation of the movement of personal mobility vehicles, renewal of the fleet of vehicles and the introduction of intelligent transport systems, including increasing the intensity of traffic on the existing rail infrastructure and updating rolling stock, integration of rail and road transport stops, development of pedestrian and bicycle infrastructure[179].

✓ **State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017, No. 1596)**

One of the target results of the State program of the Russian Federation "Development of the transport system" is to increase the availability of high-quality transport services to ensure the transport mobility of the population at the level of 9,3 thousand passenger-km per 1 inhabitant. To achieve it, it is planned to implement programs to update the fleet of vehicles using various mechanisms (leasing, subsidies, recycling fees), purchase by the constituent entities of the Russian Federation of buses running on gas motor fuel, trams, and trolleybuses[180].

✓ **Decree of the Government of the Russian Federation of April 15, 2014, No. 321 (as amended on December 24, 2021, No. 2352) "On Approval of the State Program of the Russian Federation "Energy Development". Subprogram "Development of the gas motor fuel market" (implementation period December 31, 2024)**

The Table below shows the target indicators for the consumption of natural gas as a motor fuel, the number of stationary filling stations and the number of vehicles using natural gas[181].

Table 19. Indicators of the consumption of natural gas as a motor fuel, the number of stationary filling stations and the number of vehicles using natural gas

Name of indicator	Indicator values						
	Fact	Forecast from 2018					
	2018	2019	2020	2021	2022	2023	2024
The volume of consumption of natural gas as a motor fuel in Russia as a whole, million cubic meters, including on	680	770	950	1360	1710	2170	2720
Republic of Karelia, million cubic meters	0,64	2,09	2,19	2,38	2,5	2,64	5,21
Arkhangelsk Region, million cubic meters	0,26	0,27	0,28	0,3	0,32	0,34	0,35

[178] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

[179] Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation of November 27, 2021 No. 3363-r)

[180] State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017 No. 1596)

[181] https://minenergo.gov.ru/node/13792?

Name of indicator	Indicator values						
	Fact	Forecast from 2018					
	2018	2019	2020	2021	2022	2023	2024
The number of stationary natural gas refueling facilities, units including on	419	506	596	733	892	1072	1273
Republic of Karelia, units	1	1	1	1	1	2	3
The number of produced vehicles using natural gas as motor fuel, units		5000 (fact 9850)	5600	6400	7450	7600	7960

✓ **Long-term program for the development of liquefied natural gas production in the Russian Federation, approved by the Decree of the Government of the Russian Federation of March 16, 2021, No. 640-r**

The planned target results of the Long-term program for the development of liquefied natural gas production in the Russian Federation are[182]:

- by 2024 - to bring the balance of supply and demand for liquefied natural gas to 3,4-5,3 billion cubic meters (or 5,5 million tons), to increase the number of small-capacity plants to 250, gas stations to 1300 and the number of vehicles running on gas motor fuel to 20-25 thousand units;
- by 2035 - to bring the balance of supply and demand for liquefied natural gas to 12,6-17,4 billion cubic meters.

The following Table shows the forecast values of indicators by 2035, which must be achieved within the framework of this Program.

Table 20. Indicators of demand for liquefied natural gas and natural gas motor fuels of natural gas consumption as a motor fuel, the number of stationary filling stations and the number of vehicles using natural gas

Name of indicator	Forecast value - 2024	Forecast value - 2035
The demand for LNG in the domestic market, billion cubic meters including	3,4 – 5,3	12,6 – 17,4
Natural gas motor fuel, billion cubic meters	1,1	5,2 – 7,6
Demand for LNG in the constituent entities of the Russian Federation in the Barents Region		
Murmansk Region, million cubic meters	0,59 – 0,69	0,78 – 1,00
Arkhangelsk Region, million cubic meters	0,17 – 0,33	0,33 – 0,37
Republic of Karelia, million cubic meters	0,23 – 0,43	0,52 – 0,66
Republic of Komi, million cubic meters	0,27 – 0,28	0,28 – 0,52

✓ **Action plan ("Roadmap") for the development of the market for small tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025. Approved by the Decree of the Government of the Russian Federation of February 13, 2021, No. 350-r.**

The expected target results of the Action Plan ("Roadmap") for the development of the market for small tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025 are shown in the following Table[183].

[182] Long-term program for the development of liquefied natural gas production in the Russian Federation, approved. Decree of the Government of the Russian Federation dated March 16, 2021 No. 640-r

[183] Action plan ("Roadmap") for the development of the market for small-tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025. Approved by the Decree of the Government of the Russian Federation of February 13, 2021, No. 350-r.

Table 21. Indicators of the implementation of the action plan for the development of the market for small tonnage liquefied natural gas and gas motor fuel for the period up to 2025

Name of indicator	*Execution period*					
	2020 - fact	*2021*	*2022*	*2023*	*2024*	*2025*
The cumulative installed capacity of existing low-tonnage facilities to produce liquefied natural gas on an accrual basis, tons per hour	21,7	28,7	50,8	60,8	76,8	83,3
The number of operating facilities of gas filling infrastructure for liquefied natural gas, units	10	14	24	40	58	81

✓ **Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 (Decree of the Government of the Russian Federation of August 23, 2021, No. 2290-r)**

The expected target results of the Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 are[184]:

- by 2024 - to produce at least 25 thousand electric vehicles, put into operation at least 9,4 thousand charging stations, of which at least 2,9 thousand are fast charging stations;
- by 2030 - to produce electric vehicles in the amount of at least 10% of the total volume of vehicles produced, to put into operation at least 72 thousand charging stations, of which at least 28 thousand are fast charging stations and at least 1000 hydrogen filling stations.

✓ **The Concept for the Development of Hydrogen Energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021, No. 2162-r)**

The expected target results of the Concept for the Development of Hydrogen Energy in the Russian Federation are[185]:

- by 2024 - implementation of pilot projects to achieve hydrogen exports up to 0,2 million tons per year, as well as the use of hydrogen energy carriers in the domestic market;
- by 2035 – to launch the first commercial hydrogen production projects with export volumes up to 2 million tons per year (the optimistic target is 12 million tons), as well as the implementation of pilot projects for the use of hydrogen in the domestic market;
- By 2050, to achieve export volumes of up to 15 million tons per year (an optimistic target is 50 million tons) and implement large projects for the production of low-carbon hydrogen produced on the basis of renewable energy sources.

1.2.6. Industry and corporate strategic planning documents for carbon footprint reduction

✓ **Order of JSC Russian Railways dated May 12, 2014, No. 1143r "Environmental Strategy of JSC Russian Railways for the period up to 2017 and for the perspective up to 2030"**

[184] The Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 (Decree of the Government of the Russian Federation of August 23, 2021 No. 2290-r)

[185] The Concept for the Development of Hydrogen Energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021 No. 2162-r)

The targets of JSC Russian Railways by 2030 in the field of atmospheric air protection are[186]:

- reduction of emissions of pollutants into the air from stationary pollution sources by 55% in the case of the implementation of the "optimistic" scenario, by 35% in the case of the implementation of the "conservative" scenario and by 10% in the case of the implementation of the "pessimistic" scenario for the development of environmental activities;
- reduction of emissions of pollutants into the air from mobile sources of pollution by 45% in the case of the implementation of the "optimistic" scenario, by 20% in the case of the implementation of the "conservative" scenario and by 10% in the case of the implementation of the "pessimistic" scenario for the development of environmental activities;
- reduction in annual greenhouse gas emissions by 15% if the "optimistic" scenario is implemented, by 10% if the "conservative" scenario is implemented, and by 5% if the "pessimistic" scenario for the development of environmental activities is implemented.

✓ **Decree of the Government of the Russian Federation of March 19, 2019, No. 466-r "Long-term development program of JSC Russian Railways until 2025"**

The Table below shows the target indicators for ensuring the environmental safety of JSC Russian Railways until 2025[187].

Table 22. Indicators[188] for ensuring environmental safety of JSC Russian Railways until 2025

Name of indicator	Values of the indicator to the level of 2018
Emissions of pollutants into the atmospheric air from stationary sources	reduction of at least 18%
Specific level of greenhouse gas emissions	decrease by at least 4,5%
Use of water resources	reduction of at least 20%
Discharge of polluted wastewater into surface water bodies and onto the terrain	reduction of at least 18%
The share of neutralization and involvement of production and consumption waste in the secondary circulation in the total amount of their generation	decrease by at least 2,4%

✓ **Environmental policy of PJSC Gazprom**

To assess the achieved target results, Gazprom's environmental policy uses such a key indicator as the reduction of specific emissions of natural gas in CO2 equivalent (KPI). The target value for this indicator by 2031 (in relation to the base 2018) is 11,2% (Gazprom Group's Report on Sustainable Development activities for 2020). In the gas business, the planned reduction of the specific indicator of GHG emissions from 0,259 tons of CO2-eq./ tn. e. by the end of 2019 to 0,239 tons of CO2-eq. In the reporting year, it became possible due to the implementation of the Roadmap of the Greenhouse Gas Emissions Management System in Gazprom Group companies for the future up to 2030 and the Energy Saving and Energy Efficiency Improvement Program[189].

[186] Order of JSC Russian Railways dated May 12, 2014, No. 1143r Environmental strategy of JSC Russian Railways for the period up to 2017 and for the future up to 2030 »

[187] Decree of the Government of the Russian Federation of March 19, 2019 No. 466-r "Long-term development program of the open joint-stock company "Russian Railways" until 2025"

[188]Annex No. 19 to the "Long-term development program of Russian Railways until 2025"

[189] https://www.gazprom.ru/f/posts/57/982072/sustainability-report-ru-2020.pdf

As part of the environmental program of PJSC Gazprom for the period 2020–2024, developed to achieve the Corporate Environmental Goals, one of the key targets is to reduce specific greenhouse gas emissions from natural gas transportation — 3,8% (by 2024) of the base values of 2018[190].

PJSC Gazprom actively cooperates with the administrations of the constituent entities of the Russian Federation in the implementation of state and regional programs to increase the use of natural gas as a motor fuel, contributing to the achievement of target indicators of such programs as Energy Development (Subprogram "Development of the gas motor fuel market"), Long-term program for the development of liquefied natural gas production in the Russian Federation, Regional programs for gasification of housing and communal services, industrial and other organizations for 2021-2030 in the Arkhangelsk Region, the Republic of Karelia, Action plan ("road map") "Use of gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021-2025)".

In addition, PJSC Gazprom continues to convert its own equipment to natural gas. In accordance with the Program to expand the use of natural gas as motor fuel in the own transport of Gazprom Group organizations for 2020-2022, the number of gas-powered cars of Gazprom subsidiaries is planned to increase to 70%[191].

✓ **Environmental policy of PJSC Gazprom Neft**

As part of the implementation of the environmental policy of PJSC Gazprom Neft, the planned target for reducing specific greenhouse gas emissions by 2025 is 18,9%[192].

PJSC Gazprom Neft aims to increase the level of useful use of associated petroleum gas, despite the planned increase in hydrocarbon production. PJSC Gazprom Neft supports the main provisions and goals of the Zero Routine initiative flaring by 2030 on the complete reduction of associated petroleum gas flaring by 2030. In 2020, the level of useful use of APG by subsidiaries in Russia amounted to 91,1% (growth by 2,1% compared to 2019). At the same time, excluding subsoil areas with a low degree of depletion (an increase in which amounted to 5,4% compared to 2019), the level of beneficial use of associated petroleum gas reached 95,1% due to the implementation of gas infrastructure construction projects and programs to improve the reliability of gas infrastructure. By 2022, it is planned to achieve the next target level of APG utilization in the Russian Federation - ≥95% (excluding the assets of LLC Gazprom Neft-Zapolyarye)[193].

✓ **Environmental policy of PJSC MMC Norilsk Nickel**

As part of the new Comprehensive Environmental Strategy (Strategy in the field of ecology and climate change), PJSC MMC Norilsk Nickel has determined the following target results[194]:

- Regarding climate change:
  - Keeping the volume of absolute production emissions of greenhouse gases of Scope 1 + 2 at the level of about 10 million tons of CO2-equivalent until 2030, with an increase in production volumes by 30-40% (Ni-equivalent compared to 2017);

[190] Report "Principles and methodologies used for calculating greenhouse gas emissions on the example of Gazprom Group companies" // Seminar on carbon reporting, June 17–18, Yuzhno-Sakhalinsk

[191] PJSC Gazprom environmental report for 2020.

[192] PJSC Gazprom environmental report for 2020.

[193] PJSC Gazprom Neft Sustainability Report https://www.gazprom-neft.ru/files/documents/PDF_2020.pdf

[194] Strategy in the field of ecology and climate change. Norilsk Nickel Group. June 2021

- Maintaining greenhouse gas emissions (Scope 1+2) per tonne Ni- eq. at the level of the lower quartile of the global curve for the intensity of greenhouse gas emissions in the mining and metallurgical industry;
- In terms of improving air quality:
  - Reduction of SO2 emissions at the Kola Division by 85% in 2021, at the Polar Division by 90% in 2025 from the values of 2015.

✓ **Environmental policy of PJSC Phosagro**

According to the Climate Strategy of PJSC PhosAgro, by 2028 it is planned to:

- reduction of gross greenhouse gas emissions (scopes 1,2 and 3) by 14%
- reduction of specific greenhouse gas emissions (scope 1) by 30,9%. By 2028, the value of the indicator of specific greenhouse gas emissions (coverage 1) will be 109,1 kg in CO2 eq / ton, which is 30,9% lower than the base level of 2018[195].

PhosAgro's target levels of greenhouse gas emissions are set in relation to scopes 1, 2, 3. Emissions are calculated in accordance with applicable requirements and criteria from the baseline and represent the regulatory metrics (quantitative indicators) of emissions in the target year. On their basis, the required levels of reduction of greenhouse gas emissions are calculated. For Scope 1 and 2 emissions, scientifically based target emission levels are set in accordance with international requirements. The total value of Science-Based Target Levels for Greenhouse Gas Emissions for scopes 1 and 2 in 2028 was 5,134,898 metric tons CO2-eq., which is 14% (or 835,914 metric tons CO2-eq.) below the baseline[196].

Table 23. Gross emissions of coverages 1, 2 in general for PhosAgro, metric tons CO2-eq

	2018 basic level	**2019**	**2020**	**2028 target level**
Direct emissions Coverage 1	4 855 256	4 656 329	4 739 368	4 175 520
Indirect energy emissions (Scope 2)	1 115 556	1 191 411	1 221 310	959 378

The calculation of specific greenhouse gas emissions was performed by arithmetic dividing the values of gross greenhouse gas emissions (coverage 1) by the values of indicators of manufactured products and semi-finished products. The target value of metrics for specific greenhouse gas emissions (scope 1) will be 109,1 kg in CO2-eq. / t, which is lower than the base level of 2018 by 30,9%[197].

Table 24. Specific greenhouse gas emissions for PhosAgro as a whole

	2018 basic level	**2019**	**2020**	**2028 target level**
Specific greenhouse gas emissions (Scope 1), kg in CO2-eq. per ton of products and semi-finished products	157,97	143,27	140,09	109,10

[195] https://www.phosagro.ru/sustainability/ecology/#accordion-polution_reduce

[196] Disclosure of Phosagro information related to climate change. TCFD report 2020. https://www.phosagro.ru/upload/iblock/35c/35c2ee0bc879eb911cb2aa1a4dddf722.pd f

[197] Disclosure of Phosagro information related to climate change. TCFD report 2020. https://www.phosagro.ru/upload/iblock/35c/35c2ee0bc879eb911cb2aa1a4dddf722.pd f

1.2.7. Regional strategic planning documents in terms of carbon footprint reduction

Arkhangelsk Region

✓ **Regional program for gasification of housing and communal services, industrial and other organizations in the Arkhangelsk Region for 2021–2030. Approved by the Decree of the Government of the Arkhangelsk Region of February 11, 2021, No. 65-pp**

The Table below shows the target results of the Regional Program for Gasification of Housing and Communal Services, Industrial and Other Organizations in the Arkhangelsk Region for 2021–2030[198].

Table 25. Target indicators of the Regional Program for Gasification of Housing and Communal Services, Industrial and Other Organizations in the Arkhangelsk Region for 2021–2030

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Conversion of vehicles to natural gas, units	100	100	100	-	-	-	-	-	-	500

Republic of Karelia

✓ **Regional program "Gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2022-2030". Approved by the Order of the Government of the Republic of Karelia dated February 15, 2022, No. 120r-P**

The Table below shows the target results of the Regional Program for gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2021–2030. In total, it is planned to transfer 50 units of vehicles to natural gas[199].

Table 26. Target indicators of the Regional Program for gasification of housing and communal services, industrial and other organizations on the territory of the Republic of Karelia for 2022–2030

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Conversion of vehicles to natural gas, units	0	0	0	0	10	10	10	10	10

Republic of Komi

✓ **Decree of the Government of the Republic of Komi No. 467-r dated October 8, 2021 "On approval of the action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)"**

The Table below shows the target results of the Action Plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021-2025)"[200].

[198] Decree of the Arkhangelsk Region of February 11, 2021, No. 65-pp "On Approval of the Regional Program for Gasification of Housing and Communal Services, Industrial and Other Organizations in the Arkhangelsk Region for 2021–2030"

[199] https://gov.karelia.ru/upload/iblock/c56/120r_P.pdf

[200] Decree of the Government of the Republic of Komi No. 467-r dated October 8, 2021 "On approval of the action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)".

Table 27. Target indicators of the Action Plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021-2025)"

Benchmark name	Unit of measurement	Fact				Forecast		
		2019	2020	2021	2022	2023	2024	2025
Task 1. Expansion of the fleet of vehicles running on compressed gas								
1. The number of vehicles operating on CNG, including:	units (cumulative)	476	514	557	603	644	695	782
1.1. cars	units (cumulative)	43	56	60	70	80	95	110
1.2. trucks (housing and communal services vehicles, dump trucks, special equipment)	units (cumulative)	236	251	265	280	300	325	360
1.3. buses, including:	units (cumulative)	193	203	225	245	255	265	300
- for passenger traffic	units (cumulative)	66	71	93	105	120	135	150
1.4. other self-propelled vehicles, pneumatic and caterpillar mechanisms	units (cumulative)	4	4	7	8	9	10	12
2. The volume of CNG consumption in the Republic of Komi	thousand cubic meters/year	6320	6658	7000	7300	7750	8300	9950
Task 2. Development of gas filling infrastructure on the territory of the Republic of Komi								
3. The number of CNG filling stations in the Republic of Komi	units (cumulative)	5	5	6	8	10	12	14
Task 3. Expansion of the network and scope of services of service centers for maintenance of automatic telephone exchanges running on compressed gas								
4. The number of service centers for maintenance of automatic telephone exchanges operating on CNG	units (cumulative)	2	2	3	4	4	5	6

1.3. Analysis of the structure of government measures to stimulate sustainable development practices in transport, including the use of vehicles with a carbon footprint reduction

The Russian Federation has consistently ratified in recent years international agreements in the field of climate (the UN Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement), approved the Strategy for the socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050, and National projects, including a complex activities of transport carbon footprint reduction. These actions are justified by the high rate of increase in the average annual temperature in the Russian Federation (above the world temperature), including on the coast of the Arctic Ocean, the formation of significant risks due to climate change for the population, ecosystems, national infrastructure, and climate- dependent sectors of the economy.

These legislative and regulatory actions were synchronized with specific actions to reduce the carbon footprint by sectors of the economy.

Measures to stimulate sustainable development practices in transport, including the use of vehicles with a reduced carbon footprint, by the State in the Russian Federation and the constituent entities of the federation follow from the goals and directions of development related to sustainable development in transport, defined in state strategic planning documents and related regulations - legal acts (decrees and orders of the Government of the Russian Federation, administrations/governments of constituent entities of the Russian Federation, etc.) (see section 1.1. of this report).

Based on the system of priority strategic goals, objectives, and directions of development in the field of carbon footprint reduction, the structure of state support measures for sustainable development practices in transport can be grouped into the following blocks:

1) Transfer of vehicles to environmentally friendly fuels, including the renewal of the vehicle fleet and construction, and the development of refueling infrastructure

At present, in the Russian Federation, the main measures of state incentives for vehicles in this area are concentrated in terms of transferring vehicles to gas motor fuel (both through the re-equipment of existing equipment and through the production of new ones) and promoting the creation of hydrogen-fuelled vehicles, and represent financial and economic support measures, including with subsidy mechanisms and government orders.

The key measure to stimulate the transfer of transport to gas motor fuel is the provision of subsidies from the federal budget to the budgets of the constituent entities of the Russian Federation for:

- construction and development of gas filling infrastructure (in the form of subsidizing part of the costs of investors implementing projects in the field of CNG filling stations construction, and financing measures for the development of liquefied natural gas filling infrastructure),
- compensation for the costs of businesses and citizens for the conversion of a vehicle from traditional fuel to gas (in the form of subsidizing part of the costs).

In accordance with the plans of the Government of the Russian Federation, measures of state support for the gas motor fuel market in 2020–2024 were to be financed (including for the construction of gas filling stations) from the federal budget in the amount of 19,3 billion rubles,

which would lead to an increase in the number of stationary gas filling facilities - up to 1273 units, and the fleet of natural gas vehicles by at least 40 thousand units.

An important element of this measure is also the fact that for economic entities with state/municipal participation (shares in the authorized capital) - and often transport enterprises engaged in passenger transportation by land public transport belong to this category – priorities have also been identified on the need to update rolling stock taking into account the principles of sustainable development, i.e. to purchase eco-friendly vehicles or to convert vehicles for the use of gas-engine fuel. Thus, in the Murmansk Region in 2021, 90 environmentally friendly vehicles (buses and electric vehicles) were purchased as part of the modernization program, within 3 years it is planned to completely re-equip public transport, low-carbon vehicles are considered as models for re-equipment - electric buses and buses on gas fuel. In the Arkhangelsk Region, it is planned to purchase 500 buses for urban and inter-municipal transportation using natural gas fuel in the coming years.

In fact, this approach to the procurement and modernization of public transport is also a support for producers of green modes of transport, since the public procurement policy stimulates the production and marketing of manufactured products.

In addition to measures related to subsidizing the conversion of equipment to gas engine fuel, a measure is being implemented to support manufacturers of equipment using natural gas as gas engine fuel, which also consists in providing subsidies from the federal budget[201]. The use of this measure makes it possible to obtain up to 30% efficiency from the purchase and operation of gas-powered vehicles[202]compared to diesel-powered counterparts.

The subsidy is provided to manufacturers in the amount of the discount provided to the buyer from the price of equipment, but not more than the maximum amount per unit of equipment, provided that the equipment meets a number of requirements: the equipment was manufactured no earlier than the year preceding the year the subsidy was received; compliance with the ecological class Euro-5 and higher; being registered in accordance with the legislation of the Russian Federation; equipment with means for the transportation of persons with disabilities (in relation to buses of category M_3 class I with a length of more than 12 meters); availability of a conclusion on the production of industrial products in the territory of the Russian Federation (with a score of at least 1300 points for cars and at least 1500 points for all other types of equipment), etc. To receive a subsidy, the manufacturer must conclude an agreement with the Ministry of Industry and Trade of the Russian Federation. At the same time, the maximum amount of subsidy for each of the types of vehicles differs significantly depending on the type of fuel: for equipment running on liquefied natural gas, the subsidy amount for most items (types of funds) is approximately 2,7-2,8 times higher than for equipment using compressed gas.

With regard to the unique project for the development of production and production of LNG and oil in the Arctic zone of the Russian Federation - Arctic LNG-2, under which it is planned to build 15 LNG-fueled gas tankers for transporting gas and oil along the Northern Sea Route (with a total deadweight of 1,48 million tons), the Government of the Russian Federation provides targeted subsidies, incl. from the Government's reserve fund to finance individual stages of construction. So, at the end of 2021, about 5 billion rubles of subsidies were allocated to the Ministry of Industry and Trade of Russia for the 2nd and 3rd stages of construction of 15 gas tankers of the

[201]Decree of the Government of the Russian Federation of February 4, 2021, No. 115 "On Amendments to the Rules for Providing Subsidies from the Federal Budget to Manufacturers of Equipment Using Natural Gas as a Motor Fuel"

[202]https://www.vedomosti.ru/business/articles/2021/12/12/900235-gazomotornogo-transporta

ice class Arc7 (Orders of the Government of the Russian Federation No. 3664-r of December 17, 2021, and No. 3519-r of December 10, 2021).

The action plan ("road map") for the development of the market for small tonnage liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025[203] also provides for the following non-financial and administrative measures that are the responsibility of federal and regional executive authorities and directly affect / stimulate the development of gas motor fuel consumption:

- Reduction of administrative barriers in the implementation of projects for the construction of low tonnage liquefied natural gas production facilities and gas filling infrastructure facilities;
- Introducing amendments to legal acts and improving the efficiency of regulation in the field of fire safety, industrial safety, ecology and design in order to reduce the cost of construction and operation of small tonnage liquefied natural gas facilities and gas filling infrastructure;
- Creation of conditions for the introduction of the best available technologies aimed at increasing the efficiency of production and consumption of liquefied natural gas for gasification and as a motor fuel;
- Improving the management system in the field of using liquefied natural gas for gasification and as a motor fuel.

Benefits for taxes and fees.

It should also be noted that a significant part of the constituent entities of the Russian Federation (32 regions out of 85) currently use reduced tax rates for transport tax in relation to vehicles running on gas motor fuel as an incentive measure (the amount of the benefit ranges from 20% to 100% relative to the rates for vehicles funds on diesel fuel), however, in the constituent entities of the Russian Federation that are part of the Barents Region, this measure is not used as of 2022 and may become a promising direction for stimulating sustainable development practices in transport.

In the field of sea transport, the port of Primorsk (the only one in the Russian Federation) applies discounts on port dues for ships powered by LNG. In the Barents Region of the Russian Federation, this measure is not yet applied.

Electric transport.

Due to the existing insignificant spread of electric transport, especially in the subjects of the Barents Region, incentive measures for owners of electric vehicles are applied, but they are less relevant and significant. The key measure is the exemption in certain regions of the Russian Federation of owners of electric vehicles from paying transport tax, while this benefit does not apply to owners of hybrid cars. Thus, the Law of the Murmansk Region of November 18, 2002, No. 368-01-ZMO "On Transport Tax" (as amended on April 2, 2021) provides for exemption from payment of transport tax for organizations and individuals who own vehicles (except for water and air vehicles), equipped exclusively with electric motors, with an engine power of up to 200 hp. (up to 147.1 kW) inclusive - for the indicated vehicles. From 2021, for a period of 3 years (at the time of preparation of the report), in the Republic of Karelia, persons on whom electric vehicles are registered are also completely exempt from paying transport tax[204]. At the same time, at the end of 2021, a similar measure was initiated in the Arkhangelsk Region, but it did not receive support.

[203]Decree of the Government of the Russian Federation of February 13, 2021 No. 350-r
[204] https://www.nalog.gov.ru/rn10/news/activities_fts/11255835/

At the same time, in accordance with the Concept for the development of production and use of electric vehicles in the Russian Federation for the period up to 2030[205] from 2022, as an incentive measure aimed at expanding the fleet of electric cars in the Russian Federation, electric vehicles are included in the preferential car loan program. When purchasing a Russian-made electric car (the company must have a special investment contract with the Ministry of Industry and Trade of the Russian Federation), the discount on the purchase of an electric car will be 25% of the total cost, but not more than 625 thousand rubles.

In terms of measures to stimulate the use of hydrogen fuel and the creation of vehicles using hydrogen fuel, state support measures are currently being implemented in the form of financial support (subsidizing costs) for R&D to create competitive Russian equipment (methane-hydrogen gas turbines, electrolyzers etc.), as well as the creation of certain types of transport (prototypes of railway transport, buses, trucks, and special vehicles).

In addition, the action plan "Development of hydrogen energy in the Russian Federation until 2024"[206] provides for measures to create test sites and clusters for testing hydrogen energy technologies in the fuel and energy complex, industrial production, and transport in the Russian Federation, for which existing measures to support industrial clusters related to with partial reimbursement of costs to cluster members through the provision of subsidies from the federal budget. Subsidized items of expenditure (costs are compensated in various proportions of the total volume) include the costs of:

- acquisition of technological equipment for equipment,
- acquisition of software and software and hardware systems for enterprise management, as well as their modules,
- payment of interest on loans received from Russian credit institutions for the implementation of technological measures,
- payment for services for testing industrial products, manufacturing prototypes, experimental samples, and pilot batches,
- payment for services and (or) labor costs for the development of design documentation, technologies and technological processes;
- equipment under concluded leasing agreements purchased from Russian organizations.

One of the important tools to stimulate the renewal of rolling stock, as well as the renewal of the water and air transport fleet, considering the principles of sustainable development in transport, is state support in terms of the development of leasing tools, carried out by allocating subsidies from the federal budget to the State Transport Leasing Company Joint-Stock Company (STLC). Through participation in preferential leasing programs, enterprises can renew their fleet of vehicles, acquiring and operating ships that meet modern environmental requirements. In terms of supporting the renovation of water transport and the construction of civil ships, including modern requirements for their environmental performance, shipping companies are also provided with recycling grants at the federal level (at the expense of the federal budget).

2) Public transport and its infrastructure

[205]Decree of the Government of the Russian Federation of August 23, 2021 No. 2290-r, Decree of the Government of the Russian Federation of December 29, 2021 No. 2559

[206]Decree of the Government of the Russian Federation of October 12, 2020 No. 2634-r

The promotion of sustainable development practices in transport, including the use of vehicles with a reduced carbon footprint, is expressed not only in the renewal of the rolling stock of public transport, air, and water transport, but also in the appropriate planning and development of infrastructure for its movement.

To this end, the authorized executive authorities and their subordinate institutions, as well as with the participation of transport companies engaged in the transportation of passengers, are implementing a transport policy aimed at creating an effective system of urban public transport, taking into account optimal approaches to its impact on the urban environment and residents, within the framework of which, within the framework of their powers, the authorized executive authorities develop the Programs for the Integrated Development of Transport Infrastructure, Integrated Traffic Management Schemes and planning documents for the regular transportation of passengers and luggage - both independently (within the limits of current funding) and with the involvement of expert organizations (i.e., making direct budget investments in the form of a government order).

In addition, as part of ensuring the sustainable development of public transport and its infrastructure, an incentive measure is also financing the implementation of measures for the reconstruction of roads and the road network at the expense of targeted road funds, using the mechanisms of interbudgetary transfers (subsidies from the federal budget to the budgets of the constituent entities of the Russian Federation) and /or on the basis of a public-private partnership. Maintaining the road network in a standard condition has a positive effect on the traffic conditions of both personal and public transport, which is expressed in the optimal parameters of vehicle operation (smooth running, avoiding additional transport work, etc.) and the absence of additional, "extra" emissions.

In addition, as a measure to stimulate the use of public transport in large settlements[207] instead of personal vehicles, an approach related to subsidizing passenger transportation (subsidizing the activities of public transport enterprises) can be considered.

3) Development and implementation of ITS

The goals of sustainable development in transport are achieved, among other things, through the development and implementation of intelligent transport systems that contribute to improving the quality and safety of transportation, optimizing the mode of operation of transport systems and optimizing traffic flows, thereby reducing the burden on the environment. State incentives in this area are expressed in the provision of federal budget subsidies (transfers) to the budgets of the constituent entities of the Russian Federation for the implementation of measures to introduce ITS. In addition, the subjects of the Russian Federation can implement projects for the implementation of ITS at the expense of their own budgets.

4) Creation of infrastructure for environmentally friendly (non-motorized) transport

As part of the formation of a comfortable urban environment, as well as to popularize environmentally friendly and mobile individual transport in large cities (Murmansk, Petrozavodsk) of the Barents Region, infrastructure for movement on bicycles and other means of individual mobility (bicycle paths) is being formed. On the part of the State, incentive measures in the field

[207]Federal Law No. 220-FZ of July 13, 2015 "On the Organization of Regular Transportation of Passengers and Luggage by Motor Transport and Urban Surface Electric Transport in the Russian Federation and on Amendments to Certain Legislative Acts of the Russian Federation"

of creating such infrastructure are expressed in financing projects for the construction and improvement of infrastructure.

5) Other incentive measures

Other measures to promote sustainable development practices in transport that are of a general nature and related to the powers of federal, regional, and local authorities include:

- activities in the field of legal regulation (development and amendments to regulatory legal acts in accordance with the current goals, objectives and directions of state policy in the field of sustainable development, including in transport; development of technical rules / norms / regulations governing frequency of renewal of the rolling stock, requirements for environmental classes of vehicles, etc.);
- formation of a request and a state order for scientific and technical research/development, including in terms of energy technologies, mechanical engineering, instrumentation, information technology and digitalization, etc.,
- informing the population about the state policy in the field of ecology and sustainable development (promoting an eco-friendly lifestyle) and stimulating the transition to environmentally friendly vehicles (informing about the possibility of converting cars, stimulating the use of public transport in cities, etc.);
- development of mechanisms for attracting extra-budgetary funding, including within the framework of public-private partnerships, in the implementation of projects aimed at stimulating sustainable development practices in transport, including projects for the construction and reconstruction of roads, and bringing them to a standard state, updating rolling stock, modernization and construction of transport infrastructure, etc.

The practice of implementing a set of measures to stimulate sustainable development practices in transport generally has a systemic impact on carbon footprint reduction in the field of transport and emissions of harmful substances (NOx, S, etc.). Thanks to incentive measures in 2019-2021, the gas engine fleet in Russia increased from 93,000 to 227,000 cars, the number of CNG stations increased from 298 to 650 units, the sale of gas engine fuel increased from 560 million to 1,3 billion cubic meters per year[208].

At the same time, the analysis shows a number of barriers and limitations to the implementation of the above measures, see the Table below.

Table 28. Constraints and barriers to the implementation of measures to stimulate sustainable development practices in the field of transport and transport carbon footprint reduction

N p/p	Constraint/barrier	Comment
1	Insufficient amount of federal subsidies to cover the difference between the cost of gas and diesel vehicles	The measures of state support in the Russian Federation for the purchase of gas-powered vehicles, which subsidize the difference between the cost of vehicles running on natural gas and diesel fuel, are assessed by transportation participants as insufficient and have been declining in recent years. The volume of subsidies per unit of equipment, considering the decrease in recent years, in some cases does not cover the difference in cost between similar

[208]According to the press service of KAMAZ PJSC https://www.vedomosti.ru/business/articles/2021/12/12/900235-gazomotornogo-transporta

N p/p	Constraint/barrier	Comment
		models running on CNG and diesel fuel and leads to the purchase of cheaper diesel-powered vehicles by transport companies.
2	Infrastructural constraints on the development of refueling infrastructure for environmentally friendly fuels	The insufficient level of gasification of the regions of the Russian segment of the Barents Region (primarily the Murmansk and Arkhangelsk Regions) and the absence of these regions among the priority ones for the implementation of programs for the use of natural gas motor fuel (with federal subsidies), as well as the insufficient development of infrastructure for small-scale production of LNG and CNG for regional needs creates serious obstacles for: – development of refueling infrastructure for vehicles, including CNG filling stations on highways on the main cross-border routes between Russia and the border with Finland and Norway, – development of bunkering of sea and river vessels with gas motor fuel (except for the port of Murmansk), – development of equipment stations for refueling gas carriers on the railway; – mass transfer of commercial, municipal, and private vehicles to environmentally friendly fuels.
3	Imbalances in transport carbon footprint reduction activities to switch to new fuels with a low carbon footprint and increase the vehicle fleet	In the Russian Federation, including in the Russian segment of the Barents Region, there are several imbalances associated with the rapid development of the infrastructure of filling stations for vehicles running on gas motor fuel at low load (about 34% according to Gazprom Gas Motor Fuel), which requires expansion subsidies to increase the fleet of vehicles on GMT. At the same time, the development of GMT consumption (including bunkering/equipment infrastructure) on the railway network and in sea/river ports is not adequately ensured due to the lack of appropriate vehicles (JSC Russian Railways only tests equipment) or their minimum number (marine transportation), even though these modes of transport can provide a significant reduction in greenhouse gas emissions in absolute terms when switching to GMT.
4	Limited opportunities for the production and supply of electric and gas-powered vehicles in the Russian Federation	In the new macroeconomic conditions of the introduction of sanctions against the Russian Federation by developed countries and the resulting disruption of supply chains of high-tech components, plans for the production and supply to the regions of the Russian segment of the Barents region of new equipment using gas-powered fuel and electricity, including gas-powered buses and trolleybuses, ships using LNG for the Northern Sea Route may be postponed or disrupted (including on autonomous course). Projects to produce new Russian models of passenger electric vehicles for private consumers and use in car sharing services and taxis (commercial MaaS) may also be suspended.
5	Low competition in the gas motor fuel supply market	The implementation of programs for the development of the use of gas engine fuel in the Russian Federation is carried out mainly by the forces of Gazprom's subsidiary dependent company - Gazprom Gazomotornoe Fuel LLC and is associated with the development of gasification programs of Russian regions implemented by Gazprom Mezhregiongaz LLC. Low competition in the gas engine fuel supply market does not provide competitive pricing, which in the future may create serious economic risks of fuel cost growth and loss of economic effect for organizations and individuals from the operation of gas-powered automotive, marine and

N p/p	Constraint/barrier	Comment
		railway equipment. The absence of the expected economic effect from the operation of gas-powered vehicles reduces the incentives for the conversion of vehicles and the purchase of new equipment for this type of fuel.
6	Unfavorable climatic conditions	The severe climatic conditions and a long cold period limits: – efficient operation of electric vehicles on batteries due to their faster discharge rate and low efficiency (compared to traditional internal combustion engines) during the cold season and the insecurity of using outside settlements at low temperatures (the threat of freezing when the battery is discharged), – year-round use of non- motorized modes of transport (including means of individual mobility - electric scooters, monowheels, etc.) and the development of infrastructure for them in settlements.
7	Refusal to replace catalytic converters of private car users	Efforts to encourage the transition to environmental fuels are being devalued due to the widespread practice of Russian car owners to refuse to replace neutral catalysts after they fail in personal cars. Thus, many vehicles from the Euro 4/5 environmental class are moving to Euro 0, significantly increasing emissions of harmful substances and greenhouse gases. Strengthening control over the technical condition of cars is required.

The development of a system of incentive measures and overcoming the limitations associated with their use or provision of resources will create additional points of growth in efficiency for transport carbon footprint reduction activities and promotion of a sustainable development strategy in the field of transport.

1.4. The main technological directions for the development of ITS and related (interconnected) industries in the Russian segment of the Barents Region, including sea, air and road transport, control systems, communications and mobile broadband Internet access (including 5G, LPWAN, etc.), development cyber-physical systems in transport (IoT), unmanned vehicles, electric and hydrogen transport, artificial intelligence in transport and logistics systems, multimodal systems, MaaS (transport as a service), etc.

An analysis of strategic development plans for ITS and transport carbon footprint reduction (see section 1.1.) demonstrates a developed system logic regarding the implementation of a whole range of technical and technological solutions for digital transformation in the field of traffic management and the development of user online services. Similarly, progressive solutions are planned in terms of carbon footprint reduction and introducing new transport models using new types of fuel and reducing greenhouse gas emissions by optimizing driving modes and cooperative use of vehicles.

Below is a list of the main technological directions for the development of ITS and related (interrelated) industries in the Russian segment of the Barents Region, including sea, air and road

transport, control systems, communications and mobile broadband Internet access, the development of cyber-physical systems in transport, unmanned vehicles, electric - and hydrogen transport, artificial intelligence in transport and logistics systems, multimodal systems, MaaS (transport as a service), etc. The review of technological areas was made considering implemented projects and confirmed project initiatives on the territory of the Russian segment of the Barents Region (see section 2.1), as well as based on the architecture of the implemented systems.

Thus, the implementation of the main technological areas in terms of ITS is implemented in accordance with the Order of the Ministry of Transport of the Russian Federation of March 25, 2020, No. AK-60-r approved by the Unified Digital Platform for Transport System Management, which is a modular system for collecting and analyzing traffic flows in real time with the possibility of visualization and decision support. The Unified Digital Platform for Transport System Management provides for the collection and analysis of data from the intelligent transport system of the urban agglomeration coming from all internal subsystems and external information systems (sources) such as: administrative and technical inspections of the urban agglomeration, traffic police, road services, taxis, carsharing, etc. The actual unified digital platform for transport system management defines the architecture of the ITS currently being implemented in the urban agglomerations of the Russian segment of the Barents Region. The structure of the Unified Digital Platform for Transport System Management is shown in the figure below.

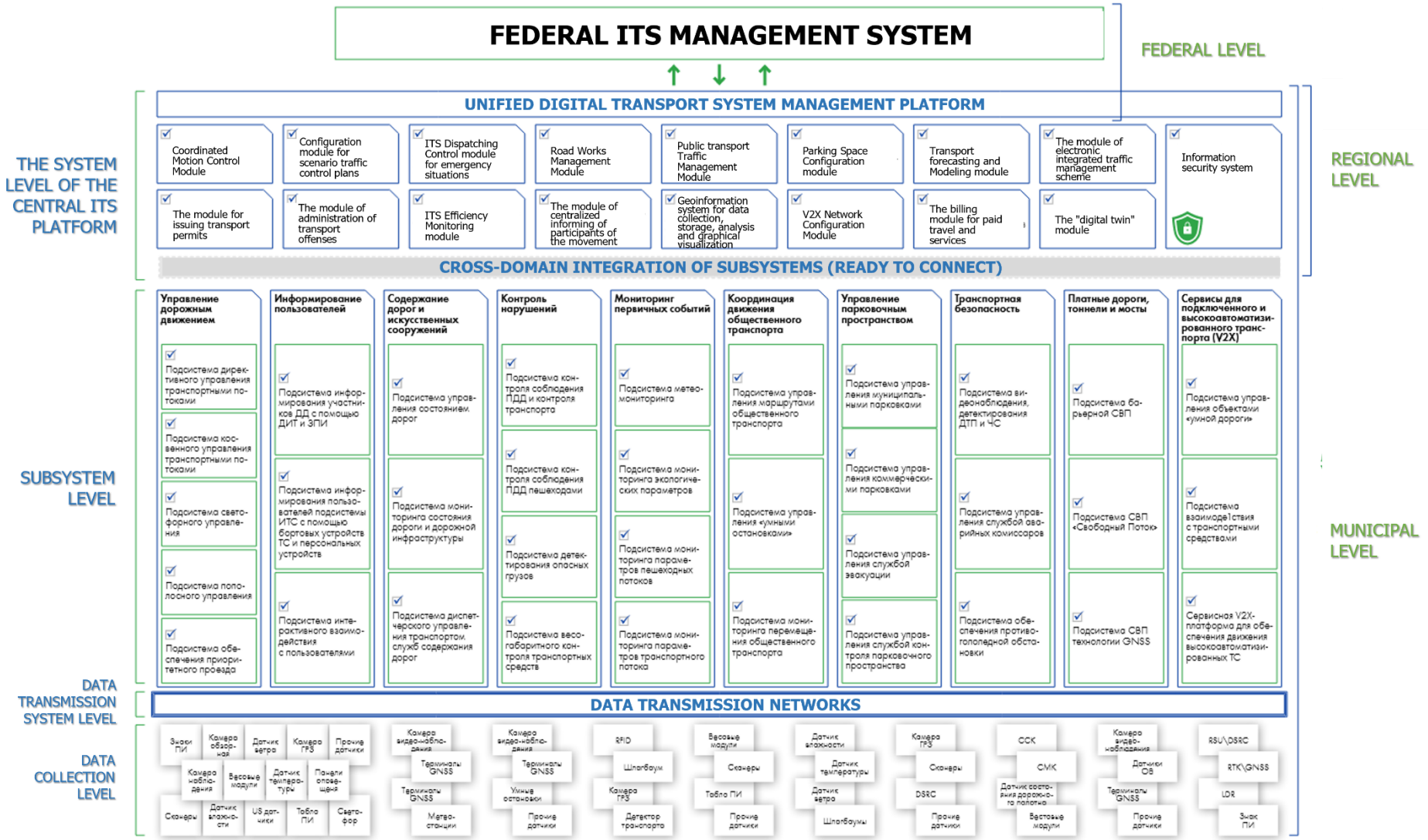

Figure 4. Composition of modules and subsystems of the Unified Digital Platform for Transport System Management

From the point of view of implementing the structure of technological areas in ITS and related areas, it is concentrated around the following basic functional blocks as part of the Unified Digital Platform for Transport System Management, which underlie local ITS in the largest cities (regional capitals) of the Russian segment of the Barents Region, see the figure below. On certain sections of federal highways (P21 Kola, etc.) and in cities, they are also supplemented by weather information systems, which are important for ensuring traffic safety and road operation, and solutions for digital twins of road infrastructure.

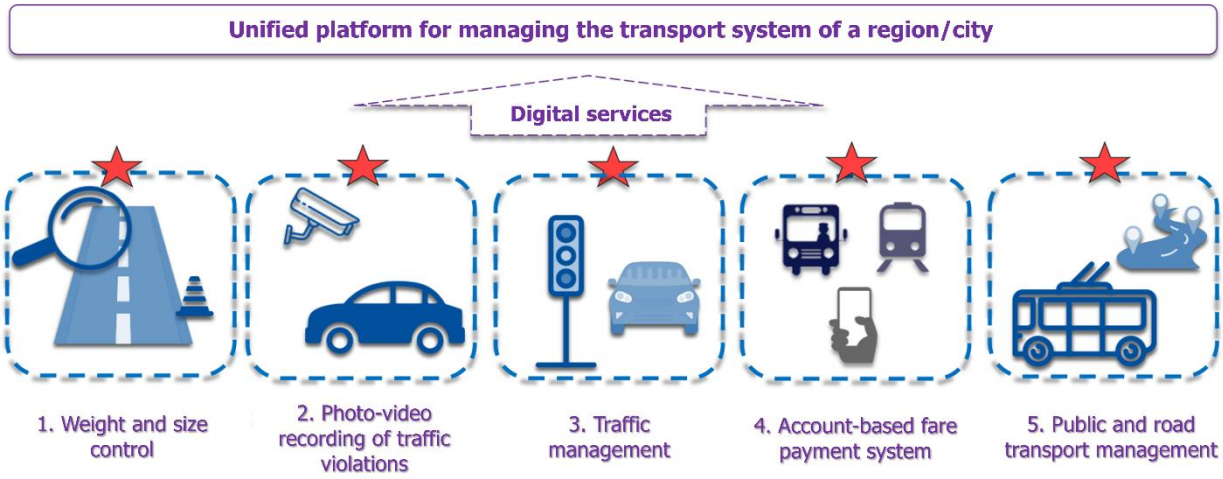

Figure 5. Main functional blocks of ITS integrating technological solutions

The sequence of implementation of the main technological solutions in the field of ITS in the Russian segment of the Barents Region, as well as the possibility of predicting further trends in the development of technologies in this area, is determined by the stages of implementation of ITS based on the Unified Digital Platform for Transport System Management architecture within the framework of local projects[209], see the figure below.

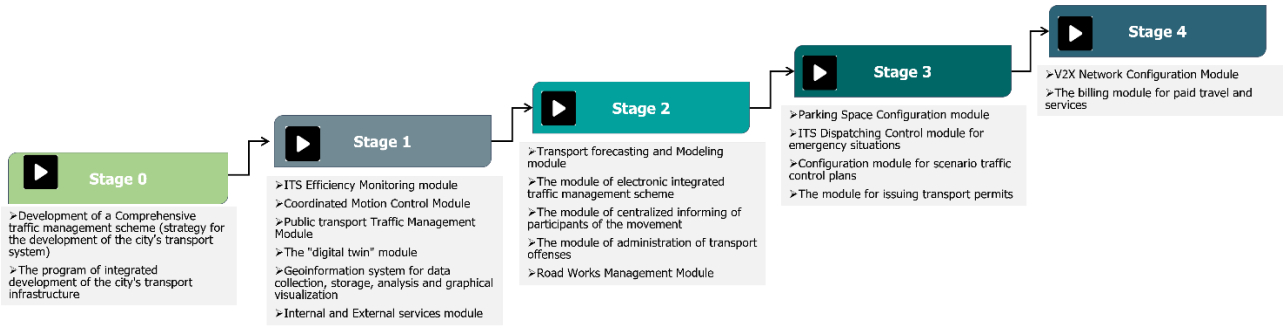

Figure 6. Typical stages of ITS implementation in urban agglomerations in the Russian segment of the Barents Region

When assessing the level of implementation of specific technologies related to ITS (and related spheres) in the Russian segment of the Barents Region, it is advisable to take into account the level of technological maturity of ITS systems in them as of Q1 2022 (as of the implementation of modules and subsystems in accordance with the architecture requirements approved by the Ministry of Transport of the Russian Federation such systems). The figure below shows an expert assessment of the level of technological maturity.

[209]According to the developments of the Transflow company, http://www.transflow.ru/eputs

Figure 7. Assessment of the technological maturity of local ITS systems in the Russian segment of the Barents Region per 1 sq. 2022

Technological directions for the development of ITS and related (interrelated) industries in the road transport segment:

1. Traffic management. Automated traffic management system on a single platform, including "smart" traffic lights and traffic control, the implementation of the "digital twin" module of the agglomeration's street and road network.

In the Arkhangelsk Region, there is a Unified ITS control center, sensors for tracking traffic flows, "smart traffic lights" are connected. The regulation of traffic flow intensity is solved by optimizing the operation of traffic lights.

The Murmansk Region is distinguished by the highest level of ITS maturity in the field of road transport. The unified platform for transport system management has been introduced in the region, and the electronic module of the Comprehensive traffic management scheme is in operation. The «digital twin» modules coordinated traffic control using "smart" traffic lights, pedestrian crossings are involved. There are subsystems for managing the movement of public transport, managing road equipment.

In the Republic of Karelia, a pilot project of Automated traffic management system is planned. By 2025, it is planned to introduce 5 "smart" traffic lights.

The Republic of Komi is not included in the ITS development program, the introduction of ITS elements is carried out as funding is available.

Technological directions for the development of ITS in the field of traffic management in the regions depend on the degree of development of these subsystems. Thus, in the Murmansk Region, it is planned to introduce an ITS efficiency control module, a transport forecasting module. In other subjects of the Barents Region, it is necessary to introduce an electronic module of the Comprehensive traffic management scheme, complete work on the "digital twin" module of the transport infrastructure, introduce the required number of traffic flow sensors, increase the proportion of traffic light objects connected in adaptive and coordinated control, and establish the work

of traffic control subsystems. As a result, to debug the work of Automated traffic management system.

2. Modules for the administration of transport offenses (video recording of traffic violations, weight and size control).

The implementation of ITS usually begins with the introduction of elements of control systems for transport offenses. They pay off with fines, bring a steady income to the local budget and even out the situation with traffic safety on difficult sections of the road. Reducing accidents on the roads is one of the priorities of the national project "Safe and high-quality roads".

In the Arkhangelsk Region, 34 complexes for monitoring traffic violations have now been introduced. 2 points of automatic weight and dimensional control points have been introduced, the third one is planned to be introduced.

In the Murmansk Region, 80 complexes for monitoring traffic violations have been introduced. It is planned to install 158 stationary and mobile complexes for fixing traffic violations. 1 automatic weight and dimensional control point is in operation, 1 more automatic weight and dimensional control point is planned to be introduced in 2022.

In the Republic of Karelia, 20 complexes for photo-video recording of traffic violations were purchased, of which 13 are stationary and seven are mobile. The republic also received 30 imitators of such cameras. It is planned to install 14 mobile complexes for photo and video recording of traffic violations. 8 automatic weight and dimensional control points have been introduced. At the implementation stage are 3 automatic weight and dimensional control points, it is planned to introduce 1 automatic weight and dimensional control point.

There are 17 complexes for monitoring traffic violations in the Republic of Komi. 6 automatic weight and dimensional control points have been introduced. In 2021, not a single automatic weight and dimensional control point is functioning. The issue of restoration of working capacity is being resolved through the court.

Technological directions of development of ITS in the field of administration of transport offenses lie in the expansion of the existing network of complexes for monitoring traffic violations. In the Murmansk Region, it is planned to introduce a module for the administration of traffic violations.

It is necessary to expand the functionality of systems for fixing traffic violations. Implementation of intelligent road cameras with new features such as recording the movement of motorcyclists between lanes, the rules for the use of motorcycle helmets, the rules for parking, turning and turning not from the extreme lane; monitoring the use of seat belts and telephones by drivers while driving; as well as the identification of cars that are not registered with the traffic police, deregistered, have not passed technical inspection and do not have the compulsory insurance of civil liability of vehicle owners. In areas with a high accident rate, where stationary means of fixing violations are not available for various reasons, use "drones".

3. Dispatch control module ITS for emergencies and aircraft

System-112 receives signals from ERA-GLONASS, which vehicles are equipped with. System-112 of Karelia is united with the Arkhangelsk, Murmansk, and Vologda Regions. System-112 of the Republic of Komi is integrated with the systems of the Khanty-Mansiysk Autonomous District and the Sverdlovsk Region.

Organization of interaction of emergency response systems System-112 and e- call. ERA-GLONASS uses the same principles and protocols as eCall but has wider functionality. In particular, it has a callback mode and can use SMS as a backup MSD transmission channel. The European constellation of navigation satellites Galileo will complement the tandem of GPS and GLONASS satellites in the "panic button" equipment of Russian cars.

4. Traffic management and improving the efficiency of public transport.

In the Arkhangelsk Region, a Unified Dispatch Service for Controlling Bus Passenger Transportation has been introduced. A study of public transport routes is being carried out to optimize them.

In Murmansk, an automated system for accounting for transport work in passenger traffic has been introduced as part of the subsystem for managing public transport routes, managing smart stops, and monitoring the movement of public transport.

In the Republic of Karelia, a pilot project of a subsystem for monitoring and coordinating public transport traffic is being implemented in accordance with the road map of the Smart City project.

The Republic of Komi is implementing the Unified Regional System for the Management of Passenger Motor Transport of the Republic of Komi. The issue of connecting special equipment, municipal equipment, equipment of the Ministry of Emergency Situations, ambulances, school buses, etc. to the subsystem is being resolved.

Technological directions for the development of ITS in the field of traffic management and improving the efficiency of public transport depend on the degree of development of these subsystems. In the Arkhangelsk Region, it is necessary to transfer the monitoring systems of public transport to the category of subsystems for managing the movement of public transport. The Republic of Karelia and the Murmansk Region are planning to introduce a unified fare collection system in various types of public transport (introduction of the Mobility as a Service with a single payment for multimodal trips). The possibility of introducing fare collection systems based on the digital profile of the passenger using the Unified Biometric System is being considered.

5. Road works management.

In the Arkhangelsk and Murmansk Regions, there are subsystems for the dispatching control of road maintenance services transport, including the service for monitoring the transport of road maintenance services, dispatching guidance, and systematic control over the operation of public utilities and the traffic of road maintenance services along the entire route. A module of the Geoinformation system (GIS) has been developed that visualizes the current location of special vehicles in the regions. In the Republic of Karelia, a subsystem for automated control over the performance of road and municipal equipment is at the implementation stage. The next technological direction of ITS subsystems in the field of road works management is the modeling of transport demand for road equipment, taking into account the data of meteorological support systems, the introduction of highly automated vehicles for road works.

6. Modules for centralized informing of traffic participants (weather information, blocked traffic, etc.)

All subjects of the Barents Region have implemented the Automated Meteorological Support System (AMS). The Automated traffic management system of the Murmansk Region is associated with weather stations and provides dynamic information about the state of the road surface. Informing road users is primarily carried out by providing information about the accessibility of roads on the website of road management companies, as well as in the regions there is a system of

SMS informing residents about the closure of road traffic due to weather conditions. In addition, the Federal State Institution Management of the St. Petersburg - Murmansk Highway of the Federal Road Agency provides video data in the form of images from the road from video control points on the site.

Of the regions studied, only in the Murmansk Region is it planned to introduce a module for centralized informing of road users, 3 road information boards have been installed. In the Arkhangelsk Region, it is planned to install two dynamic screens that warn drivers about the state of the roadway and weather conditions.

It is necessary to expand the network of road information boards, introduce modules for centralized informing of traffic participants. Interfacing these modules with geoinformation services, with modules for managing parking spaces not only in agglomerations, but also on federal roads, which can relieve local traffic. In the future, informing traffic participants can be carried out by transmitting information directly to the vehicle, to terminals inside the car, where various messages will be displayed to assist the driving process.

7. MaaS systems (mobility as a service)

On-demand transport access services (public transport, carsharing, taxis) act as an alternative to a private car. The impact of the COVID-19 pandemic on public transport has been reflected in the personalization of services and the Mobility as a Service (MaaS) trend. To obtain information about the schedule of public transport routes, the location and movement of vehicles on a city map, renting a vehicle, calling a taxi, passengers usually use mobile applications. In the studied regions, only the service for obtaining information about public transport, taxi call services operate. In Karelia (in Petrozavodsk) there is a car sharing service "Yandex.Go". At the same time, cross-border MaaS services aimed at tourists already exist in Finland, Norway, and Sweden.

8. Modules of V2X systems based on regional road infrastructure.

The introduction of subsystems for managing "smart road" facilities, the introduction of a service V2X platform for ensuring the movement of highly automated vehicles is considered in the subjects of the Barents Region in the future. In the Murmansk Region, the draft resolution "On Amendments to the Decree of the Government of the Russian Federation dated November 26, 2018, No. 1415" On conducting an experiment on trial operation on public roads of highly automated territory of the Murmansk Region was held public discussions. To date, the draft resolution has not been adopted by the Government of the Russian Federation.

V2X systems will be facilitated by 5G network technologies and possibly ITS - G5 (based on WiFi), since only they allow you to transfer the amount of information generated by the road infrastructure and vehicles at the required speed (unlike 4 G communication). It is assumed that the cars will communicate with the road infrastructure, with the so-called RSU-devices that will be built into the road elements. The lack of methods for linking unmanned vehicles to existing elements of the road infrastructure hinders the development of V2X systems. As well as in the world and in the Russian Federation there is no final single standard regarding the use of communication technology (5G or ITS - G5), the countries of the Barents Region also use different frequency bands regarding 5G communication.

9. Modules of cyber-physical systems in transport (IoT)

IoT modules help to model transport demand, taking into account real, rather than calculated, movements of residents during the day, month, and year. Also, IoT modules are necessarily used in multimodal logistics systems. In the future, the next stage in the development of ITS should

be the introduction of configuration modules for scenario plans for traffic control, transport forecasting and modeling. Telecommunication technologies for IoT systems are well developed in the Barents Region. The implementation of LPWAN networks for services and devices of the Internet of Things in the LTE standard based on NB- IoT (Narrow Band IoT) technology was provided by MTS. The impetus for the development of IoT systems may be the completion of the regulatory framework for the introduction of the industrial Internet of things. The first international standard for the Industrial Internet of Things was published, which was developed at the initiative of Rostelecom on the basis of the Technical Committee (TC) for Standardization 194 Cyber-Physical Systems of Rosstandart with the support of the Russian Ministry of Industry and Trade. The standard will become a platform for the development of the National Technology Initiative (NTI) and the digital economy. Its approval took place at the level of key organizations - the International Organization for Standardization and the International Electrotechnical Commission (ISO / IEC).

In the development of ITS systems in the regions, it is necessary to develop the technological base of ITS. In most regions, only the initial ITS infrastructure is being created, without significant automation and digitalization of traffic management processes. In a comprehensive solution to the problems of introducing ITS in the regions, it is no longer enough just to introduce the necessary technologies and launch the equipment necessary for the functioning of the system. Design based on transport planning and modeling data, taking into account regional tasks for managing urban mobility, and developing modules for scenario traffic control come to the fore.

Technological directions of development of ITS and related (interrelated) industries in the segment of railway transport.

JSC Russian Railways demonstrated a systematic approach to the implementation of ITS in the rail transport segment. Implemented:

- Digital platform for managing the transportation process,
- Intelligent control system and automation of production processes in railway transport,
- Ecosystem "digital twin" of Russian Railways,
- Integrated spatial data system of railway transport infrastructure,
- Platform for the analysis of "big data" of the movement of vehicles using IoT technologies,
- Digital platform for multimodal passenger transportation (Innovative Mobility system),
- Digital platform for managing and monitoring freight traffic,
- Digital platform "operator of linear infrastructure",
- Digital platform "traction rolling stock,
- The capacity of the backbone and local data transmission networks is being increased,
- LPWAN networks are being built for Internet of Things connections.

It is planned to develop quantum communication systems (working with optical signals and creating devices based on them). Assembled fiber optic backbone. A typical trusted node has been designed. Engineering infrastructure has been developed. By 2024, the total length of quantum networks in the Russian Federation should be more than 7,000 km, and include backbone, regional and subscriber networks.

Technological directions for the development of ITS and related (interrelated) industries in the sea transport segment.

In the field of sea transport management, the following have been introduced:

- Complex integrated information system "Sea - River" ("MoRe"). It allows you to receive accurate and timely information about functional elements: the composition and arrangement of the fleet under the flag of the Russian Federation, shipowners and their fleet, cargo turnover in ports, duty forces and rescue equipment, statistical data, etc. Organized information exchange with a unified system of information about the World Ocean,
- Situational center based on the technology of "Digital Twin" using the technology of processing "big data". The system is designed for graphical visualization of reporting operational information about the activities of the organization and the entire controlled port infrastructure in real time and is a digital twin of the enterprise,
- Public digital maps have been created for all inland waterways included in the reference network. A system has been created that contains a common knowledge base of the pilot service, a single database of electronic charts, magazines, reference books of ships, routes, and movement histories,
- Platform for the development of technology for unmanned navigation by computer simulation. In 2020, testing of unmanned navigation began as part of the Marinet. In 2021, the flight was performed in automatic mode under the control of the crew,
- Unmanned aerial vehicles are being tested on ships to obtain additional information about the ice situation,
- Testing of the control system of the hydrographic boat from the board of the dredging vessel or from the shore is being carried out, which will ensure the carrying out of sounding works without the presence of a hydrographer and a navigator on board.

It is planned:

- Implementation of digital technologies for the development of multimodal transportation in the waters of the Northern Sea Route. Development of a digital platform for paperless electronic registration of multimodal transportation of passengers and goods,
- Equipping ships with an ecosystem of IoT devices. Predictive (or predictive) analytics of data received from ship mechanisms and systems will allow identifying technical problems earlier. Interaction with the digital shore system will reduce the time of repair and stay in the port,
- Deployment of the highly elliptical hydrometeorological space system Arktika-M, which provides interested federal executive authorities and organizations with satellite hydrometeorological data of high temporal resolution over the polar region of the Earth,
- Construction of an underwater transarctic fiber-optic transmission line along the route Murmansk - Vladivostok with exit points along the Northern Sea Route (NSR).

Technological directions for the development of ITS and related (interrelated) industries in the aviation transport segment.

In the field of aviation transport management, the following have been introduced:

- Unified Air Traffic Management System of the Russian Federation. The Unified Air Traffic Management System and 12 Regional Centers of Unified Air Traffic Management System were established. 98 airfield control centers of Unified Air Traffic Management System have also been established.

It is planned to introduce:

- Digital infrastructure platform for managing a unified system of aerospace search and rescue and interaction with other search and rescue services based on the solutions of FSIS "POISK-IAS",
- Geoinformation system for monitoring the operational and technical condition of aviation infrastructure elements (using artificial intelligence technology),
- New Aviation Safety Information System,
- Module of "digital twin" of airfields of the Russian Federation,
- Biometric passenger identification system. Six Russian airports by the end of 2023.

As general trends in the development of ITS of all types of transport, the following can be noted:

- The introduction of multimodal passenger transportation, the introduction of a single ticket for all modes of transport,
- Equipping cargo transport with on-board devices to optimize traffic flows,
- Digital solutions in the field of "Big Data", including forecasting the intensity of traffic flows, as well as digital solutions in the field of video analytics, including video analytics in public passenger transport,
- Connecting the vehicle to communication systems at any point of the road infrastructure,
- Digital monitoring of the state of infrastructure,
- Digitalization of cross-border logistics,
- Information security system. An important issue for the development of ITS for all modes of transport is the high level of vulnerability of the information and telecommunications infrastructure. A ban has been introduced on the use of foreign software by state-owned companies and critical infrastructure facilities.

1.5. Assessment of the level of consistency of strategic planning documents with the plans of the neighboring countries of the Barents Region

The key document defining the strategic directions of cooperation between the countries of the Barents Region in terms of the development and connectivity of transport systems is the "*Joint Transport Plan for the Barents Region*"[210]. An updated version was released in 2019. It defines:

- key objectives for the development of the transport system in the Barents Region,

[210]Joint Transport Plan for the Barents Region (https://mintrans.gov.ru/documents/8/10541?type=)

- measures to reduce the negative impact of transport on the climate, improve safety, create a more efficient transport system,
- transport needs and the state of the transport system in the Barents Region, priority transport corridors and cross-border routes,
- opportunities to increase the connectivity of national transport systems (including an increase in freight turnover), including in the East-West direction.

The Joint Transport Plan for the Barents Region also pays great attention to the development of intelligent transport systems, connected mobility and digitalization, which are recognized as a promising area for cooperation between the countries of the Barents Region (for more details, see paragraph 1.1.1.).

The development goals of the national transport systems of Russia, Norway, Finland, Sweden are generally similar, and especially in strategic approaches and development priorities. First of all, the strategic targets of the countries of the Barents Region include such factors as:

- Ensuring economic growth and social development of countries (including regional development) through the national transport system;
- Ensuring the safety of road users;
- Improving mobility and transport accessibility;
- Digitalization of the transport industry;
- Ensuring the carbon footprint reduction and the harmful impact of transport on the climate.

The countries of the Barents Region have adopted national strategic planning documents for the development of the transport system in general, and the development of ITS in particular. A detailed list of documents and plans is presented below in Table 29.

In **Finland,** the main strategic planning documents are**:**

- *"National Transportation System Plan 2021–2032"* [211]. The objectives of the development of the transport system are to increase the competitiveness of Finland, combat climate change, as well as the viability and accessibility of regions. These social goals are achieved through the design of transport systems while meeting customer needs.
- *"National Program for Sustainable Growth in the Transport Sector 2021-2023"* [212]. The goal of the program is to promote export growth in the sector based on sustainable solutions, support the creation of five to seven active international transport business ecosystems, and create 10,000 new sustainable jobs through new business by 2025. The program provides for the creation of an international competitive ecosystem, including MaaS, blockchain, machine learning, artificial intelligence, automation, big data, new sources of energy and zero-emission fuels.

In **Sweden**:

- *"National Transportation Plan 2019–2024"*[213]. It is focused in the long term on the development of sustainable infrastructure.

[211] Valtakunnallinen liikennejarjestelmäsuunnitelma vuosille 2021–2032 (https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/163389/VN_2021_75.pdf?sequence=1&isAllowed=y)

[212] National Program for Sustainable Growth in the Transport Sector 2021-2023 (https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/163884/VN_2022_8.pdf?sequence=1&isAllowed=y)

[213]The Swedish Transport Administration's implementation plan for the years 2019–2024 (https://trafikverket.ineko.se/Files/sv-SE/61956/Ineko.Product.RelatedFiles/2019_106_the_swedish_transport_administrations_%20implementation_plan_for_the_years_2019_2024%20_english_short_version.pdf)

– *"National strategy*[214] *and action plan for the use of ITS"* [215]. The goal of the transport policy is to ensure socio-economic efficient and long-term sustainable transport for citizens and businesses throughout the country. The national ITS strategy should contribute to the achievement of the set goals, using the opportunities of digitalization. "Leadership through innovative transport solutions" is the vision of the strategy and action plan for the development of Swedish ITS.

In **Norway**:

– *"National Transportation Plan 2018–2029"* [216]. It aims to create a Norway with increased mobility, lower transport costs and reduced emissions.
– *"ITS Strategy of the Norwegian Public Roads Authority 2018-2023"* [217]. The main objectives of this strategy are to prepare the transport system of the future, professionally develop the road network and take care of it, contribute to the safety of road users and safe vehicles. The strategy targets all work processes, dialogues and interactions with internal and external users and partners.

In **Russia:**

– *"Transport strategy of the Russian Federation for the period up to 2030 with a forecast for the period up to 2035"* [218]. The strategy provides for the implementation of the following long-term goals for the development of the transport system:
  – increasing spatial connectivity and transport accessibility of territories;
  – increasing the mobility of the population and the development of domestic tourism;
  – increase in the volume and speed of cargo transit and development of multimodal logistics technologies;
  – digital and low-carbon transformation of the industry and accelerated adoption of new technologies.
– *"State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017, No. 1596)"*[219]. The State program, being a tool for implementing the State transport policy and the priorities of the Transport Strategy, provides for the implementation of the following key goals:
  – acceleration of goods circulation based on improving the quality of transport infrastructure by 5,7 percent compared to the level of 2021 (including the digital transformation of the industry);
  – increasing the availability of high-quality transport services to ensure the transport mobility of the population at the level of 9,3 thousand passenger-km per 1 inhabitant;

[214] Nationell strategi och handlingsplan för användning av ITS (https://www.trafikverket.se/contentassets/e7bc1e3e3f434566a923bae23940e7a7/strategi_handlingsplan_its_140430_ts.pdf)

[215] Komplettering av Nationell strategi och handling plan for användning av Intelligenta transport system i Sverige (http://trafikverket.diva-portal.org/smash/get/diva2:1363756/FULLTEXT01.pdf)

[216] The National Transport Plan 2018–2029

[217] ITS strategies for Statens vegvesen 2018–2023 (https://www.vegvesen.no/globalassets/fag/trafikk/its-portalen/its-strategi-2018-2023.pdf)

[218] Transport strategy of the Russian Federation for the period up to 2030 with a forecast for the period up to 2035 (https://docs.cntd.ru/document/727294161)

[219] Transport strategy of the Russian Federation for the period up to 2030 with a forecast for the period up to 2035 (https://docs.cntd.ru/document/727294161)

- increasing the competitiveness of the Russian transport system in the global transport services market and increasing the export of transport complex services to 22 billion dollars;
- bringing the share of motor roads of regional and intermunicipal significance that meet regulatory requirements to 50,9 percent;
- ensuring the share of the road network in the largest urban agglomerations that meets regulatory requirements at a level of at least 85 percent;
- improving the integrated safety and resilience of the transport system to reduce the number of transport accidents per unit of vehicles by 6,6 percent compared to 2021 levels.

– *"National project "Safe quality roads"*[220]. The national project aims to increase regional roads that meet regulatory requirements, reduce the proportion of federal and regional highways operating in overload mode, reduce accident-hazardous areas, and reduce road deaths. Within the framework of the federal project "System-wide measures for the development of the road sector", which is an integral part of this national project, the vector of development of ITS in the Russian Federation is determined.

ITS play a significant role in the development of national transport systems, including in improving road safety, optimizing traffic flows, and the mobility of road users.

There are several factors that determine the inconsistency in the development of ITS in the Nordic countries (Norway, Sweden, Finland) and in Russia:

- The development of Russian ITS is mainly focused on the installation of systems in large agglomerations, while in the Nordic countries ITS is being developed not only in agglomerations and rural settlements, but also on main roads (See the structure of projects in Table 30). This vector of development of Russian ITS is determined by the settlement system and the concentration of the population of the Russian Federation in large cities, budgetary and infrastructural constraints. Thus, by 2024, according to the Federal project "Public measures for the development of the road sector", it is planned to introduce integral ITS systems in 64 urban agglomerations with over 300 thousand people. It is planned to introduce ITS elements on federal roads (120 sections) (an increase in the number of stationary cameras for photo and video recording of traffic violations), and on regional roads (60 sections) it is also planned to introduce individual elements of ITS (photo and video recording cameras for traffic violations, automatic points of weight and size control of vehicles). On main roads (highways of federal significance), the introduction of integrated ITS systems is carried out on the most significant metropolitan structures (such as the Central Ring Road, the M11 Moscow - St. Petersburg highway), whereas in the regions of the Barents Region on roads of federal and regional significance, as already noted above, it is planned to implement individual elements of ITS.
- Increased attention from the Nordic countries (Norway, Sweden, Finland) to the development of ITS in ensuring traffic safety on roads in winter conditions and on

[220]https://mintrans.gov.ru/documents/8/11524?

difficult road sections (See the structure of projects in Table 30). The Barents Region and its transport network is in the Far North, which creates significant problems for traffic. On some routes of the northern regions, the problem of closing roads during snowstorms and snowfalls is significant. Norway has some of the longest tunnels in the world in mountainous terrain, and there are narrow stretches of road where it is difficult for oncoming heavy vehicles to pass. The use of ITS contributes to the optimization of traffic, increasing its reliability and safety in any conditions. At the same time, much less attention has been paid to this area in the development of Russian ITS.

As part of environmental policy (including transport carbon footprint reduction), all the countries of the Barents Region, including Russia, have ratified the Paris Climate Agreement (2015).

Norway, Sweden, and Finland have broadly similar strategies in place to achieve emission reduction targets in the transport sector. At the same time, these countries have various incentive mechanisms to reduce travel needs, switch modes of transport, increase the use of environmentally friendly vehicles and renewable fuels:

- In Norway, the climate goal is to reduce greenhouse gases by at least 50% and up to 55% by 2030 compared to 1990 levels[221]. To achieve this goal in the transport sector, it is assumed[222]:
  - gradual replacement of personal vehicles, trucks and buses with zero-emission vehicles. For example, by 2025, all new passenger car sales must be zero-emissions. First of all, the emphasis is on the distribution of electric vehicles, for which tax incentives are provided;
  - reducing the need for transport use and ensuring the transition to more environmentally friendly modes of transport (increased use of environmentally friendly public transport, walking and cycling);
  - a significant increase in freight traffic by rail and sea transport due to a decrease in road transport (by 2030, at least 30% of road transport at distances over 300 km should be transferred to rail transport and sea transport);
  - expanding the use of biofuels. The admixture of biofuels to petrol and diesel sold in Norway is mandatory.
- In Sweden, the climate goal is to reduce greenhouse gases by 2030 to at least 63% lower than emissions in 1990[223]. To achieve this goal in the transport sector, it is assumed[224]:
  - transition to environmentally friendly and energy efficient vehicles. To do this, economic incentives are used to accelerate the transition to more environmentally friendly vehicles. In particular, a system of bonuses is provided for the purchase of electric and hydrogen fuel vehicles (60,000 kronor) and natural gas vehicles (10,000 kronor);

[221]https://www.regjeringen.no/no/tema/klima-og-miljo/innsiktsartikler-klima-miljo/klimaendringer-og-norsk-klimapolitikk/id2636812/

[222]Eco-friendly transport in the Barents Region. Report 03/27/2020

[223]https://www.regeringen.se/artiklar/2017/06/det-klimatpolitiska-ramverket/

[224]Eco-friendly transport in the Barents Region. Report 03/27/2020

- increase in the share of transportation by rail and sea. This is facilitated by a number of measures aimed at increasing the competitiveness of rail and sea transport;
- moving towards a society with more public transport, walking and cycling;
- promotion of renewable fuels. Sweden has programs to support renewable fuels. The Climate Change Program (Klimatklivet)[225] aims to support investment in innovative technologies to reduce greenhouse gas emissions. Another program "Charging the car" (Ladad bilen)[226] aims to support investments in the development of vehicle charging infrastructure. In addition, in Sweden the addition of biodiesel to gasoline and diesel sold is mandatory.

- In Finland, the climate goal is to achieve carbon neutrality by 2035. For the transport sector, the goal is to reduce emissions by 50% by 2030 compared to 2005 levels. To achieve this goal in the transport sector, it is assumed[227]:
  - improving the energy efficiency of the transport system. The main tool to achieve this goal is mobility as a service (MaaS) with the aim of reducing the number of car trips alone. It is planned to create conditions for walking, cycling and public transport;
  - improving the energy efficiency of vehicles. The emphasis is on accelerating the pace of renewal of the vehicle fleet, increasing electric vehicles;
  - replacing oil-based fossil fuels with renewable and/or low-emission fuel alternatives. The addition of biofuels to refuel vehicles is one of the measures to replace oil-based fossil fuels. The goal is that in 2030, 30% of all fuels sold will be energy from biofuels. Also, much attention is paid to the construction of filling infrastructure (gas and hydrogen stations and chargers for electric vehicles). The transition to environmentally friendly vehicles should be based largely on market conditions. Despite this, there are also economic incentives in Finland to switch to environmentally friendly vehicles.

In Russia, in accordance with the Decree of the President of the Russian Federation "On the reduction of greenhouse gas emissions" as part of the implementation of the Paris Climate Agreement (dated December 12, 2015), it is planned to reduce greenhouse gas emissions by 70% by 2030 compared to the 1990 level, taking into account the maximum possible absorption capacity of forests and other ecosystems and subject to sustainable and balanced socio-economic development of the Russian Federation. In pursuance of the Decree of the President of the Russian Federation, a Strategy was developed for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050. For its implementation in the transport sector it is expected:

- the use of new energy-efficient vehicles, large-scale electrification and gasification of public transport, the transfer of road transport to hybrid power plants, stimulating the use of public transport;
- construction of gas engine and electric charging infrastructure for various categories of transport;

[225]https://www.naturvardsverket.se/bidrag/klimatklivet/
[226]https://www.naturvardsverket.se/bidrag/ladda-bilen/
[227]Eco-friendly transport in the Barents region. Report 03/27/2020

– introduction of new transport and information technologies for control and positioning, development, and implementation of intelligent information systems for monitoring and control in transport. (For more details, see paragraph 1.1.).

In order to reduce greenhouse gas emissions in the transport sector of the Russian Federation, road transport is considered a priority through the use of alternative fuels, namely liquefied natural gas, batteries, hydrogen fuel and fuel cells. At the same time, the greatest attention is paid to the expansion of the use of natural gas vehicles, which is confirmed both by the analysis of strategic planning documents and by the actual practice of implementing regional projects. The expansion of the use of electric transport is expected mainly in the field of urban public rather than personal transport. For a significant expansion of the use of electric vehicles in the Russian Federation, there are currently significant limitations in the form of an underdeveloped production of electric vehicles and an underdeveloped charging infrastructure. This is one of the key differences from the environmental policy in the transport sector of the Nordic countries (Norway, Sweden, Finland), in which more emphasis is placed on the widespread use of electric vehicles, as well as a significant reduction in freight transport by road transport towards an increase in rail and sea transport to reduce greenhouse gas emissions.

Table 29. List of documents and plans regulating the development of transport systems in the countries of the Barents Region

№	Document title in original language	Title of the document in English	Links
1.	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 (Text with EEA relevance)	Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on a framework for the deployment of ITS in the field of road transport and for interfacing with other modes of transport (Text relevant to the EEA)	https://eur-lex.europa.eu/eli/dir/2010/40/oj/eng
2.	ITS Finland	ITS Finland	https://its-finland.fi/
3.	Valtakunnallinen liikennejärjestelmäsuunnitelma vuosille 2021–2032	National Transport System Plan 2021-2032	https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/163389/VN_2021_75.pdf?sequence=1&isAllowed=y
4.	National Programme for Sustainable Growth in the Transport Sector 2021-2023	National program for sustainable growth in the transport sector for 2021-2023	https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/163884/VN_2022_8.pdf?sequence=1&isAllowed=y
5.	ITS Sweden	ITS Sweden	https://its-sweden.se/
6.	Nationell strategi och handlingsplan för användning av ITS	National strategy and action plan for the use of ITS	https://www.trafikverket.se/contentassets/e7bc1e3e3f434566a923bae23940e7a7/strategi_handlingsplan_its_140430_ts.pdf
7.	Nationell strategi för användandet av ITS (Kortversion)	National strategy for the use of ITS (short version)	https://www.trafikverket.se/contentassets/e7bc1e3e3f434566a923bae23940e7a7/nationell_strategi_anvandandet_its_kortversion.pdf
8.	Komplettering av Nationell strategi och handlingsplan för användning av Intelligenta transportsystem i Sverige	Complementing the National Strategy Action Plan for the Use of ITS in Sweden	http://trafikverket.diva-portal.org/smash/get/diva2:1363756/FULLTEXT01.pdf
9.	Komplettering av Nationell strategi och handlingsplan för användning av Intelligenta transportsystem i Sverige Kortversion	Complementing the National Strategy Action Plan for the Use of ITS in Sweden (short version)	http://trafikverket.diva-portal.org/smash/get/diva2:1363757/FULLTEXT01.pdf
10.	För ett hållbart digitaliserat Sverige – en digitaliseringsstrategi	Digitalization strategy	https://www.regeringen.se/49adea/contentassets/5429e024be6847fc907b786ab954228f/digitaliseringsstrategin_slutlig_170518-2.pdf
11.	Sverige helt uppkopplat 2025 – en bredbandsstrategi	Broadband Strategy	https://www.regeringen.se/4b00e7/contentassets/a1a50c6a306544e28ebaf4f4aa29a74e/sverige-helt-uppkopplat-2025-slutlig.pdf

№	Document title in original language	Title of the document in English	Links
12.	Regeringsinitiativ med anledning av OECDs grundläggande genomlysning av Sveriges digitaliseringspolitik	Government Initiative for the OECD Fundamental Review of Sweden's Digital Policy	https://www.regeringen.se/artiklar/2019/08/regeringsinitiativ-med-anledning-av-oecds-grundlaggande-genomlysning-av-sveriges-digitaliseringspolitik/
13.	Regional utvecklingsstrategi Norrbotten 2030	Norrbotten Regional Development Strategy 2030	https://www.norrbotten.se/publika/lg/regio/2019/Regional%20utvecklingsstrategi%20Norrbotten%202030_webb%20(Utskrift%20A4).pdf
14.	ITS Norway	ITS Norway	www.its-norway.no
15.	The National Transport Plan 2018–2029	National Transport Plan 2018–2029	https://www.regjeringen.no/contentassets/7c52fd2938ca42209e4286fe86bb28bd/en-gb/pdfs/stm201620170033000engpdfs.pdf
16.	ITS-strategi for Statens vegvesen 2018–2023	ITS strategy of the Norwegian Public Roads Authority 2018–2023	https://www.vegvesen.no/globalassets/fag/trafikk/its-portalen/its-strategi-2018-2023.pdf
17.	Transport21	Strategy Transport21	https://www.regjeringen.no/contentassets/ba71b86246904239a1f6d56721be97e1/transport21-rapporten---web.pdf
18.	Транспортная стратегия Российской Федерации на период до 2030 года с прогнозом на период до 2035 года	Transport strategy of the Russian Federation for the period up to 2030 with a forecast for the period up to 2035	https://docs.cntd.ru/document/727294161
19.	Государственная программа Российской Федерации «Развитие транспортной системы» (Постановление Правительства РФ от 20.12.2017 г. № 1596)	The State Program of the Russian Federation "Development of the Transport system" (Decree of the Government of the Russian Federation No. 1596 dated 20.12.2017)	https://docs.cntd.ru/document/556157375
20.	Национальный проект «Безопасные качественные дороги»	National Project "Safe quality roads"	https://mintrans.gov.ru/documents/8/11524?
21.	The Barents Euro-Arctic Council	The Barents Euro-Arctic Council	https://www.barents-council.org/ https://mintrans.gov.ru/activities/69/84
22.	Barents Euro-Arctic Transport Area (BEATA)	Barents Euro-Arctic Transport Area (BEATA)	https://www.barentscooperation.org/en/Working-Groups/BEAC-Working-Groups/Transport-(BEATA)
23.	Совместный транспортный план Баренцева региона (проект)	Joint Transport Plan of the Barents Region (project)	https://mintrans.gov.ru/documents/8/10541?type=

Table 30. Examples of ITS pilot projects proposed for implementation in the Barents Region

№	Project name	Project description	Years of project implementation	Location of the project	Links
Finland					
1.	E8 Aurora	Improving road safety and the reliable functioning of freight transport on the Vt21 Kolari-Kilpisjärvi highway	2017–2019	On highways, highways (out of town)	https://vayla.fi/documents/25230764/0/Reija+Viinanen.pdf/a28f9b60-82ee-47ba-b630-d702548d5a42
2.	Arctic Challenge	Automated traffic in snowy and icy road conditions	2017–2019	On highways, highways (out of town)	https://julkaisut.vayla.fi/pdf12/vt_2019-19_arctic_challenge_web.pdf
3.	WIRMA	Industrial "Internet of Things" for winter maintenance of roads in the north of the country	2018–2020	On highways, highways (out of town)	https://www.wirma-project.eu/
4.	ALASCA (Automated Road Monitoring Pilot Using 2D Laser Scanning)	Pilot project on road monitoring using a 2D laser scanner	2017–2018	On highways, highways (out of town)	https://www.lapinamk.fi/fi/Yrityksille-ja-yhteisoille/Julkaisut/Lapin-AMKin-julkaisut/Tekniikka-ja-teollisuus?itemid=2440&showlocation=7c5ea7f8-c8b2-454d-ae43-dddd71cfde31
5.	Nordic Silk Way	Digitalization and improving the continuity of cross-border traffic between Finland and Russia. Key areas of focus include automation, smart infrastructure, and freight efficiency improvements	2019	On highways, highways (out of town)	http://www.ytl.fi/files/177/Sujuva_ja_digitaalinen_Suomen_ja_Venajan_rajat_ylittava_liikenne_tutkimus_18.6.2019.pdf
6.	Reindeer Warning Bell	Reindeer tracking and warning on the roads. Travelers receive reindeer alerts through the Porokello website, the free Porokello mobile app, or GPS systems. Warnings are valid for half an hour, within a radius of 750 meters	2018 - present time	In cities/rural areas	https://porokello.fi/
7.	Lapin Reittiopas — Open Arctic MaaS	Advanced mobility services for local people and tourism	Current project	In sparsely populated areas of Northern Finland	https://www.arcticmaas.fi/
Sweden					
8.	Drive Sweden	Development of a cloud-based traffic management platform that ensures the seamless exchange of information between emergency and automated vehicle coordinators	2017–2018	In the agglomeration	https://www.drivesweden.net/en/projects-5/traffic-management-emergency-vehicles

№	Project name	Project description	Years of project implementation	Location of the project	Links
9.	Drive Sweden	Intelligent transport services in rural areas. The project aims at future transport systems for sparsely populated areas in the form of transport services driven by autonomous, electric, and on-demand vehicles and unmanned aerial vehicles	2020	In the countryside	https://www.drivesweden.net/en/projects-5/smart-rural-transport-services
10.	Drive Sweden	Autonomous unmanned vehicles in the countryside	2020–2021	In the countryside	https://www.drivesweden.net/en/projects-5/countryside-selfdriving-vehicles
11.	Interreg Sverige - Norge	Solving common problems identified in the border region through cross-border cooperation and exploiting untapped potential	Current project	On highways, highways (out of town)	http://www.interreg-sverige-norge.com/planera/malet-med-programmet/insatsomraden/insatsomrade-hallbara-transporter/
Norway					
12.	Borealis E8	46 km of the road Skibotn (Norway) - Kilpisjärvi (Finland). Collection of road meteorological information, data on road conditions and traffic accidents, as well as the issuance of warnings about wild animals or obstacles on the road	2017–2019	On highways, highways (out of town)	-
13.	Borealis E8 Scania / Ahola	Systems of unmanned vehicles when driving in formed convoys (platooning)	2018	On highways, highways (out of town)	-
14.	Borealis E8 Triona and Euroskilt	Intelligent electronic signs posting information from ITS stations and sensors	2019	On highways, highways (out of town)	https://www.triona.no/
15.	Borealis E8 Aventi	Autonomous control systems for unmanned vehicles in difficult areas	2019	On highways, highways (out of town)	http://aventi.no/
16.	Borealis E8 ITS Perception	Using LIDAR sensors for remote detection of objects on the roadway	2019	On highways, highways (out of town)	https://itsperception.no/
17.	Borealis E8 Q-Free	Small sensors on the road for continuous monitoring of particularly difficult routes	2019	On highways, highways (out of town)	https://www.q-free.com/
18.	Borealis E8 Bouvet	Digital system to avoid potentially dangerous situations when meeting heavy vehicles in rural areas. The project uses elements of machine learning, IoT solutions and cloud technologies	2019	In the countryside	https://www.bouvet.no/prosjekter/takting-smart-flatestyring-copy-2
19.	Borealis E8 Norce	Development of a system based on acoustic fiber for registration of traffic accidents	2019	On highways, highways (out of town)	https://www.norceresearch.no/

№	Project name	Project description	Years of project implementation	Location of the project	Links
20.	Borealis E8 Norce	Situational understanding of unexpected events (collection of data from road authorities, emergency services and road users; rapid exchange of information between various stakeholders; real-time 3D visualization of the situation)	2019	On highways, highways (out of town)	https://www.norceresearch.no/
21.	Borealis E8 PSI - Group	Forecast of trip duration by road sections	2019	On highways, highways (out of town)	-
22.	BITS (Båtsfjord intelligente transportsystemer)	Development of a data dissemination platform. The solution uses GPS data and real-time information about weather conditions, snow removal and other road conditions.	2019	On highways, highways (out of town)	-
23.	Webstep	Understanding past events and predicting future risks by combining geospatial data and machine learning	Current project	Inside and outside cities	https://www.webstep.com/
24.	Aventi	Ensuring efficient and controlled border crossings for heavy vehicles with V2X technology	Current project	On highways, highways (out of town)	http://aventi.no/
25.	Bouvet	Reduced time and increased safety of cargo transportation from the northern coast of Norway to Helsinki	Current project	On highways, highways (out of town)	https://www.bouvet.no/
26.	ITS Perception	Autonomous solution for detecting and sharing real-time traffic data for problem areas of rural roads	Current project	In the countryside	https://itsperception.no/
Russia					
27.	State system of emergency response in case of accidents (GAIS) "ERA-GLONASS"	Ensuring prompt receipt of information on traffic and other incidents on roads in the Russian Federation, its processing, storage, and transfer to emergency operational services, as well as access to this information by state bodies, local governments, officials, legal entities, individuals	2017 - present time	Inside and outside cities	https://eraglonass.ru/
28.	National project "Safe and high-quality roads"	By 2024, it is planned to reduce the number of accident sites (accident-hazardous areas) on the road network of the Russian Federation by two times compared to 2017, as well as reduce the death rate as a result of an accident by 3,5 times compared to 2017 - to a level not exceeding 4 people per 100 thousand. population (by 2030 – striving for a zero-mortality rate)	2019 - present time	Inside and outside cities	https://bkdrf.ru/
Relevant Nordic projects					

№	Project name	Project description	Years of project implementation	Location of the project	Links
29.	NordicWay 3	Improving road safety with K-ITS. Implemented by the national road authorities of Finland, Norway, Sweden, and Denmark, as well as private companies and research centers	2019–2023	Inside and outside cities	https://www.nordicway.net/

2. Analysis of the current status and structure of the implementation of Russian regional projects for the development of ITS and transport carbon footprint reduction in the Barents Region

2.1. Formation of a list of current and prospective Russian projects with the main technical and economic characteristics, implementation timeframes and target results

Based on the results of the analysis of the information base on projects in the field of ITS and transport carbon footprint reduction, formed on the basis of a wide list of open sources, verified through requests to the regional and local authorities of the Russian segment of the Barents Region, regional authorities of JSC Russian Railways and organizations for the operation of federal and regional roads, a database of current and prospective Russian projects in the field of ITS and transport carbon footprint reduction was collected.

The structuring of the database was carried out in accordance with the identified structure of projects in the technological areas of their implementation.

The list of projects for the development of ITS and related project areas implemented in the Russian segment of the Barents Region is presented in the Table below.

2.1.1. List of projects in the field of intelligent transport systems and related project areas implemented in the Russian segment of the Barents Region

Table 31. List of projects for the development of ITS and related project areas implemented in the Russian segment of the Barents Region

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
1.	Unified digital platform for managing the transport system	Automotive	Implementation of the Unified transport system management platform in accordance with the requirements of the federal ITS management system	Murmansk Region	Implementation of the Unified transport system management platform in Murmansk to organize the interconnected functioning of all subsystems and services of the ITS of the road network of agglomerations. The architecture of the implemented ITS complies with the approved federal requirements and recommendations. Implemented modules: - "digital twin" - coordinated traffic management - public transport traffic management - GIS for collecting, storing, analyzing, and visualizing data - electronic Comprehensive traffic management scheme The following modules are planned for implementation until 2024: - transport forecasting and modeling - centralized informing of traffic participants - administration of traffic violations	Government of the Murmansk Region, GOBU "Center for Information Technologies of the Murmansk Region"	2020–2024	n/a	Improving the safety of road users Improving the quality of urban agglomeration transport development planning Increasing the capacity of the transport network Transport carbon footprint reduction	Operation of implemented modules, implementation of planned modules
2.	Unified digital platform for managing the transport system	Automotive	Implementation of the Unified transport system management platform in accordance	Arkhangelsk Region	Establishment of a Unified Control Center for an intelligent transport system for the effective management of traffic flows in Arkhangelsk for the effective management of traffic flows on the roads. The architecture of the implemented ITS complies with the approved	Government of the Arkhangelsk Region, State budgetary institution of the Arkhangelsk Region	2020–2024	2022 – 81,8 2023 – 93,5	Improving the safety of road users Improving the quality of urban agglomeration transport development planning Increasing the capacity of intersections by 25% (according to the traffic police)	Operation of implemented modules, implementation of planned mosules

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
			with the requirements of the federal ITS management system		federal requirements and recommendations	"Archtelecenter"			Transport carbon footprint reduction	
3.	Coordinated motion control module	Automotive	Implementation of an automated traffic management system	Republic of Karelia	Implementation of the pilot project of automated traffic management system in the Petrozavodsk city district. In 2020, a pilot facility was introduced - a traffic control subsystem (installation of flow sensors, video surveillance cameras, information light sections) A pilot project of automated traffic management system is being implemented on the street and road network of the Petrozavodsk city district. The number of traffic light objects (intersection, pedestrian crossing) with intelligent control by 2025 - 6 pcs.	Government of the Republic of Karelia, LLC Urbanomics PJSC Rostelecom	2020–2024	n/a	Improving the safety of road users Improving the quality of urban agglomeration transport development planning Increasing the capacity of the transport network Transport carbon footprint reduction	Investment stage
4.	Coordinated motion control module	Automotive	Implementation of traffic control subsystems	Arkhangelsk Region	Implementation of traffic control subsystems in Arkhangelsk (installation of flow sensors, video surveillance cameras, smart traffic lights)	Government of the Arkhangelsk Region	2022–2024	n/a	Increasing the capacity of the transport network Improving the safety of road users	Investment stage, (implementation of software, installation of peripheral equipment)
5.	Coordinated motion control module	Automotive	Implementation of traffic control subsystems	Murmansk Region	Subsystems for monitoring the parameters of traffic flows, traffic light control, lane control, directive control of traffic flows, smart pedestrian crossing	Government of the Murmansk Region	2020–2024	n/a	Increasing the capacity of the transport network Improving the safety of road users	Exploitation
6.	Coordinated motion control module	Automotive	Implementation of traffic control subsystems	Republic of Karelia	It is planned to introduce a traffic control subsystem in Petrozavodsk (traffic light control, traffic flow control)	Government of the Republic of Karelia, PJSC Rostelecom	2022–2024	n/a	Increasing the capacity of the transport network Improving the safety of road users	Investment stage

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
7.	Coordinated motion control module	Automotive	Implementation of traffic control subsystems	Republic of Komi	Equipping two intersections in Syktyvkar with "smart" traffic lights	Government of the Republic of Komi	2022	n/a	Reducing the travel time of cars by at least 18%	Exploitation
8.	Coordinated motion control module	Automotive	Implementation of traffic control subsystems	Nenets Autonomous District	It is planned to introduce ITS elements for the Naryan-Mar ring roads: collect data on the parameters of traffic flows, monitor weather conditions, record traffic violations, and manage outdoor lighting, traffic lights, road signs, information boards, etc.	Nenets Autonomous District government	2022–2024	n/a	Increasing the capacity of the transport network Improving the safety of road users	Pre-project (development of the implementation concept)
9.	Traffic Violations Administration Module	Automotive	Implementation of violation control subsystems	Arkhangelsk Region	Implementation of subsystems for detecting accidents and emergencies in the territory of the Arkhangelsk urban district. Installation of 7 systems and rent of 17 systems for automatic control and detection of traffic violations	Government of the Arkhangelsk Region	2022–2024	n/a	Improving road safety The share of decisions sent to offenders identified by means of the subsystem - 100%	Implementation stage (equipment installation)
10.	Traffic Violations Administration Module	Automotive	Development of violation control subsystems	Murmansk Region	Development of a system for photo and video recording of traffic violations. Installation of 80 additional stationary systems for monitoring and detecting traffic violations. Increase in the number of mobile complexes up to 78	Government of the Murmansk Region	2020–2022	n/a	Improving road safety The share of decisions sent to offenders identified by means of the subsystem - 100%	Implementation stage (equipment installation)
11.	Traffic Violations Administration Module	Automotive	Development of violation control subsystems	Republic of Karelia	Implementation of mobile complexes for photo-video recording of traffic violations	Government of the Republic of Karelia	2022–2024	n/a	Improving road safety The share of decisions sent to offenders identified by means of the subsystem - 100%	Investment stage
12.	Traffic Violations Administration Module	Automotive	Development of violation control subsystems	Republic of Komi	A project to equip crossroads and streets in Syktyvkar with the VOCORD Traffic system. Traffic violations are recorded at five intersections and twelve streets of the city. The system automatically monitors traffic flows, counts cars, and compares data on passing cars with search databases. 17 control lines of the VOCORD Traffic system were installed,	Government of the Republic of Komi, OJSC Rostelecom, LLC Nordkomp	2021–2024	n/a	Reduction of accidents by 30% in the areas of implementation of the subsystem (according to the traffic police)	Implementation stage (equipment installation)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
					equipped with specialized VOCORD NetCam4 cameras					
13.	Digital twin module	Automotive	Implementation of the "digital twin" module of the transport infrastructure	Arkhangelsk Region	Launching a system for monitoring road funds, creating 3D models of all transport infrastructure facilities, developing an information system for accounting and planning work / costs for the design, construction, repair, and maintenance of transport infrastructure facilities, creating mobile measuring laboratories	Government of the Arkhangelsk Region	2021–2030	The project is implemented at the expense of the regional budget and (or) extrabudgetary sources	1. Reduction of costs for the construction of transport infrastructure facilities 2. Reducing the construction time (including design) of transport infrastructure facilities 3. Reducing the number of incidents of destruction of transport infrastructure and collateral damage 4. Extending the life of transport infrastructure facilities 5. Reducing the cost of maintenance and repair of objects transport infrastructure	Pre-project stage (search for an investor)
14.	Digital twin module	Automotive	Implementation of the "digital twin" module of the transport infrastructure	Murmansk Region	Launching a system for monitoring road funds, creating 3D models of all transport infrastructure facilities, developing an information system for accounting and planning work / costs for the design, construction, repair, and maintenance of transport infrastructure facilities, creating mobile measuring laboratories. Innovative mobile road laboratory "Eskandor". It will diagnose regional roads and create their "digital twin"	Government of the Murmansk Region	2022	The project is implemented at the expense of the regional budget and (or) extrabudgetary sources	1. Reduction of costs for the construction of transport infrastructure facilities 2. Reducing the construction time (including design) of transport infrastructure facilities 3. Reducing the number of incidents of destruction of transport infrastructure and collateral damage 4. Extending the life of transport infrastructure facilities 5. Reducing the cost of maintenance and repair of transport infrastructure facilities	Implementation stage (formation of the information base for the module)
15.	Digital twin module	Automotive	Implementation of the "digital twin" module of the transport infrastructure	Republic of Karelia	Launching a system for monitoring road funds, creating 3D models of all transport infrastructure facilities, developing an information system for accounting and planning work / costs for the design, construction, repair, and maintenance of transport infrastructure	Government of the Republic of Karelia	2022–2024	The project is implemented at the expense of the regional	1. Reduction of costs for the construction of transport infrastructure facilities 2. Reducing the construction time (including design) of transport infrastructure facilities	Pre-project stage (search for an investor)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
					facilities, creating mobile measuring laboratories			budget and (or) extra-budgetary sources	3. Reducing the number of incidents of destruction of transport infrastructure and collateral damage 4. Extending the life of transport infrastructure facilities 5. Reducing the cost of maintenance and repair of transport infrastructure facilities	
16.	ITS efficiency control module	Automotive	ITS efficiency control module	Murmansk Region	Ensuring continuous monitoring of the functioning of complex subsystems, individual subsystems and local ITS projects with the possibility of setting up the operation of ITS at different levels depending on changes in the traffic situation, as well as in the event of emergency or emergency situations in the functioning of individual subsystems and ITS modules	Government of the Murmansk Region	Until 2024	The project is implemented at the expense of the regional budget and (or) extra-budgetary sources	Improving the quality of planning and management in the field of the transport complex and transport infrastructure	Pre-project stage (search for an investor)
17.	Implementation of the weather monitoring subsystem	Automotive	AMSS implementation	Arkhangelsk Region	Implementation of the Automated Meteorological Support System (AMSS). Installation of meteorological complexes on the entire network of roads of the Arkhangelsk Region (highways M-8, A-123, A-215). The meteorological complex includes a video surveillance unit, an air temperature and humidity sensor, a wind direction sensor, wind speed sensor, road surface condition sensor, precipitation sensor, and pressure sensor. Implementation of subsystems for providing anti-icing conditions	Highway Administration of the Federal Highway Agency	2020–2024	n/a	Raising awareness of road services about road conditions, including precipitation, ice, etc. Increasing the speed and quality of the response of road and emergency services to changes in traffic conditions and incidents Improving the efficiency of road services in terms of road maintenance Taking timely measures to prevent traffic constraints or closures Increasing the awareness of drivers about the traffic situation	Operation (expansion of the system by installing new meteorological complexes)
18.	Implementation of the weather monitoring subsystem	Automotive	AMSS implementation	Murmansk Region, Republic of Karelia	Installation of 60 automatic road meteorological stations and more than 70 video control posts on the federal highway R-21 "Kola". Part of the meteorological	Federal State Institution Management	2020–2024	n/a	Raising awareness of road services about road conditions, including precipitation, ice, etc.	Operation (expansion of the sys-

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
					complexes is provided with energy by wind -solar generators. Video data in the form of images from the road, from the newly installed 6 video control posts, is also available online for any user of the route on the website of the FKU Uprdor "Kola"	of the St. Petersburg - Murmansk Highway of the Federal Road Agency			Increasing the speed and quality of the response of road and emergency services to changes in traffic conditions and incidents Improving the efficiency of road services in terms of road maintenance Taking timely measures to prevent traffic constraints or closures Increasing the awareness of drivers about the traffic situation	tem by installing new meteorological complexes)
19.	Module of centralized informing of traffic participants	Automotive	Implementation of a subsystem for informing participants in road traffic using dynamic information boards and variable information signs	Arkhangelsk Region	Installation of two dynamic screens that warn drivers about the state of the roadway, weather conditions	Government of the Arkhangelsk Region	2021–2022	n/a	Increasing the awareness of drivers about the traffic situation Improving traffic safety on the road section Reducing accidents due to weather conditions Decreased mortality on the road section Reducing the cost of eliminating the consequences of accidents	Implementation stage (equipment installation)
20.	Module of centralized informing of traffic participants	Automotive	Implementation of a subsystem for informing participants in road traffic using dynamic information boards and variable information signs	Murmansk Region	Installation of road information boards in the Murmansk Region: on the Kola-Serebryanskiye HPP highway, at the 32nd kilometer of the highway, at the entrance to the Teriberka village	Government of the Murmansk Region	2020	n/a	Increasing the awareness of drivers about the traffic situation Improving traffic safety on the road section Reducing accidents due to weather conditions Decreased mortality on the road section Reducing the cost of eliminating the consequences of accidents	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
21.	Module of centralized informing participants	Automotive	Implementation of a subsystem for informing participants in road traffic using dynamic information boards and variable information signs	Murmansk Region	Installation of road information boards in Murmansk. Content of road information boards on public roads of regional importance	GOKU for road management of the Murmansk Region	2019–2020	24,9	Increasing the awareness of drivers about the traffic situation Improving traffic safety on the road section Reducing accidents due to weather conditions Decreased mortality on the road section Reducing the cost of eliminating the consequences of accidents	Exploitation
22.	Public transport control module	Automotive	Implementation of a subsystem for monitoring and coordinating public transport traffic	Republic of Karelia	Implementation of a pilot project for a subsystem for monitoring and coordinating public transport. Implementation is carried out according to the roadmap of the Smart City project	Government of the Republic of Karelia	2019–2024	6 900	Improving the quality of public transport traffic management (monitoring compliance with traffic intervals and timetables, accounting for the implementation of transportation plans) Increasing the responsiveness to incidents and emergencies Improving the efficiency of public transport planning	Pre-project stage (the project is included in the planning documents)
23.	Public transport control module	Automotive	Public transport route management subsystem	Arkhangelsk Region	Introduction in Arkhangelsk of the Unified Dispatch Service for Controlling Bus Passenger Transportation. Carrying out optimization of public transport routes	Government of the Arkhangelsk Region	2022–2024	The project is implemented at the expense of the regional budget and (or) extrabudgetary sources	Improving traffic safety Evaluation of the performance of carrier companies Increasing traffic regularity indicators Reduced fuel costs of public transport	Pre-project stage (the project is included in the planning documents)
24.	Public transport control module	Automotive	Implementation of a subsystem for monitoring	Murmansk Region	Implementation in Murmansk of subsystems for managing public transport routes, managing "smart stops", monitoring the movement of public transport	Government of the Murmansk Region	2020–2021	n/a	Improving traffic safety Evaluation of the performance of carrier companies	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
			and coordinating public transport traffic						Increasing traffic regularity indicators Reduced fuel costs of public transport	
25.	Public transport control module	Automotive	Implementation of a subsystem for managing public transport routes	Republic of Komi	Implementation of the Unified Regional System for the Management of Passenger Motor Transport of the Republic of Komi. The issue of connecting special equipment, municipal equipment, equipment of the Ministry of Emergency Situations, ambulances, school buses, etc. to the subsystem is being resolved	Government of the Republic of Komi	2021–2024	n/a	Improving traffic safety Evaluation of the performance of carrier companies Increasing traffic regularity indicators Reduced fuel costs of public transport	Subsystem operation Development of a subsystem expansion project
26.	Billing module for paid travel and services	Automotive	Creation of a unified fare collection system in different types of public transport	Republic of Karelia	Creation in Petrozavodsk of a unified fare collection system for different types of public transport. Pilot project for integrating the Unified Regional System for the Management of Passenger Motor Transport with the public transport booking and ticketing system	Government of the Republic of Karelia	2021–2024	n/a	Increase in the average speed of movement of passengers in urban public transport Increasing tax revenue	Implementation stage (private carriers are required to equip transport with online cash desks)
27.	Billing module for paid travel and services	Automotive	Implementation of the project "Green Digital Passenger Corridor"	Arkhangelsk Region, Murmansk Region, Republic of Komi	Integration of ITS with the public transport booking and ticketing system Implementation of the "Mobility as a Service" with a single payment for multimodal trips Implementation of fare collection systems based on a digital passenger profile using the Unified Biometric System	Regional government	2021–2030	n/a	Increase in the average speed of movement of passengers in urban public transport Reducing the waiting time of urban public transport Increase in tax revenues in cities with a population of more than 300 thousand people Reducing the proportion of residents who use daily a car in the coverage area of regional (urban) public transport Increasing the mobility of citizens when traveling between subjects of the Russian Federation	Pre-project stage (the project is included in the planning documents)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
									With an increase in the level of control and accounting in the process of passenger transportation, it becomes possible to optimize resource allocation, which allows increasing the number of flights and the quality of the client component	
28.	Traffic Violations Administration Module	Automotive	Implementation of a subsystem for weight and size control of vehicles	Murmansk Region	Installation of an automatic point of weight and dimensional control at the road entrance to the city of Apatity	Government of the Murmansk Region	2021	n/a	Prevention of damage to roads	Exploitation
29.	Traffic Violations Administration Module	Automotive	Implementation of a subsystem for weight and size control of vehicles	Arkhangelsk Region	Implementation of 3 automatic points of weight and dimensional control. 2 points were implemented. Tender announced for the installation of the third point	Government of the Arkhangelsk Region	2021–2022	72,3	Prevention of damage to roads	Operation (expansion of the number of automatic points of weight and dimensional control is planned)
30.	Traffic Violations Administration Module	Automotive	Implementation of a subsystem for weight and size control of vehicles	Republic of Karelia	8 points of automatic weight and dimensional control points have been introduced. Stages of implementation of 3 points, it is planned to introduce 1 point	Government of the Republic of Karelia	2021–2024	n/a	Prevention of damage to roads	Operation (expansion of the number of points is planned)
31.	Traffic Violations Administration Module	Automotive	Implementation of a subsystem for weight and size control of vehicles	Republic of Komi	6 points of automatic weight and dimensional control points have been introduced. In 2021, not a single point is functioning. The issue of restoration of working capacity is being resolved through the court	Government of the Republic of Komi	2014–2020	467	Prevention of damage to roads	Operation (restoration)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
32.	Traffic Violations Administration Module	Automotive	Implementation of a concession automated system for weight and size control on federal highways	The entire territory of the Barents Region	Implementation of a unified centralized system of weight and dimension control, including a center for automated recording of administrative offenses in this area, various communication interfaces with cargo carriers	Concedent: Rosavtodor Concessionaire - the company "Rostelematica"	2022–2032	2022–2024: 24,300 2022–2032: 63,400 operating expenses 36,600 add. cap. expenses	Prevention of damage to roads Increasing tax revenue	Pre-project stage (the project is included in the planning documents)
33.	Roadworks Management Module	Automotive	Implementation of a subsystem for the dispatching control of transport of road maintenance services	Arkhangelsk Region	Implementation of a subsystem for the dispatching control of road maintenance services transport, including a service for monitoring the transport of road maintenance services, dispatching guidance and systematic control over the work of public utilities and the traffic of road maintenance services along the entire route	Government of the Arkhangelsk Region JSC Mezen Road Administration	n/a	n/a	Improving the quality of cleaning of roadways and other urban surfaces Reducing the wear area of the road surface by reducing the use of road surface treatment products in winter Reduction of labor costs for road treatment in winter Reduced fuel costs Transport carbon footprint reduction	Exploitation
34.	Roadworks Management Module	Automotive	Implementation of a subsystem for the dispatching control of transport of road maintenance services	Murmansk Region	Implementation of a subsystem for the dispatching control of road maintenance services transport, including a service for monitoring the transport of road maintenance services, dispatching guidance and systematic control over the work of public utilities and the traffic of road maintenance services along the entire route	Government of the Murmansk Region	n/a	n/a	Improving the quality of cleaning of roadways and other urban surfaces Reducing the wear area of the road surface by reducing the use of road surface treatment products in winter Reduction of labor costs for road treatment in winter Reduced fuel costs Transport carbon footprint reduction	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
35.	Roadworks Management Module	Automotive	Implementation of a subsystem for the dispatching control of transport of road maintenance services	Republic of Karelia	Implementation of a subsystem for automated control over the performance of road and municipal equipment. By 2024, 75% of road and municipal vehicles should be connected to the system	Government of the Republic of Karelia	2021–2024	Recommended federal project not supported by federal funding	Improving the quality of cleaning of roadways and other urban surfaces Reducing the wear area of the road surface by reducing the use of road surface treatment products in winter Reduction of labor costs for road treatment in winter Reduced fuel costs Transport carbon footprint reduction	Pre-project stage (the project is included in the planning documents)
36.	Public transport control module	Automotive	Implementation of a subsystem for monitoring the movement of public transport	Murmansk Region	Implementation of a subsystem for monitoring the movement of public transport. Online control over the movement of more than 300 buses making routes in 96 directions of the Kola Peninsula and to Finland	Government of the Murmansk Region Integrator "Fort-Telecom".	2013	n/a	Improving traffic safety Increasing traffic regularity indicators Reduced fuel costs of transport	Exploitation
37.	Public transport control module	Automotive	Implementation of a subsystem for monitoring the movement of public and special vehicles	Arkhangelsk Region	Implementation of a subsystem for monitoring the movement of public transport. GLONASS satellite monitoring systems are equipped with about three hundred buses designed to transport children, 150 ambulances, more than two hundred vehicles operating on passenger automobile and water routes	Government of the Arkhangelsk Region	2016	n/a	Improving traffic safety Increasing traffic regularity indicators Reduced fuel costs of transport	Exploitation
38.	Public transport control module	Automotive	Implementation of a subsystem for monitoring the movement of special vehicles	Republic of Karelia	Implementation of a subsystem for monitoring the movement of special vehicles. GLONASS satellite monitoring systems are equipped with ambulances, vehicles of the Ministry of Internal Affairs	Government of the Republic of Karelia	2018	n/a	Improving traffic safety Increasing traffic regularity indicators Reduced fuel costs of transport	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
39.	Public transport control module	Automotive	Implementation of a subsystem for monitoring the movement of special vehicles	Republic of Komi	Implementation of a subsystem for monitoring the movement of special vehicles. The regional navigation and information system tracks the movement of all types of departmental vehicles, ambulances, public utilities and road repair services, timber trucks and agricultural machinery, passenger and school buses	Government of the Republic of Komi	2015	n/a	Improving traffic safety Increasing traffic regularity indicators. Reduced fuel costs of transport	Exploitation
40.	Implementation of telematics systems in parks rolling stock (Fleet management)	Automotive	Implementation of a satellite monitoring system for special vehicles	Arkhangelsk Region, Murmansk Region, Republic of Karelia, Republic of Komi	Implementation of a satellite monitoring system for special vehicles. In seven branches of PJSC IDGC of the North-West, more than 4,000 trackers were installed on crew cars, auto-hydraulic lifts, freight transport, snow and swamp vehicles and other equipment. Hosting is deployed on the servers of the branch "Karelenergo"	PJSC IDGC of the North-West	2019	n/a	Improving traffic safety Reduced fuel costs (about 10 million rubles per year) Transport carbon footprint reduction	Exploitation
41.	Implementation of telematics systems in parks rolling stock (Fleet management)	Automotive	Implementation of a satellite monitoring system for special vehicles	Arkhangelsk Region	Implementation of a satellite monitoring system for special vehicles. The capacity of all motor transport enterprises of the holding is more than 1300 units of auto and special equipment. All units of equipment are equipped with GLONASS monitoring system terminals	Group of companies "Ustyansk timber industry company"	2016–2021	n/a	Improving traffic safety Reduced fuel costs Transport carbon footprint reduction	Exploitation
42.	V2X network configuration module	Automotive	Implementation of the smart road facility management subsystem	Arkhangelsk Region	Implementation of a subsystem for managing "smart road" facilities Implementation of a V2X service platform to ensure the movement of highly automated vehicles	Government of the Arkhangelsk Region	2021–2025	The project is implemented at the expense of the regional budget and (or) extrabudgetary sources	Improving the safety and efficiency of traffic management Ensuring the movement of highly automated vehicles	Pre-project stage (the project is included in the planning documents)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
43.	V2X network configuration module	Automotive	Implementation of the smart road facility management subsystem	Murmansk Region	Implementation of a subsystem for managing "smart road" facilities Implementation of a V2X service platform to ensure the movement of highly automated vehicles	Government of the Murmansk Region	2021–2025	The project is implemented at the expense of the regional budget and (or) extrabudgetary sources	Improving the safety and efficiency of traffic management Ensuring the movement of highly automated vehicles Reduced fuel costs Transport carbon footprint reduction	Pre-project stage (the project is included in the planning documents)
44.	V2X network configuration module	Automotive	Testing of highly automated vehicles (unmanned vehicles)	Murmansk Region	An experiment on pilot operation of unmanned taxi cars with a driver on public roads in the Murmansk Region from 2021 to 2025	Yandex Self - Driving Group Government of the Murmansk Region	2021–2025	n/a	Improving the safety and efficiency of traffic management Development of the movement of highly automated vehicles in the conditions of the Arctic Circle Reduced fuel costs Transport carbon footprint reduction	Exploitation
45.	V2X network configuration module	Automotive	Testing of highly automated vehicles (unmanned vehicles)	Murmansk Region	Test operation of unmanned trucks in the border area - on the section of the E105 Kirkenes-Murmansk highway as part of the Norwegian project for the development of a network of "smart roads"	Yandex Self - Driving Group Government of the Murmansk Region	n/a	n/a	Improving the safety and efficiency of traffic management Reduced fuel costs Transport carbon footprint reduction	Pre-project stage (the project is frozen)
46.	Transport Forecasting and Simulation Module	Automotive	Implementation of the transport forecasting and modeling module	Murmansk Region	The introduction of the transport forecasting and modeling module is the next stage in the development of the Unified transport system management platform in the Murmansk Region. Creation of a working model of traffic, corresponding to the movement in real conditions on roads and road networks, allows predicting the parameters of traffic flows, optimizing the current comprehensive traffic management schemes	Government of the Murmansk Region	2021–2023	n/a	Improving the safety and efficiency of traffic management Transport carbon footprint reduction	Pre-project stage (the project is included in the planning documents)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
47.	Dispatch control module ITS for emergencies and aircraft	Automotive	Implementation of emergency response systems Sistema-112	The entire territory of the Barents Region	System-112 receives signals from ERA-GLONASS, which vehicles are equipped with. System-112 of Karelia is united with the Arkhangelsk, Murmansk and Vologda Regions. The 112 system of the Republic of Komi is integrated with the systems of the Khanty-Mansiysk Autonomous District and the Sverdlovsk Region	Government of the Russian Federation	2020	n/a	Acceleration of response and improvement of interaction of emergency operational services in case of calls (incident reports) on the principle of "one window" Reducing the severity of consequences after an accident by 70%	Exploitation
48.	Dispatch control module ITS for emergencies and aircraft	Automotive	Interaction of ecall and System-112 in the Russian Federation and the European Union	The entire territory of the Barents Region	Organization of interaction of emergency response systems System-112 and eCall. ERA-GLONASS uses the same principles and protocols as eCall but has wider functionality. It has a callback mode and can use SMS as a backup MSD transmission channel. The European constellation of navigation satellites Galileo will complement the tandem of GPS and GLONASS satellites in the "panic button" equipment of Russian cars	Government of the Russian Federation	2015–2019	n/a	The Russian State emergency response system ERA-GLONASS is fully compatible with the eCall system	Exploitation
49.	Billing module for paid travel and services	Automotive	Implementation of Free Flow systems for a barrier-free fare payment procedure	Russian Federation, Murmansk Region, Arkhangelsk Region Republic of Karelia	Implementation of Free Flow systems for a barrier-free fare payment procedure on toll roads. The system uses the DATEX II data exchange standard in force in the EU. Federal Law No. 289-FZ of August 2, 2019, allows the construction of toll roads in the Far North without free backups, which will lead to the introduction of Free Flow systems	Government of the Russian Federation	n/a	n/a	Uniform traffic 1800 t/s per hour Reducing the number of accidents due to the absence of obstacles Smooth driving results in lower fuel consumption and reduced emissions	Pre-project stage (implementation in case of construction of toll roads in the region)
50.	ITS user services	Automotive	GIS online monitoring of public transport	Murmansk Region	Implementation of online system for tracking the movement of public transport along 48 routes in the Murmansk Region	2GIS	n/a	does not require funding	Public transport tracking allows you to optimize passenger flows, reducing the load on the transport system of the agglomeration	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
51.	ITS user services	Automotive	GIS online monitoring of public transport	Arkhangelsk Region	Implementation of the service "Routes of Arkhangelsk online". Providing information to passengers about the current location of public transport in real time	LLC Bastaim	n/a	does not require funding	Public transport tracking allows you to optimize passenger flows, reducing the load on the transport system of the agglomeration	Exploitation
52.	ITS user services	Automotive	GIS online monitoring of public transport	Republic of Komi	Implementation of the services "Routes of Syktyvkar Online / Smart Transport". Providing information for passengers about the current location of public transport in real time	Komiavtotrans Bastime	n/a	does not require funding	Public transport tracking allows you to optimize passenger flows, reducing the load on the transport system of the agglomeration	Exploitation
53.	Commercial Maas - transport solutions available on request	Automotive	Development of the Yandex carsharing service in the region. Drive	Republic of Karelia	Extension of the car sharing service Yandex. Drive from St. Petersburg to the Republic of Karelia	Yandex Company	2021	does not require funding	Reducing travel time Reduce carbon emissions by optimizing all travel parameters	Exploitation
54.	Commercial Maas - transport solutions available on request	Automotive	Development of commercial MaaS solutions in large cities of the Barents Region	Murmansk Region Arkhangelsk Region Republic of Karelia Republic of Komi	Yandex MaaS system, which includes navigation and route building, schedules and online monitoring of public transport, taxi services, food delivery, and other services. The system exchanges data with ITS in the cities of presence	Yandex.Go company and other taxi services	2018–2022	does not require funding	Reducing travel time Reduce carbon emissions by optimizing all travel parameters	Exploitation
55.	Telecommunication technologies	All types of transport	Creation of the Federal Transport Telematics Network (FTTN)	The entire territory of the Barents Region	Creation of a federal network of the Internet of Things, a separate communication network for transport routes, which will become part of the Unified Information and Telecommunication Environment for the Development of Intelligent Transport Systems. The FTTN will include a narrowband wireless access network using a technology like LPWAN and a mobile wireless broadband access network	Government of the Russian Federation, GLONASS-TM, created by the state company GLONASS, Zashchitainfotrans	2018–2024	768,000 for the federal project "Information infrastructure"	Continuous cargo control Monitoring of the technical condition of infrastructure and vehicles Determination of the location of the latter Transfer of critical information Improving the safety and efficiency of traffic management Transport carbon footprint reduction	Pre-project stage (the project is included in the planning documents)
56.	Telecommunication technologies	Automotive	Implementation of the	The entire territory of	Creation of the state information system (GIS) "Avtodata" based on Era-Glonass	Government of the Russian Federation	2022–2030	n/a	Continuous cargo control Monitoring of the technical condition of infrastructure and vehicles	Pre-project stage (the is-

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
			Autodata platform	the Barents Region	Information about providers, information about cars and motorcycles and their operation in Russia, information about roads and their operation, as well as information about state and municipal information systems interacting with Avtodata will be placed in the system without fail Creation of a digital environment to support the movement of vehicles with various degrees of automation on public roads	NTI "Autonet"			Determination of the location of the latter Transfer of critical information Improving the safety and efficiency of traffic management Transport carbon footprint reduction	sue of legislative consolidation of the status of the system is being resolved)
57.	Telecommunication technologies	All types of transport	Providing satellite communications for public transport	The entire territory of the Barents Region	The introduction of the Express-RV system, which will provide communications and broadcasting in remote and hard-to-reach regions of the country, as well as reliable high-speed communications and the Internet throughout the entire Arctic zone, including the Northern Sea Route. Provision of satellite communications and broadcasting to mobile objects for collective (aircraft, ships, long-distance trains, intercity buses) and individual (cars and trucks) use. The Marathon IoT satellite system, which is part of the Sphere program, will provide Internet of Things services	Government of the Russian Federation JSC "Information Satellite Systems. Academician M. F. Reshetnev	2022–2024	30,000	The possibility of large-scale implementation of unmanned and robotic systems in transport, in the agro-industrial complex and other sectors of the economy Transport carbon footprint reduction	The stage of implementation of satellite systems
58.	Telecommunication technologies	All types of transport	Development of 5G cellular coverage	The entire territory of the Barents Region	Building 5G networks on domestic equipment. New 5G base station introduced. It is capable of operating in the 4,4-4,99 GHz band, which is defined in Russia as the main one for the construction of 5G / IMT-2020 communication networks. The station can be used in the network simultaneously with 4G equipment	Rostec State Corporation PJSC Rostelecom	Until 2024	21,463 Ministry of Digital Development. Rostec co - finances the project	The advantages of high-speed communication will allow you to solve many new problems that place high demands on the reliability of the connection in real time	Implementation stage (equipment testing started)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
59.	Telecommunication technologies	All types of transport	100% coverage of main roads with 4G (LTE) cellular communication	The entire territory of the Barents Region	Ensuring 100% coverage of all federal highways with communication networks with the possibility of wireless data transmission, which is necessary for the development of modern intelligent logistics and transport technologies	Government of the Russian Federation Cellular operators	2018–2024	Does not require funding	As of the end of 2021, the degree of mobile communication coverage of federal highways averages 97,5%	Exploitation
60.	Telecommunication technologies	All types of transport	100% coverage of main roads with 4G (LTE) cellular communication	Arkhangelsk Region	Ensuring sustainable operation of mobile radiotelephone communications on federal highways	Cellular operators	2018–2024	Does not require funding	Coverage of the M8 Kholmogory highway Moscow - Yaroslavl - Vologda - Arkhangelsk: MTS – 95,8% MegaFon – 99,5% VimpelCom – 89,5% T2 RTK Holding – 99,5%	Operation (extension of the LTE base station network continues)
61.	Telecommunication technologies	All types of transport	100% coverage of main roads with 4G (LTE) cellular communication	Murmansk Region Republic of Karelia	Ensuring sustainable operation of mobile radiotelephone communications on federal highways	Cellular operators	2018–2024	Does not require funding	Coverage of the M18 "Kola" highway St. Petersburg - Petrozavodsk - Murmansk - Pechenga - border with the Kingdom of Norway: MTS - 82% MegaFon – 89,9% VimpelCom – 76,7% - T2 RTK Holding – 85,2%	Operation (extension of the LTE base station network continues)
62.	Telecommunication technologies	All types of transport	100% coverage of main roads with 4G (LTE) cellular communication	Republic of Komi	Ensuring sustainable operation of mobile radiotelephone communications on federal highways	Cellular operators	2018–2024	n/a	Federal roads are 100% covered by mobile operators	Exploitation
63.	Telecommunication technologies	Automotive	Building LPWAN networks for Internet of Things connections	Murmansk Region Arkhangelsk Region Republic of Komi	Implementation of LPWAN networks for services and devices of the Internet of things in the LTE standard based on NB- IoT (Narrow Band IoT) technology.	Cellular operators	2019–2022	n/a	Providing solutions in the IoT segment ("smart" city, "smart" transport, etc.) The network provides fast and secure connection of smart devices and smart city solutions to control street lighting, collect readings from metering devices and control the operation of water and electricity networks, monitor the operation of utilities and garbage collection,	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
									public transport and special equipment	
64.	Digital platform for managing the transportation process	Railway	Implementation of a unified corporate platform	The entire territory of the Barents Region	A single corporate platform for comprehensive resource management, risks and reliability at the stages of the life cycle as a means of information support for the asset management system	JSC Russian Railways JSC NIIAS	2019–2025	n/a	With experimental implementation on the Northern Railway (PCh-2): reduction of direct current expenses for the maintenance of the track infrastructure by 51,827 million rubles; reduction in the number of failures, and the cost of their elimination and demurrage of trains by 47,102 million rubles	Operation (expansion of the area of implementation)
65.	Digital platform for managing the transportation process	Railway	Implementation of an intelligent control system and automation of production processes in railway transport	The entire territory of the Barents Region	The intelligent system for managing and automating production processes in railway transport is focused on improving the quality of transport services and optimizing the interaction of all production units of JSC Russian Railways	JSC Russian Railways JSC NIIAS	2019–2025	n/a	Optimize freight traffic Cost reduction Creation of a reserve of throughput of highways Delivery of goods in guaranteed and established terms for high-quality customer service of JSC Russian Railways	Exploitation
66.	Digital platforms of Russian Railways	Railway	Implementation of the Russian Railways digital twin ecosystem	The entire territory of the Barents Region	Launch of the Russian Railways digital twin ecosystem	JSC Russian Railways JSC VNIIZhT JSC VNIKTI JSC NIIAS	2018–2020	n/a	Continuous monitoring of safety performance Improving the safe operation of rolling stock Business Performance Optimization	Exploitation
67.	Big data analysis platform for vehicle movement	Railway	Center for Analysis and Data Processing	The entire territory of the Barents Region	A digital platform for collecting, storing information and interacting with project participants that ensure the operation of traction rolling stock.	JSC Russian Railways	2018–2020	n/a	Reduction of reporting preparation time by 43,5 times Increase the speed and accuracy of cost allocation by 40 times	Exploitation
68.	Digital platform for multimodal passenger transportation	Railway	Development of the "Innovative mobility" system	The entire territory of the Barents Region	A new generation digital platform for providing services to passengers on the railway. will allow you to order and carry out a trip "from door to door" on a single electronic ticket. And during the trip, the passenger will have a whole	JSC Russian Railways LLC Innovative Mobility	2018–2025	n/a	Development of domestic tourism and tourism in Russian Railways The share of electronic documents in the interaction with the participants of the transportation	Implementation stage (hotel booking system launched)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
					range of services: Internet access, services on board, including goods for the journey, ordering food, ordering travel services				process (including international transit traffic) 90% The number of users in the open joint-stock company "Russian Iron roads" and subsidiaries that use domestic software included in the Unified Register of Russian Programs for electronic computers and databases at least 70%	
69.	Digital platform for multimodal freight transport	Railway	Creation of a platform for managing and monitoring freight traffic	The entire territory of the Barents Region	Creation of a platform for managing and monitoring freight traffic. Monitoring of the location and condition of goods, a comprehensive door-to-door cargo transportation service, legally significant exchange of electronic documents with participants in the transportation, end-to-end use of digital transport data	JSC Russian Railways	2019–2025	n/a	The share of freight transportation and related services available for registration in electronic form 75% Share of electronic documents when interacting with participants in the transportation process (including international transit traffic) 90% Share of operations in customer service business processes performed without human intervention 55%	Implementation stage (creation of monitoring systems, big data processing systems)
70.	Digital platform for multimodal freight transport	Railway	Development of a service for monitoring smart contracts for freight transportation	The entire territory of the Barents Region	Development of a service for monitoring smart contracts for freight transportation on the platform "Distributed data registry" (blockchain service). The goal is to create a single information space between the participants of freight railway transportation and to ensure monitoring of the implementation of smart contracts for such transportation	JSC Russian Railways	2019–2022	JSC Russian Railways	Creation of a trusted environment for the railcar complex Reducing the possibility of fraud	Operation (pilot project)
71.	Digital platform "line infrastructure operator"	Railway	Equipping electric trains with an on-board complex for ultra-	The entire territory of the Barents Region	Equipping electric trains with an on-board complex for ultrasonic flaw detection of rails	JSC Russian Railways	Until 2025	n/a	Improving traffic safety	Implementation stage (experimental implementation of the pilot project)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
			sonic flaw detection of rails							
72.	Digital platform "traction rolling stock	Railway	Implementation of the Digital Depot system	Russian Federation, Murmansk Region Arkhangelsk Region Republic of Komi	Implementation of the Digital Depot system. The system of intelligent diagnostics and prediction of the technical condition of equipment "Smart locomotive" allows you to automate the process of analyzing data and searching for incidents in the operation of locomotive equipment, creating a list of over-cycle work and preparing the necessary materials and spare parts before the locomotive enters the depot	LLC LocoTech - Service Cognitive Technologies	2020–2025	n/a	Reducing the repair time of one locomotive from the normative 24 hours to 8 hours of work Improving traffic safety Growth in labor productivity	Implementation stage (trial operation)
73.	Digital platform "traction rolling stock	Railway	Implementation of predictive diagnostic systems "smart locomotive" solution	Russian Federation, Murmansk Region Arkhangelsk Region Republic of Komi	Implementation of a system for collecting data from sensors located on the rolling stock and analyzing this data in real time. Self-diagnosis of locomotives equipped with microprocessor control systems. Testing a "digital" car. Predictive repair of rolling stock	LocoTech-Service LLC Clover Group LLC	2017–2022	n/a	Time for locomotive diagnostics reduced from 4 hours to 10 minutes Improving the performance of locomotives Reduced downtime due to lack of spare parts Improving traffic safety	Implementation stage (trial operation)
74.	Digital platform "traction rolling stock	Railway	Implementation of services for connected and highly automated transport (V2X)	The entire territory of the Barents Region	Development of Cognitive Rail Pilot autopilot complexes for freight trains with artificial intelligence, which allows using technical vision and artificial intelligence to detect objects on the railway, including other trains, arrows, tracks, people, traffic lights and minimize the number of accidents due to for the human factor. Currently, this technology is not used anywhere in the world. It is planned that 500 such complexes will be produced for JSC Russian Railways in 2022	JSC Russian Railways OJSC Sberbank PJSC Cognitive Pilot Company	2017–2025	n/a	Improving the safety of shunting operations on the railway 70% reduction in incidents	Implementation stage (testing of "autopilot" complexes completed)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
75.	Digital platform "traction rolling stock	Railway	Implementation of services for connected and highly automated transport (V2X)	The entire territory of the Barents Region	Implementation of a complex for automated train traffic control in conditions of high traffic intensity in the "Avtodispatcher" - "Motorist" mode. The system implements the automatic train guidance mode, the use of digital communication systems, a high-precision coordinate network and a digital track model that ensure high accuracy of electric train positioning, the introduction of a crypto - protected paperless technology for transferring critical information on board, which will allow organizing the movement of electric trains in the "Avtomashinist" mode in accordance with the established traffic safety requirements	JSC Russian Railways	2018–2025	n/a	Improving traffic safety in difficult weather conditions	Implementation stage (experimental implementation of the pilot project)
76.	Telecommunication technologies	Railway	Increasing the capacity of the backbone and local data transmission network	The entire territory of the Barents Region	Implementation of new data transmission technologies to increase the length of fiber-optic communication lines by 24% by building an additional 25,8 thousand km of optical fiber. To increase the capacity of the backbone data transmission network, it is proposed to build 2,1 thousand communication nodes. In the local subscriber access network, the number of communication nodes must be increased from the current 1,5 thousand to 35 thousand. Options are being considered for creating a network of LTE base stations to provide wireless coverage at 262 stations and 10 road sections of the network	JSC Russian Railways	2021–2025	n/a	Increase in the capacity of the backbone data transmission network by 40% and by 96% - the capacity of the local network.	Stage of implementation (increase of the transport communication network)
77.	Telecommunication technologies	Railway	Building LPWAN networks for Internet of	The entire territory of the Barents Region	Creation of the Development Center for LPWAN XNB network devices and technologies in the field of the Internet of things (IoT) for the Russian transport and logistics industry.	JSC Russian Railways JSC RT-Invest	since 2019	n/a	Traffic Tracking Monitoring the state of rolling stock, infrastructure, personnel actions	Pre-project stage (development and testing of

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
			Things connections		Connection of all objects of the railway system (rolling stock and locomotives, infrastructure elements, individual cargo units, security systems, electronic scoreboards, surveillance cameras)	(Rostec State Corporation)				system elements)
78.	Systems of geoinformation services	Railway	Implementation of satellite and geoinformation technologies in transportation management	The entire territory of the Barents Region	Creation of an information and communication infrastructure that allows monitoring the location of rolling stock, including dangerous goods, based on the receipt and processing of GLONASS/GPS navigation data. Creation of an integrated system of spatial data of the railway transport infrastructure	JSC Russian Railways JSC NIIAS	2016–2020	n/a	Traffic Tracking Improving traffic safety Formation of a database for the ecosystem "digital twin" of JSC Russian Railways	Exploitation
79.	Telecommunication technologies	Railway	Quantum backbone network	The entire territory of the Barents Region	Development of quantum communication systems (working with optical signals and creating devices based on them). Assembled fiber optic backbone. A typical trusted node has been designed. Engineering infrastructure has been developed. By 2024, the total length of quantum networks in the Russian Federation should be more than 7,000 km, and include backbone, regional and subscriber networks	JSC Russian Railways	2020–2025	25 000	Improving the integrated secure infrastructure of the digital economy Increasing information security	Pre-project stage (the route was put into trial operation)
80.	Big data analysis platform for vehicle movement	Water	Situational center based on the Digital Twin technology	The entire territory of the Barents Region	Situational center based on the technology of "Digital Twin" using the technology of processing "big data". The system is designed for graphical visualization of reporting operational information about the activities of the organization and the entire controlled port infrastructure in real time and is a digital twin of the enterprise	FSUE Rosmorport	2018–2020	n/a	Improving maritime safety Operational informing Optimization of production activities	Operation (further development of functionality is planned)
81.	A unified digital platform for the daily schedule	Water	Implementation of a unified digital	The entire territory of	Creation of a digital platform for carrying out all actions with ships in a single	Government of the Russian Federation	2018–2020	n/a	Improving maritime safety	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
	of the placement and movement of ships		platform for the formation and use of a daily schedule for the placement and movement of vessels	the Barents Region	electronic form of a daily schedule in all seaports of the Russian Federation				Significant reduction in the impact of the "human" factor on ship traffic management	
82.	Coordinated motion control module	Water	Construction of an automated radiotechnical post of the vessel traffic control system in the port of Murmansk	Murmansk Region	Construction of an automated radio station for a ship traffic control system in the port of Murmansk as part of the creation of an infrastructure for a marine transshipment complex for liquefied natural gas in the Murmansk Region. It is planned to build a communication tower, a hardware room for radio navigation equipment, an automatic weather station	FSUE Rosmorport	2022–2025	14,4	Ensuring the safety of navigation in the water area of the seaport of Murmansk in the Ura Bay and on the approaches to it	Stage of implementation (a positive opinion was issued on the design and estimate documentation for construction)
83.	Digital platform for multimodal freight transport	Water	Implementation of digital technologies for the development of multimodal transportation in the waters of the Northern Sea Route	Murmansk Region Arkhangelsk Region	Implementation of digital technologies for the development of multimodal transportation in the waters of the Northern Sea Route. Development of a digital platform for paperless electronic registration of multimodal transportation of passengers and goods. Arkhangelsk is considered as a pilot zone for the creation of digital coastal infrastructure	Ministry of Transport of Russia State Corporation Rosatom	2020–2023	n/a	Improving the efficiency of cargo transportation Ensuring year-round transportation of goods across all water areas of the NSR with established deadlines for the passage of the entire water area	Pre-project stage (December 2023 - report to the Government of the Russian Federation)
84.	Subsystem of interaction with vehicles	Water	Implementation of the "Digital Vessel" system	The entire territory of the Barents Region	Equipping ships with an ecosystem of IoT devices. Predictive (or predictive) analytics of data received from ship mechanisms and systems will allow identifying technical problems earlier. Interaction with the digital shore system will reduce the time of repair and stay in the port	Orange Business Services	Until 2024	n/a	Improve navigation safety Reducing the time the ship stays in port Increase Port Throughput Substantiation of the ship's carbon footprint	Pre-project stage

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
85.	V2X platforms for providing highly automated vehicles	Water	Creation of a platform for modeling unmanned navigation	The entire territory of the Barents Region	Creation of a platform for the development of unmanned navigation technology by computer simulation. In 2020, testing of unmanned navigation began as part of the Marinet. In 2021, the flight was performed in automatic mode under the control of the crew	Sitronics KT Company (Kronstadt Group) Northern (Arctic) Federal University (NArFU)	2022	263	Accelerating the development of autonomous shipping Safe testing of maritime autonomous ships (MAS) in a virtual environment Reducing the volume of costs for shipping companies - the maintenance of seafarers is 30-40% of the daily operating costs of the ship	Operation (test)
86.	V2X platforms for providing highly automated vehicles	Water	Testing of unmanned aerial vehicles on ships	Russian Federation, Murmansk Region Arkhangelsk Region	Testing unmanned aerial vehicles on ships for more information about ice conditions.	FSUE Rosmortflot	2020–2022	n/a	Improve navigation accuracy	Implementation stage (trial operation)
87.	V2X platforms for providing highly automated vehicles	Water	Hydrographic boat control system from a dredging vessel or from the shore	The entire territory of the Barents Region	The hydrographic boat control system from the board of the dredging vessel or from the shore will ensure the carrying out of sounding works without the presence of a hydrographer and a navigator on board	FSUE Rosmortflot R&D "Nautilus"	2020–2025	n/a	Improving maritime safety Making transportation more environmentally friendly Reduced operating costs	Implementation stage (trial operation)
88.	GIS systems	Water	Creation of a complete database of electronic navigational charts of inland waterways of Russia	The entire territory of the Barents Region	Creation of digital public maps for all inland waterways included in the core network. Electronic navigation charts - the basis of unmanned navigation, the basis for the introduction of unmanned and autonomous navigation technologies	Ministry of Transport of the Russian Federation Group "Kronstadt"	2018	n/a	Improve navigation accuracy	Exploitation
89.	Traffic Control Scenario Module	Water	Pilot automation systems	Ports of the Russian segment of the Barents Region	Creation of systems containing a common knowledge base of the pilotage service, a single database of electronic charts, magazines, ship directories, routes and movement histories	FSUE Rosmortflot	2021–2022	n/a	Improving navigation accuracy and ship traffic safety, Reducing the number of incidents	Implementation stage (equipment of port infrastructure with modern

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
										technical means of monitoring)
90.	Weather information systems	Water	Increasing the accuracy of weather forecasting in the NSR water area	Murmansk Region, Arkhangelsk Region	Increasing the density of the network of Roshydromet stations and their technical equipment to the values recommended by the World Meteorological Organization	Roshydromet	2020–2024	n/a	Increasing the accuracy of forecasts to the level of "excellent" (In accordance with RD 52.27.759-2011)	Implementation stage (expansion of the network of stations)
91.	Weather information systems	Water	Deployment of the highly elliptical hydrometeorological space system Arktika-M	Murmansk Region, Arkhangelsk Region	Deployment of a highly elliptical hydrometeorological space system "Arktika-M", which provides interested federal executive authorities and organizations with satellite hydrometeorological data of high temporal resolution over the polar region of the Earth	State Corporation Roscosmos State Corporation Rosatom	2020–2025	n/a	Obtaining hydrometeorological data of high temporal resolution in the polar region of the Earth	Implementation stage (creation of a satellite system)
92.	Weather information systems	Water	Implementation of information system for identifying dangerous ice formations	Murmansk Region, Arkhangelsk Region	The information system for identifying dangerous ice formations, implemented on the basis of a neural network, informs ships about the coordinates of the boundaries of a dangerous ice formation. The assessment of the ice situation in the sea areas will ensure the pilotage of vessels based on promptly updated data	"Scanex" company FSUE Atomflot PJSC Lukoil	2017–2019	n/a	Improving the safety of navigation	Pre-project (integration developed system
93.	Telecommunication technologies	Water	Providing satellite communications in the NSR water area	Russian segment of the Barents Region	Creation of 4 spacecraft "Express-RV1", "Express-RV2", "Express-RV3" and "Express-RV4" on highly elliptical orbits and 1 spacecraft "Express-RV5", which is in reserve	Rossvyaz, Ministry of Communications of Russia, State Corporation "Roscosmos"	2020–2024	n/a	Stable uninterrupted satellite communication was provided for users in the waters of the Northern Sea Route in the territories located north of 70 degrees north latitude	Implementation stage
94.	Billing module of the paid passage of the vehicle	Water	Implementation of the information system "Port dues"	Ports of the Russian segment of the Barents Region	Implementation of the information system "Port dues". Integration with the module for registering the service of vessel entries/departure in the ports of	FSUE Rosmorport	2018–2020	n/a	Accelerate billing data analysis Acceleration of vehicle passage Transport carbon footprint reduction	Exploitation

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
					the Russian Federation - the PortCall system					
95.	Unified digital platform for managing the transport system	Aviation	Implementation of the Unified Air Traffic Management System of the Russian Federation	Airports of the Russian segment of the Barents Region	Implementation of the Unified Air Traffic Management System of the Russian Federation. Established the Main Center of the Unified Air Traffic Management System and 12 regional centers. 98 airfield control centers of Unified Air Traffic Management System have also been established	FSUE Rosaviatsiya FSUE State ATM Corporation	2014–2021	n/a	Improving the quality of planning for the use of Russian airspace	Exploitation
96.	Dispatch control module ITS for emergencies and aircraft	Aviation	Creation of a digital infrastructure platform for managing a unified system of aerospace search and rescue and interaction with other search and rescue services	The entire territory of the Barents Region	Creation of the information system "Digital infrastructure platform for managing a unified system of aerospace search and rescue and interaction with other search and rescue services based on the solutions of the FSIS "POISK-IAS". The platform is being implemented as part of the "Artificial Intelligence" of the national program "Digital Economy"	FSUE Rosaviatsiya	2020–2024	150	80% of the images of unmanned aerial vehicles and satellite monitoring will automatically recognize damage to infrastructure, hot spots, carbon dioxide emissions, etc. Improving the safety of transport systems Increasing the speed of response in emergencies	Implementation stage (development of recognition systems)
97.	Subsystems for monitoring the technical condition of the vehicle	Aviation	Creation of a Geographic Information System for Monitoring the Operational and Technical Condition of Aviation Infrastructure Elements	The entire territory of the Barents Region	Creation of a Geographic Information System for monitoring the operational and technical condition of aviation infrastructure elements (using artificial intelligence technology). The Aircraft Components Authenticity system, a system for processing visual materials from search aircraft, is expected to be put into operation	FSUE Rosaviatsiya	2020–2024	150	Improving flight safety indicators by promptly providing up-to-date electronic operational documentation to aircraft users, monitoring it, as well as monitoring the performance of work on aircraft	Implementation stage (development of recognition systems)

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
98.	Information security module	Aviation	Software systems of information security	The entire territory of the Barents Region	Development of the ITCI facility of the Information Security System of the Federal Air Transport Agency	FSUE Rosaviatsiya	2002	129 Operation - 9,3 per year	Ensuring information security of digital systems of FSUE "Rosaviatsia"	Exploitation
99.	Transport Forecasting and Simulation Module	Aviation	Creation of a new information system for ensuring flight safety to replace the ASOBP of Rosaviatsia	The entire territory of the Barents Region	Creation of a new information system for ensuring flight safety to replace the ASOBP of Rosaviatsia. Designed to collect, store and process data on aviation events to analyze the causes and trends that determine the state of flight safety	FSUE Rosaviatsiya	2002	21	Ensuring technical safety of flights Organizational safety Compliance with environmental safety requirements	Implementation stage
100.	Telematic data collection and processing services module	Aviation	Regional software and hardware complex for aeronautical information of the Federal Air Transport Agency	Russian Federation, Murmansk Region Arkhangelsk Region	Regional software and hardware complex for aeronautical information of the Federal Air Transport Agency. The State Corporation for the Unified air traffic management system has begun practical support for the activities of several newly created enlarged centers in airspace responsibility areas that are not supported by the operation of Radio engineering support of flights facilities, including the Arctic regions, with a domestic communication and data transmission system	FSUE Rosaviatsiya	2020–2024	n/a	Increasing situational awareness in flight operations	Implementation stage
101.	GIS module	Aviation	Development of domestic state aeronautical charts	The entire territory of the Barents Region	Development of domestic state aeronautical charts: 1.Software for the digital cartographic database of airfields for creating and updating state aeronautical charts 2.Digital elevation model database software for creating and updating state aeronautical charts	FSUE Rosaviatsiya	2019	11	Effective state regulation of the use of the airspace of the Russian Federation Increasing the level of air traffic safety and economic efficiency of using the airspace of the Far North Reducing the negative impact on the environment of gas emissions	Exploitation
102.	Digital twin module	Aviation	Creation of a "digital twin"	The entire territory of	Creation of a "digital twin" of Russian airfields	FSUE Rosaviatsiya	2021–2023	n/a	Ensuring the creation of digital twins for 16% of airfields owned by the Russian Federation	Implementation stage

№	Project direction/ ITS module	Type of transport	Name of the project	Implementation region	Project Description	Initiator / participants	Implementation timeline	Investments, million rubles	Main results, effects	Implementation status
	2	3	4	5	6	7	8	9	10	11
			of Russian airfields	the Barents Region						
103.	V2X platforms for providing highly automated vehicles	Aviation	Use of unmanned aerial vehicle for forest pathological monitoring	Arkhangelsk Region	The use of unmanned aerial vehicle for forest pathological monitoring in the territory of the Arkhangelsk and Vologda Regions. It is planned to purchase a mobile control center for unmanned aerial vehicles	FBI Roslesozashchita	2022	n/a	Reducing the carbon footprint through timely response to wildfires	Implementation stage
104.	Platform for multimodal passenger transportation	Aviation Railway	Implementation of a biometric passenger identification system	The entire territory of the Barents Region	Implementation of a biometric passenger identification system. Six Russian airports will use biometric data to identify passengers by the end of 2023	Ministry of Transport of the Russian Federation	2024	n/a	Improving the safety of passenger transportation	Implementation stage
105.	Unified Automated Information System Federal Customs Service of Russia	All types of transport	Informatization of the regional Federal Customs Service	Murmansk Region Arkhangelsk Region Republic of Karelia	Implementation of the all-Russian departmental program for the Digital Transformation of the Federal Customs Service. Digitalization of the passage of transport through checkpoints across the state border. Establishment of electronic declaration centers. Electronic declaration allows you to register goods transported by road, water, and rail	Government of the Russian Federation	2022–2024	n/a	Reducing the number of documents required for the movement of goods Acceleration of operations for the movement of goods Reducing transport costs Transport carbon footprint reduction	Exploitation (the issue of implementing logistics blockchain platforms is being discussed)
106.	Implementation of telematics systems in rolling stock fleets	All types of transport	Implementation of an electronic navigation seal	The entire territory of the Barents Region	Implementation of sealing systems for all international cargo transportation on the territory of the Eurasian Union	Government of the Russian Federation	2016	n/a	Increase in container transit Acceleration of customs procedures Transport carbon footprint reduction	Implementation stage (overcoming the resistance of carriers)

2.1.2. List of projects in the field of transport carbon footprint reduction and related project areas implemented in the Russian segment of the Barents Region

Table 32. List of projects in the field of transport carbon footprint reduction and related project areas implemented in the Russian segment of the Barents Region

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
1.	Improving the efficiency of transportation	Automotive	Optimization of the route network of public transport	Arkhangelsk Region	Development of a project for optimizing the route network of public transport to Arkhangelsk	Government of the Arkhangelsk Region LLC Road Information Agency Radar	2021–2022	5,8	Route network optimization Improving the quality of transport services for the population Decrease in trips by private motor transport Growth in the quality of life	Implementation stage (existing network analysis)
2.	Improving the efficiency of transportation	Automotive	Optimization of the route network of public transport	Republic of Komi	Development of a project for optimizing the route network of public transport to Syktyvkar	Government of the Republic of Komi	2021–2022	n/a	Route network optimization Improving the quality of transport services for the population Decrease in trips by private motor transport Growth in the quality of life	Implementation stage (existing network analysis)
3.	Improving the efficiency of transportation	Automotive	Optimization of the route network of public transport	Murmansk Region	Development of a project for optimizing the route network of public transport to Murmansk	Government of the Murmansk Region	2021–2022	n/a	Route network optimization Improving the quality of transport services for the population Decrease in trips by private motor transport Growth in the quality of life Reducing the negative impact of public transport on the environment	Implementation stage (existing network analysis)
4.	Improving the efficiency of transportation	Automotive	Optimization of the route network of public transport	Republic of Karelia	Development of a project for optimizing the route network of public transport to Petrozavodsk	Government of the Republic of Karelia	Since 2022	n/a	Route network optimization Improving the quality of transport services for the population Decrease in trips by private motor transport	Implementation stage (existing network analysis)

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
									Growth in the quality of life	
5.	Use of sustainable modes of transport	Automotive	Modernization of passenger transport in urban agglomerations	Arkhangelsk Region	In 2018, 15 MAZ-206 buses were purchased, corresponding to Euro-5 30 LiAZ-429460 buses transferred from the Mosgortrans fleet do not comply with Euro-5 standards In 2019, 48 KAVZ school diesel buses were purchased; in 2020-2021, 54 new school buses were purchased	Government of the Arkhangelsk Region	2018–2022	400 - 2020	Purchase of 15 MAZ buses Purchase of 102 new diesel school buses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
6.	Use of sustainable modes of transport	Automotive	Modernization of passenger transport in urban agglomerations	Murmansk Region	NefAZ buses. JSC Murmanskavtotrans sent 20 buses to the municipal routes of Severomorsk. Buses comply with Euro5 environmental standards	Government of the Murmansk Region	2021–2022	200 - 2021 800 - 2022	Purchase of 23 Euro-5 buses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
7.	Use of sustainable modes of transport	Automotive	Modernization of passenger transport in urban agglomerations	Republic of Karelia	Purchase of 12 passenger buses. Previously, 28 buses were purchased	Government of the Republic of Karelia	2021–2022	105	Purchase of 40 Euro-5 buses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
8.	Use of sustainable modes of transport	Automotive	Modernization of passenger transport in urban agglomerations	Republic of Komi	106 new school diesel buses were arrived, 49 of them the republic bought on its own	Government of the Republic of Komi	2021	113	Purchase of 106 new diesel buses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
9.	Use of sustainable modes of transport	Automotive	Modernization of the rolling stock of suburban electric transport	Arkhangelsk Region	Purchase of rail buses RA-3 "Orlan" for running in the Arkhangelsk Region	Government of the Arkhangelsk Region	2021–2022	n/a	Purchase of 20 rail buses Carbon footprint reduction using low-carbon transport Reducing the number of car trips Improving the quality of suburban transportation	Operation (park renewal)

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
10.	Use of sustainable modes of transport	Automotive	Modernization of the rolling stock of urban electric transport in Murmansk	Murmansk Region	In 2021, 6 Avangard brand trolleybuses and 5 Belarusian-made trolleybuses were purchased. In 2022, 4 regular trolleybuses and 3 autonomous ones are planned	Government of the Murmansk Region	2021–2022	200 - 2021 800 - 2022	Purchase of 18 trolleybuses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
11.	Use of sustainable modes of transport	Automotive	Modernization of the rolling stock of urban electric transport in Petrozavodsk	Republic of Karelia	Purchase of new 16 trolleybuses for the needs of the Petrozavodsk city district	Government of the Republic of Karelia	2021–2022	290	Purchase of 16 trolleybuses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
12.	Use of sustainable modes of transport	Automotive	Transfer of industrial transport to electric traction (fleet management)	Arkhangelsk Region Republic of Komi	Timber company Segezha Group is switching shunting locomotives to electric traction.	Segezha Group	2015–2025	n/a	Making the company fully carbon neutral by 2025	Operation (park renewal)
13.	Use of sustainable modes of transport	Automotive	Construction of filling stations for electric vehicles	Arkhangelsk Region	2 charging stations for electric vehicles appeared in Arkhangelsk	Government of the Arkhangelsk Region	2019	n/a	Launched 2 charging stations for electric vehicles Reduced carbon footprint using sustainable fuels	Exploitation
14.	Use of sustainable modes of transport	Automotive	Construction of filling stations for electric vehicles	Murmansk Region Republic of Karelia	As part of the Arctic Electric Road initiative, a charging station for electric vehicles has been launched in Teriberka. As part of the roadmap, it is intended to provide a route from St. Petersburg to the coast of the Barents Sea with charging stations for electric vehicles under the Barents -Baltic Electric Road project	Government of the Murmansk Region, Government of the Republic of Karelia NPO Bellona, Enel X Rus	2020–2022	n/a	Launched 1 charging station for electric vehicles Reduced carbon footprint using sustainable fuels	Exploitation

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
15.	Use of sustainable modes of transport	Automotive	Construction of filling stations for electric vehicles	Republic of Karelia	On a private initiative, a network of charging stations for electric vehicles GreenRoad10 is being created. Electric filling stations have been installed in Petrozavodsk, Sortaval and the Ruskeala mountain park.	Ministry of Economic Development of the Republic of Karelia IP Ananiev	2019–2022	A grant of 500 thousand rubles for the equipment of filling stations and a preferential loan of 300 thousand rubles	Launched 4 charging stations for electric vehicles Reduced carbon footprint using sustainable fuels	Operation (network expansion in progress)
16.	Use of sustainable modes of transport	Automotive	Purchase of passenger transport on gas fuel	Arkhangelsk Region	In 2022-2024, it is planned to purchase 200 low-floor gas-fueled buses	Government of the Arkhangelsk Region LLC Road Information Agency Radar	2023–2024	700 - 2023 Arkhangelsk 385 - 2023 Severodvinsk	Procurement of 200 LNG low-floor buses Reduced carbon footprint using sustainable fuels	Pre-project stage (financing sources are being sought)
17.	Use of sustainable modes of transport	Automotive	Purchase of passenger transport on gas fuel	Republic of Komi	In 2016–2019 purchase of 66 gas engine fuel buses In 2020 purchase of 30 NEFAZ buses running on gas engine fuel 2022 planned to purchase 55 units of CNG vehicles	Government of the Republic of Komi	2018–2024		Procurement of 151 LNG low-floor buses Reduced carbon footprint using sustainable fuels	Operation (park renewal)
18.	Use of sustainable modes of transport	Automotive	Construction of new CNG filling stations	Arkhangelsk Region	In 2022, 3 CNG filling stations will be commissioned in the Arkhangelsk Region. Implementation is planned in Severodvinsk and Novodvinsk. As part of the program "Gasification of housing and communal services, industrial and other organizations in the Arkhangelsk Region for 2021-2030 ", convert 500 units of gas to natural gas. motor vehicles	Government of the Arkhangelsk Region	2022–2025	n/a	Launch of 3 CNG stations 500 units vehicles running on natural gas Carbon footprint reduction	Operation (network expansion in progress)

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
19.	Use of sustainable modes of transport	Automotive	Construction of new CNG filling stations	Republic of Karelia	Within the framework of the program "Gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2022–2030", it is planned to build 1 CNG station, convert 50 units to natural gas. motor vehicles	Government of the Republic of Karelia	2022–2030	n/a	1 CNG station 50 units motor transport equipment at GMT Carbon footprint reduction	Exploitation
20.	Use of sustainable modes of transport	Automotive	Construction of new CNG filling stations	Republic of Komi	As of March 2022, there are 5 CNG filling stations. It is planned to increase the number of CNG filling stations in the Republic of Komi by the end of 2025 to 14 units. According to the action plan No. 467-r "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)", expansion of the fleet of vehicles running on CNG	Government of the Republic of Komi	2020–2025	n/a	14 CNG stations Number of CNG vehicles by 2025: 300 buses 360 trucks 360 units special equipment 110 units cars Carbon footprint reduction	Operation (network expansion in progress)
21.	Creation of infrastructure for non-motorized transport	Automotive	Development of bike paths in Arkhangelsk	Arkhangelsk Region	It is planned to build a 16,5 km bicycle path. A sketch of the future bicycle network with a total length of sixteen and a half kilometers is presented in seven directions of two central urban districts: Oktyabrsky and Lomonosov.	Government of the Arkhangelsk Region	2019–2024	66	Bicycle paths 16,5 km long Carbon footprint reduction	Pre-investment
22.	Creation of infrastructure for non-motorized transport	Automotive	Development of bike paths in Severodvinsk	Arkhangelsk Region	A new planning project for the Eastern District of Severodvinsk involves the construction of bike paths	Government of the Arkhangelsk Region	Until 2025	n/a	Carbon footprint reduction	Implementation stage
23.	Creation of infrastructure for non-motorized transport	Automotive	Development of bike paths in Murmansk	Murmansk Region	As part of the comprehensive plan "Our Murmansk", a pilot project is being implemented to create a 1,1 km long cycle path along Lenin Avenue. Further, the	Government of the Murmansk Region OTS Lab Company	2021–2025	n/a	Bicycle paths 1,1 km long Carbon footprint reduction	Implementation stage

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
					length of the allocated routes should increase annually until 2025.					
24.	Creation of infrastructure for non-motorized transport	Automotive	Development of bike paths in Petrozavodsk	Republic of Karelia	Construction in 2018 of the Ivan Tsarevich Trail bike paths in Petrozavodsk. The route, 1,6 kilometers long, connected two residential complex on Drevlyanka. There are plans to increase the length to 10 km	Government of the Republic of Karelia	2018–2025	30	11,6 km bike paths Carbon footprint reduction	Exploitation
25.	Creation of infrastructure for non-motorized transport	Automotive	Development of bike paths in Syktyvkar	Republic of Komi	In Syktyvkar, on the road from Lesozavod to the village of Krasnozatonsky, it is planned to install artificial lighting, equip pedestrian, and bicycle paths	Government of the Republic of Komi LLC Invest Group	2022–2024	2,4	Transport carbon footprint reduction Reducing the number of trips by private vehicles	Implementation stage
26.	Introduction of automated LED lighting	Automotive	Implementation of automated lighting control systems of roads	Arkhangelsk Region	Automated outdoor lighting control system in the Arkhangelsk Region	FKI Management of the highway Moscow - Arkhangelsk of the Federal Road Agency	2022–2024	37,9	Reducing your carbon footprint: reducing emissions by improving the energy efficiency of processes	Exploitation
27.	Introduction of automated LED lighting	Automotive	Implementation of automated lighting control systems of roads	Murmansk Region	Automated outdoor lighting control system "Helios" has been implemented in Murmansk, Tuloma, Monchegorsk, Kirovsk. The introduction of Automated outdoor lighting control system allows monitoring and control of outdoor road lighting in populated areas	Government of the Murmansk Region JSC Murmansk Regional Electric Grid Company	2022–2024	n/a	Reducing your carbon footprint: reducing emissions by improving the energy efficiency of processes	Exploitation
28.	Introduction of automated LED lighting	Automotive	Implementation of automated lighting control systems of roads	Republic of Karelia	Automated outdoor lighting control system "Helios" implemented in Petrozavodsk	Government of the Republic of Karelia	2022–2024	n/a	Share of lines equipped with Automated outdoor lighting control system by 2024 70% Reducing your carbon footprint: reducing emissions by improving the energy efficiency of processes	Operation (network expansion)

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
29.	Use of sustainable modes of transport	Railway	The use of passenger transport on gas fuel	Arkhangelsk Region and Republic of Komi	Introduction into operation of mainline gas turbine locomotives in the territories of Siberia and the Far North. Currently, test operation is being carried out on the Northern Railway (OJSC Russian Railways). There is potential for implementation in the Russian segment of the Barents Region	JSC Russian Railways OJSC VNIKTI	2020–2025	44 000	Reduced carbon footprint by at least 25-30% compared to diesel locomotives	Operation (test)
30.	Use of sustainable modes of transport	Railway	The use of transport on hydrogen	Russian Federation	JSC Russian Railways and the SNCF Group (National Company of French Railways) have approved a roadmap for the use of hydrogen fuel cell trains and systems for their operation, as well as the introduction of other "green" technologies. Issues of safety, design, maintenance and certification of freight and passenger rolling stock are being addressed	JSC Russian Railways SNCF Group	2020–2025	n/a	Reduced carbon footprint through the use of sustainable fuels	Pre-project (regulatory regulation)
31.	Public transport traffic management module (Fleet management)	Water	Digital management system for arctic logistics CAPTAIN Gazprom Neft	Russian Federation Murmansk Region Arkhangelsk Region	PJSC Gazprom Neft has implemented an intelligent digital system for managing Arctic logistics KAPTAN. The system carries out long-term and operational planning, dispatching of the Arctic fleet and analytics using artificial intelligence. The analysis uses data on the volume of daily production, the volume of oil storage facilities and the possibility of forming new supplies of raw materials, the location and parameters of the movement of ships, data on ice conditions on routes, tide and tide charts, and weather conditions	PJSC Gazprom Neft	2020	n/a	Improving traffic safety Increasing traffic regularity indicators. Reduced fuel costs of transport Carbon footprint reduction	Exploitation

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
32.	Modernization of the backbone infrastructure	Water	Construction of ice-class ships	Murmansk Region Arkhangelsk Region	It is planned to build 10 nuclear-powered icebreakers to operate on the NSR	Government of the Russian Federation State Corporation Rosatom	2022–2030	70 000	Nuclear icebreakers do not produce carbon emissions 20-30% reduction in carbon dioxide emissions compared to similar conventional heavy fuel ships Reduced carbon footprint with NSR that saves up to 2 weeks travel time from Southeast Asia to the European market	Implementation stage (ship building)
33.	Modernization of the backbone infrastructure	Water	Construction of ice-class ships on environmentally friendly fuel	Arkhangelsk Region	Construction of four ships with ice reinforcement (project REGC.126) for the transportation of passengers on the intracity lines of Arkhangelsk and Onega	State Budgetary Institution of the Arkhangelsk Region "Regional Transport Service" Shipyard "Red Forge"	2022–2024	n/a	Improving the transport accessibility of remote regions of the Arkhangelsk Region Reducing the carbon footprint using transport that meets modern environmental safety requirements	Implementation stage (production)
34.	Modernization of the backbone infrastructure	Water	Construction of ice-class ships on environmentally friendly fuel	Murmansk Region Republic of Karelia	Construction of two dual-fuel icebreakers of project 23620 for operation in both gas and low- sulphur fuel. Icebreakers will be used in the ports of the Russian segment of the Barents Region	FSUE Rosmorport	2021–2025	18500	Reduction of harmful emissions of carbon dioxide is 24%, sulfur oxides - 100%, and nitrogen oxides - 95% compared with the use of traditional marine fuel	Investment stage
35.	Use of sustainable modes of transport	Water	Supply of environmentally friendly marine fuel	Murmansk Region Arkhangelsk Region	By 2021, PJSC Gazprom Neft has increased the supply of marine fuel to the ports of the Northwestern Federal District. A record growth of 26% in sales of green fuel was recorded in the ports of Murmansk and Arkhangelsk, where the company provides refueling for the ships of the main cargo carriers along the Northern Sea Route and the fleet of the	PJSC Gazprom Neft	n/a	n/a	Reduced carbon footprint using sustainable fuels	Exploitation

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
					largest infrastructure projects in the Arctic. The share of low- sulphur fuel in total sales already exceeds 60% and will increase in the medium term with the restoration of freight and passenger traffic					
36.	Improving the efficiency of transportation	Aviation	Route network optimization	Russian Federation, Arkhangelsk Region Murmansk Region	Optimization of the air traffic service route network, taking into account the use of modern navigation technologies. Changes in the network of air traffic services routes in the area of responsibility of the regional centers of the Unified Air Traffic Management System Murmansk, Arkhangelsk, Vologda and St. Petersburg.	Federal State Unitary Enterprise "State Corporation for Air Traffic Management in the Russian Federation"	2020–2024	n/a	Reduced flight time Save fuel Carbon footprint reduction	Implementation stage
37.	Improving the efficiency of transportation	Aviation	Implementation of wide - area multi-position surveillance systems	Russian Federation	The ground station of the wide -area multi-position surveillance system is designed to determine the position and control the movement of aircraft equipped with on-board transponders operating in the international range. Providing an effective digital air traffic control solution on the territory of the Russian segment of the Barents Region. Development of a network of observation stations, including in areas not provided with radar coverage	Federal State Unitary Enterprise "State Corporation for Air Traffic Management in the Russian Federation"	2020–2024	6 793	Improving fuel efficiency in flights and reducing emissions greenhouse gases from aircraft engines	Implementation stage
38.	Use of sustainable modes of transport	Aviation	The use of passenger transport on gas fuel	The entire territory of the Barents Region	The airline signed an agreement with Gazprom to develop the production and use of more environmentally friendly SAF jet fuel (produced from vegetable raw materials) in accordance with international requirements for limiting greenhouse gas emissions and the CORSIA	Aeroflot PJSC Gazprom	2021–2024	n/a	Up to 80% reduction in carbon footprint with cleaner fuels	Implementation stage

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
					environmental program of the international civil aviation organization ICAO. The new fuel will reduce the carbon footprint of flights by 80%. Aeroflot will switch to it on domestic and international flights.					
39.	Improving the efficiency of transportation	Aviation	Route network optimization. Modernization of transport (fleet management)	The entire territory of the Barents Region	S7 Airlines is modernizing its aircraft fleet and optimizing its route network. With aerodynamic design, lighter materials and fuel-efficient engines, next-generation aircraft use less fuel, reducing emissions. In 2022, the airline plans to reduce CO2 emissions by another 4-5% and the average fleet age to 8,5 years	S7 Airlines	2020–2022	n/a	The share of S7 Airlines flights operated on new generation aircraft with reduced CO2 emissions amounted to more than 45%	Implementation stage
40.	Use of sustainable modes of transport	All types of transport	LNG production	Arkhangelsk Region	Northern Dvina LNG. Construction of a plant with a capacity of 120 thousand tons of LNG per year. Transfer to liquefied natural gas of 550 units of public transport and special equipment with the creation of filling infrastructure	State Corporation "Rostec"	2020–2024	14 000	550 units public transport on LNG Carbon footprint reduction	Implementation stage
41.	Use of sustainable modes of transport	All types of transport	LNG production	Arkhangelsk Region	Construction of a small-scale LNG plant The production capacity of the plant at the first stage is 25 thousand tons of LNG per year (3 tons / hour) with an increase to 110 thousand tons of LNG per year	Design company Arkhangelsk LNG LLC	2019–2024	1,800 in 2019 prices	Reducing the carbon footprint using transport on LNG	Pre-investment
42.	Use of sustainable modes of transport	All types of transport	LNG production	Republic of Komi	Construction of a small-scale natural gas liquefaction plant with a capacity of 24 tons / hour	SPG KOMI LLC	2018–2026	7058	Reducing the carbon footprint using transport on LNG Possibilities for refueling cars, special equipment, and LNG river vessels	Pre-investment

Transport carbon footprint reduction activities										
№	**Measure type of transport carbon footprint reduction**	**Type of transport**	**Project name**	**Implementation region**	**Project description**	**Initiator / participants**	**Implementation timeline**	**Investments million rubles**	**Main results, effects**	**Implementation status**
1	2	3	4	5	6	7	8	9	10	11
43.	Use of sustainable modes of transport	All types of transport	LNG production	Republic of Karelia	Construction of an LNG production complex with a capacity of 150 thousand tons in the Prionezhsky district of the Republic of Karelia	JSC Cryogas	2020–2024	n/a	Reducing the carbon footprint using transport on LNG	Pre-investment
44.	Use of sustainable modes of transport	All types of transport	Production of "green" hydrogen	Arkhangelsk Region	It is planned to produce "green hydrogen" on the basis of the capacities of the Mezen tidal station (after the implementation of the station project)	Government of the Russian Federation	After 2025	n/a	Reducing the carbon footprint using hydrogen transport	Pre-project (the project is included in the planning documents)
45.	Use of sustainable modes of transport	All types of transport	Production of "green" hydrogen	Murmansk Region	Launch of a pilot project to produce "green" hydrogen by water electrolysis using electricity from the Kola wind farm. The project will produce 12 thousand tons of hydrogen per year, starting in 2025	Government of the Murmansk Region JSC "Rosnano" Enel Russia Company	until 2025	n/a	Reducing the carbon footprint using hydrogen transport	Pre-project (the project is included in the planning documents)
46.	Use of sustainable modes of transport	All types of transport	Production of "green" hydrogen	Murmansk Region	The production of low-carbon hydrogen by water electrolysis using electricity from the Kola NPP is implemented by Rosatom The forecast production volume in 2024 will be 150 tons of hydrogen per year. Achievement of industrial production volumes is planned for 2030	State Corporation Rosatom	2020–2030	n/a	Reducing the carbon footprint using hydrogen transport	Pre-project (the project is included in the planning documents)
47.	Use of sustainable modes of transport	All types of transport	Production of "green" hydrogen	Murmansk Region	H2 Clean Energy, together with TGC-1, plans to produce "green" hydrogen by water electrolysis using hydroelectric power. The forecast volume is 16 thousand tons per year	H2 Clean Energy LLC, TGC-1 PJSC	until 2025	n/a	Reducing the carbon footprint using hydrogen transport	Pre-project (the project is included in the planning documents)
48.	Use of sustainable modes of transport	All types of transport	Production of "turquoise" hydrogen	Republic of Komi	In the Republic of Komi, it is planned to create a large-scale production - "turquoise hydrogen". This will make it possible in the future to organize the supply of hydrogen for the needs of new energy and industry.	Government of the Russian Federation	Until 2025	n/a	Reducing the carbon footprint using hydrogen transport	Pre-project (the project is included in the planning documents)

2.2. Assessment of the integrated impact of ongoing projects on solving the problems of developing ITS, carbon footprint reduction and increasing the connectivity of national transport systems in the Barents Region

2.2.1. Assessment of the complex impact of ongoing projects on solving the problems of developing ITS

An intelligent transport system (ITS) is a system that integrates modern information, communication, and control technologies, designed for automated search and adoption for implementation of the most effective decisions for managing the region's transport system, a specific vehicle or group of vehicles.

The main functions of the ITS are the collection and processing of data from road infrastructure and vehicles, and the provision of processed information to the relevant consumers for managing traffic flows, public transport and road infrastructure maintenance, traffic safety, including responding to weather conditions. ITS operates to meet the demand for passenger and freight traffic, i.e., optimizing the movement of vehicles, achieving a balance between the capacity of the road network and the actual load on the existing infrastructure, improving comfort for road users and improving safety.

Specific examples of the results of the impact of ITS can be:

- Reduction of time delays on the way and an increase in the average speed of vehicles, a decrease in fuel consumption - the results that affect the increase in traffic and the optimization of traffic;
- Reducing the mass of emissions of harmful substances is a result that affects the quality of life of society as a whole;
- Reducing the number of accidents and the time of their liquidation - the results that affect the increase in traffic and improve safety;
- A decrease in the area of the zone of increased wear of road surfaces is a result that affects the road infrastructure;
- The provision of commercial services and data in the field of transport (MaaS, etc.) is a result that affects the optimization of transportation.

These examples show that the results of the implementation of ITS projects can affect one characteristic (eg, comfort or infrastructure) or several characteristics (eg, transport and safety) of the transport system.

In the Barents Region of the Russian Federation, a greater number of ITS development projects are aimed at optimizing road transport. The projects implemented by ITS for-road transport are at the regional level, and each region implements projects independently. ITS development projects for railway, water and air transport are mainly implemented at the federal level.

List of ITS development projects for road transport (mainly related to the regional level)

Projects aimed at both optimizing transportation and traffic, and improving infrastructure, and improving comfort and safety include:

- Implementation of a unified digital platform for managing the transport system, implemented in the Murmansk and Arkhangelsk Regions,
- The introduction of an automated traffic control system is being implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia, in the Nenets Autonomous District,
- The introduction of a subsystem for the dispatching control of transport of road maintenance services is being implemented in the Murmansk and Arkhangelsk Regions, in the Republic of Karelia,
- The introduction of Free Flow systems for a barrier-free procedure for paying for the passage of vehicles is being implemented in the Murmansk and Arkhangelsk Regions, in the Republic of Karelia,
- The ITS efficiency control module is being implemented in the Murmansk Region.

Individual effects from such projects are measured in quantitative terms. According to the ITS projects for road transport, the results of the implementation of a single ITS control center in Arkhangelsk, the implementation of traffic control subsystems and VOCORD Traffic control subsystems in Syktyvkar were currently evaluated. According to the traffic police in Arkhangelsk, at intersections equipped with intelligent systems, the throughput increased by 25%, in Syktyvkar, at intersections with "smart" traffic lights, the throughput increased by 18%, and in Syktyvkar, at intersections with an implemented control subsystem, there was a decrease accident rate by 30%.

Projects aimed at improving transportation and traffic, increasing comfort and safety include:

- The introduction of an automated meteorological support system is being implemented in the Murmansk and Arkhangelsk Regions, in the Republic of Karelia;
- The introduction of a subsystem for managing the movement of public transport is being implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia;
- Implementation of a subsystem for monitoring the movement of public and special transport, implemented in the Murmansk and Arkhangelsk Regions;
- Implementation of the smart road facility management subsystem is being implemented in the Murmansk and Arkhangelsk Regions;
- Testing of highly automated vehicles (unmanned vehicles) is being implemented in the Murmansk Region;
- The implementation of commercial Maa S solutions for transport is being implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia.
- Full coverage of main roads with cellular communication of the 4G standard is implemented throughout the Russian Federation as a whole;
- Full coverage of main roads with LPWAN networks for Internet of Things connections is being implemented throughout the Russian Federation as a whole.

The implementation of these projects in relation to projects for the development of communications and coverage of main roads with cellular communications of the 4G (LTE) standard has a number of specific effects from the implementation of projects. According to them, mobile operators have exceeded the coverage level of 75% on the road network. Data on the highways M8 Kholmogory in the Arkhangelsk Region and M18 Kola in the Murmansk Region and the Republic of Karelia are shown in the following Table.

Table 33. Level of coverage of main roads by mobile operators in the Arkhangelsk and Murmansk Regions and the Republic of Karelia

Track name	*Level of route coverage by mobile operators, %*			
	MTS	***Megafon***	***VimpelCom***	***T2 RTK Holding***
M8 "Kholmogory"	95,8	99,5	89,5	99,5
M18 "Cola"	82,0	89,9	76,7	85,2

Projects aimed only at optimizing transportation and traffic include:

- The introduction of a subsystem for monitoring the movement of special vehicles is being implemented in the Republics of Komi and Karelia;
- The introduction of a satellite monitoring system for special road transport is being implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia.

Projects aimed only at improving road infrastructure include:

- The introduction of the "digital twin" module of the transport infrastructure is being implemented in the Murmansk and Arkhangelsk Regions, in the Republic of Karelia.

Safety related projects include:

- Development of subsystems for monitoring violations, implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia;
- The introduction of a subsystem for weight and dimension control of vehicles is being implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia;
- Implementation of a subsystem for informing participants with the help of dynamic information boards and variable information signs, implemented in the Murmansk and Arkhangelsk Regions;
- The introduction of a unified fare collection system in public transport is being implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia;
- Implementation of emergency response systems, implemented in the Murmansk and Arkhangelsk Regions, in the Republics of Komi and Karelia;
- The introduction of online system for tracking the movement of public transport is being implemented in the Murmansk and Arkhangelsk Regions, in the Republic of Komi.

List of ITS development projects for railway transport (mainly related to the federal level)

Projects aimed at optimizing transportation and rail traffic, as well as improving infrastructure, and improving comfort and safety include:

- The introduction of a unified corporate platform for the integrated management of resources, risks and reliability is being implemented throughout the Russian Federation as a whole;
- The introduction of an intelligent control system and automation of production processes on railway transport is being implemented throughout the Russian Federation as a whole;
- Implementation of the ecosystem "digital twin" of JSC Russian Railways, implemented in the Russian Federation as a whole;

– Implementation of services for connected and highly automated transport V2X, implemented in the Russian Federation as a whole;
– The introduction of satellite and geoinformation technologies in transportation management is being implemented throughout the Russian Federation as a whole.

Projects aimed at optimizing transportation and railway traffic, improving comfort and safety include:

– The platform for the analysis of "big data" of the movement of the railway vehicle, is implemented throughout the Russian Federation as a whole;
– The development of the system "Innovative mobility" of passenger transportation is being implemented throughout the Russian Federation as a whole;
– Creation of a platform for managing and monitoring freight traffic, implemented throughout the Russian Federation as a whole;
– Development of a service for monitoring smart contracts for freight transportation, implemented throughout the Russian Federation as a whole;
– The development of quantum communication systems of backbone networks is being implemented in the Russian Federation as a whole.

Projects aimed only at improving the railway infrastructure include:

– Equipment of electric trains with on-board complex for ultrasonic flaw detection of rails is implemented throughout the Russian Federation as a whole;
– The introduction of the Digital Depot system is implemented throughout the Russian Federation as a whole;
– The introduction of predictive diagnostic systems, the "smart locomotive" solution, is being implemented throughout the Russian Federation as a whole.

Safety-only projects include:

– The increase in the capacity of the backbone and local data transmission network is being implemented throughout the Russian Federation as a whole;
– The construction of LPWAN networks for Internet of Things connections is implemented throughout the Russian Federation as a whole.

A number of effects from ITS projects on the railway has a quantitative dimension.

– The implementation of the ITS project for the development of a unified corporate platform for managing resources and reliability for railway transport on the Northern Railway made it possible to reduce direct operating costs for the maintenance of the track infrastructure by more than 51 million rubles and expenses for demurrage of trains for 47 million rubles,
– The effects of the implementation of the ITS project on a digital platform for collecting, storing information, and interacting with participants that ensure the operation of traction rolling stock are a reduction in reporting time by 43 times and an increase in the speed and accuracy of cost allocation by 40 times,
– The introduction of a digital platform for passenger and cargo transportation, firstly, increased the share of electronic documents in the provision of door-to-door services to 90%, secondly, raised the share of operations in customer service business processes performed without human intervention to 55% and, thirdly, raised the share of cargo transportation services available for registration in electronic form, up to 75%,

– The project to develop services for highly automated transport and improve the safety of shunting operations on the railway ensured a 70% reduction in the number of incidents.

List of projects for the development of ITS for-aviation transport (mainly related to both the federal level, including the waters of the Northern Sea Route, and the ports of Murmansk and Arkhangelsk)

Projects aimed at optimizing transportation and traffic, as well as improving infrastructure, and improving comfort and safety include:

– Construction of an automated radio-technical post for a ship traffic control system in the port is being implemented in Murmansk;
– The introduction of digital technologies for the development of multimodal freight traffic in the waters of the Northern Sea Route is being implemented in Murmansk and Arkhangelsk.

Projects aimed at optimizing transportation and traffic, improving comfort and safety include:

– The development of a comprehensive integrated information system "Sea - River" is being implemented throughout the Russian Federation as a whole;
– The development of the Big Data Analysis Platform for the movement of vehicles based on the Digital Twin technology is being implemented throughout the Russian Federation as a whole;
– The introduction of a unified digital platform for the formation and use of the daily schedule for the placement and movement of ships is being implemented throughout the Russian Federation as a whole;
– Implementation of the "Digital Vessel" system is being implemented throughout the Russian Federation as a whole;
– Creation of a platform for modeling unmanned navigation, implemented throughout the Russian Federation as a whole;
– Testing of unmanned aerial vehicles on ships is implemented throughout the Russian Federation as a whole;
– The hydrographic boat control system from the ship or from the shore is implemented throughout the Russian Federation as a whole;
– Creation of automation systems for pilotage, implemented in the Russian Federation as a whole;
– The introduction of the information system "Port dues" is being implemented throughout the Russian Federation as a whole;
– The construction of a trans-Arctic submarine fiber-optic communication line Murmansk - Vladivostok is being implemented throughout the Russian Federation as a whole, Murmansk and Arkhangelsk;
– The provision of satellite communications in the waters of the Northern Sea Route is implemented throughout the Russian Federation as a whole, Murmansk and Arkhangelsk.

Safety-only projects include:

- Creation of a complete database of electronic navigational charts of inland waterways, implemented throughout the Russian Federation as a whole;
- The development of a weather information system in the waters of the Northern Sea Route is being implemented in the Russian Federation as a whole, in Murmansk and Arkhangelsk;
- The deployment of the highly elliptical hydrometeorological space system "Arktika-M" is being implemented in the Russian Federation as a whole, in Murmansk and Arkhangelsk;
- The introduction of an information system for identifying dangerous ice formations is being implemented in the Russian Federation as a whole, Murmansk and Arkhangelsk.

List of ITS development projects for aviation transport (mainly related to the federal level)

Projects aimed at both optimizing transportation and air traffic, and improving infrastructure, and improving comfort and safety include:

- The introduction of the Unified Air Traffic Management System of the Russian Federation is being implemented throughout the Russian Federation as a whole;
- The creation of a digital infrastructure platform for managing a unified system of aerospace search and rescue and interaction with services is being implemented throughout the Russian Federation as a whole;
- The creation of a Geographic Information System for monitoring the operational and technical condition of aviation infrastructure elements is being implemented throughout the Russian Federation as a whole;
- The development of the electronic document management system of the Federal Air Transport Agency is being implemented throughout the Russian Federation as a whole;
- The development of software and hardware systems of information security is being implemented in the Russian Federation as a whole;
- The creation of a new information system for ensuring flight safety is being implemented in the Russian Federation as a whole;
- The development of telematic data collection and processing services is being implemented throughout the Russian Federation as a whole;
- The creation of a "digital twin" of the airfields of the Russian Federation is being implemented throughout the Russian Federation as a whole;
- The development of the information system "Registration of unmanned aerial vehicles" of the Federal Air Transport Agency is being implemented throughout the Russian Federation as a whole.

Projects aimed at optimizing transportation and air traffic, and improving comfort and safety include:

- The use of unmanned aerial vehicles for forest pathological monitoring is implemented throughout the Russian Federation as a whole and the Arkhangelsk Region;
- The introduction of a biometric passenger identification system is being implemented throughout the Russian Federation as a whole.

Also in the Barents Region, a list of ITS development projects can be selected that are applicable to all modes of transport (mainly related to the federal level)

Projects aimed at optimizing transportation and traffic, as well as improving infrastructure, and improving comfort and safety include:

- Creation of a federal network of transport telematics, implemented throughout the Russian Federation as a whole;
- The creation of the state information system (GIS) "Avtodata" based on Era-Glonass is being implemented throughout the Russian Federation as a whole.

Projects aimed at optimizing transportation, traffic and improving comfort and safety include:

- Provision of satellite communications for public transport is implemented throughout the Russian Federation as a whole;
- Providing coverage with cellular communication of the 5G standard is implemented throughout the Russian Federation as a whole;
- Unified automated information system of the Federal Customs Service of the Russian Federation, implemented throughout the Russian Federation as a whole;
- The introduction of an electronic navigation seal is being implemented throughout the Russian Federation as a whole.

The projects discussed above in the field of ITS development have either only recently been implemented or are currently in the implementation stages. Since separate modules and subsystems of ITS are mainly operated, the current state of the entire information system can only be described as "fragmentary". Linking regional systems into a single whole is a matter of the future. Systems in urban agglomerations have predominantly a basic level of technological maturity (Petrozavodsk, Arkhangelsk, Syktyvkar) or an initial level (Naryan-Mar). A relatively mature ITS operates in Murmansk. The effectiveness of the implementation of ITS at the current moment cannot be assessed, it is possible to evaluate the effectiveness of only disparate working modules and subsystems (individual results are given above for the blocks of communication between ITS development tasks and projects).

2.2.2. Transport carbon footprint reduction

The number of emissions from transport depends on the types and characteristics of the engines used and the types and quality of the fuel they consume. Traditional types of fuel for sea and river transport are heavy oil fuels - fuel oil, diesel fuel, as well as nuclear energy. Kerosene is used for air transport, diesel fuel and electricity for rail transport, and gasoline and diesel fuel for road transport. As new types of fuel liquefied natural gas (LNG) is being used in sea transport, LNG in rail transport, and LNG, compressed (compressed) natural gas, as well as hydrogen and electricity in road transport.

In the Barents Region, transport carbon footprint reduction is possible through two project areas. The first direction is transport carbon footprint reduction from projects for the modernization of road transport and projects for the transition to gas motor fuel. The second direction is transport carbon footprint reduction from projects for the conversion of sea transport to LNG. In 2012, it was planned to launch LNG locomotives - gas turbine locomotives on the Northern Railway, but since there are currently only 2 prototypes of gas turbine locomotives operated on the Sverdlovsk Railway (Urals Federal District), the feasibility, duration and transport carbon footprint reduction of the project do not yet have final data.

As part of the first direction, reducing emissions from road transport, possibly through a project to modernize mobile public transport by replacing obsolete vehicles of environmental classes from Euro 2 to Euro 4 with new vehicles of Euro 5 and Euro 6 classes, and also at the expense of the project of transferring part of the vehicle to natural gas fuel. The replacement of obsolete vehicles is carried out in accordance with the Federal project "Modernization of passenger transport in urban agglomerations", and the transition to gas motor fuel is carried out in accordance with the State subprogram "Development of the gas motor fuel market".

The modernization of the fleet of passenger vehicles with diesel engines with environmental classes from Euro-2 to Euro-4 to new vehicles with modern Euro-5 engines in the Barents Region of the Russian Federation is proceeding at a slow pace. The table below shows data on the number of Euro-2 to Euro-4 class buses in operation and on the number of newly purchased modern Euro-5 class buses in the period 2019-2021. The number of buses in operation includes both linear passenger and service buses available to passenger automobile enterprises in the region[228]. The number of newly acquired modern buses for public transport is determined according to the data received from the responses to the sent requests from the administrations of the regions, municipal authorities of the regional capitals. The largest number of passenger buses are operated in the Arkhangelsk Region and the Republic of Komi, 5,7 thousand units each, and the smallest in the Murmansk Region – 3,0 thousand units. For the period 2019-2021, the most modern buses were purchased in the Komi Republic - slightly less than 150 units, and the least – in the Republic of Karelia – less than 30 units.

The number of passenger buses using natural gas fuel in the Barents Region of the Russian Federation in the period 2019–2021 according to Rosstat is a little over 400[229]. The largest number of passenger buses running on gas motor fuel are operated in the Arkhangelsk Region more than 300 units, and such buses are not operated in the Republic of Karelia.

Table 34. The number of buses in operation, newly purchased in the period 2019–2021, and using natural gas fuel

Region	***Number of operated buses of Euro-2 - Euro-4 classes, thousand units***	***Number of newly purchased Euro-5 buses, units***	***Share of newly purchased buses, %***	***Number of operated buses running on natural gas fuel, units***	***Share of operated buses running on natural gas, %***
Arkhangelsk Region excluding Nenets Autonomous District	5,4	87	1,6	302	5,6
Nenets Autonomous District	0,3	15	5,7	41	15,6
Republic of Komi	5,7	143	2,5	49	0,9
Republic of Karelia	3,5	27	0,8	0	0
Murmansk Region	3,0	124	4,2	25	0,8
Total	~ 17,8	~ 400	2,3	~ 400	~ 2,3

Since the late 1990s, vehicle manufacturers, consumers and European countries in general have been trying to limit emissions from internal combustion engines. The first full-fledged and

[228] Rosstat website. https://www.gks.ru/free_doc/new_site/business/trans-sv/trans_gaz.htm

[229] Rosstat website. https://www.gks.ru/free_doc/new_site/business/trans-sv/trans_gaz.htm

environmentally developed Euro-0 class was adopted in 1988. The environmental class limited the maximum allowable concentrations of emissions from internal combustion engines for carbon monoxide (CO), nitrogen oxide (NO_x) and hydrocarbons (HC). In 2001, the Euro-3 class was adopted, and in 2011, the Euro-5 class. The Euro-5 class, compared to Euro-3, sets a reduction in total emissions by almost 2 times for a diesel engine.

Gas motor fuel engines have 1,7 times fewer specific emissions than diesel engines[230] [231]. Data on maximum allowable emission concentrations are given in the Table below[232].

Table 35. Maximum Permissible Emission Concentrations for Diesel and Natural Gas Engines

Maximum allowable emission concentrations, g/km											
Diesel Euro-3				*Diesel Euro-5*				*gas engine*			
CO	***NO x***	***HC***	∑	***CO***	***NO x***	***HC***	∑	***CO***	***NO x***	***HC***	∑
0,64	0,50	0,06	1,20	0,50	0,18	0,05	0,73	0,38	0,29	0,04	0,71

Data on the calculation of emission volumes from buses with diesel engines of Euro-3, Euro-5 and gas-powered engines and emission reductions due to the purchase of Euro-5 and gas-powered buses are presented in the following Table. The maximum reduction in emissions during the transition to the Euro-5 environmental class was revealed in the Murmansk Region and the Republic of Komi, and the maximum reduction in the transition to gas motor fuel was in the Arkhangelsk Region.

As a result, in fact 2021, the transport carbon footprint reduction is:

- 9,7 tons per year or 0,9% of the emissions of all operated buses upon transition to the Euro-5 class;
- 9,1 tons per year or 0,8% of the emissions of all buses in operation when switching to natural gas.

Table 36. Calculation of the annual effect of the transport carbon footprint reduction obtained as part of the implementation of projects for the modernization of passenger vehicles and their transition to natural gas fuel in the Russian segment of the Barents Region in 2019–2021

Region	***Emissions from operated buses, tons / year***	***Reduction of emissions due to the Euro-5 class, t./g.***	***Relative reduction due to Euro-5 class, %***	***Reduction of emissions due to gas motor fuel, t./g***	***Relative reduction due to gas engine fuel, %***
Arkhangelsk Region excluding Nenets Autonomous District	300	1,9	0,6	6,8	2,3
Nenets Autonomous District	10	0,2	2,2	0,5	6,4
Republic of Komi	320	3,2	1,0	1,1	0,4
Republic of Karelia	250	0,8	0,3	0	0

[230] Ecological effect of motor transport on gas motor fuel in the regions of the Russian Federation. Gazprom. 2016. https://www.gazprom.ru/f/posts/22/538143/atlas-ecology-effect-gas-transport.pdf

[231] https://www.gov.spb.ru/gov/otrasl/c_transport/news/234009/

[232] Information business site "Journal-I". http://img59.ru/2015/11/09/sistema-evro-5-v-dizele-princip-work/?

Region	*Emissions from operated buses, tons / year*	*Reduction of emissions due to the Euro-5 class, t./g.*	*Relative reduction due to Euro-5 class, %*	*Reduction of emissions due to gas motor fuel, t./g*	*Relative reduction due to gas engine fuel, %*
Murmansk Region	220	3,7	1,6	0,8	0,3
Total	1100	9,7	0,9	9,1	0,8

From open sources of information and from responses to requests to the regions, it was revealed that until 2024 inclusive in the Barents Region, it was announced the purchase of another 175 modern buses with an environmental class Euro-5 (80 in the Murmansk Region, 50 in the Arkhangelsk Region and 45 in the Republic of Komi). Also, during this period in the Arkhangelsk Region, they plan to purchase 200 buses running on natural gas fuel.

The planned result for the transport carbon footprint reduction until 2024 inclusive will be:

- 5 tons per year or 0,4% of the emissions of all buses in operation when some buses switch to the Euro-5 class;
- 6 tons per year or 0,5% of the emissions of all buses in operation when some buses switch to natural gas.

The regional authorities would like to achieve a greater effect from the transport carbon footprint reduction, but the existing budget constraints on the implementation of the renewal of the rolling stock of public utilities and emergency services do not allow them to be transferred to the Euro-5 environmental class, to gas motor fuel or to electric energy. Due to changes in macroeconomic conditions and sanctions pressure on the Russian economy, such projects will be postponed for longer periods.

An important project area for transport carbon footprint reduction could also be the construction of new LNG-powered vessels. LNG is one of the most promising types of fuel for shipping. This is influenced by the modern environmental agenda, on the one hand, and the active development of LNG production in the world, which leads to an increase in the availability of LNG in the world and the supply of LNG at competitive prices. As of 2019, there[233] are 170 LNG-fueled ships in operation worldwide and 75 ports are already bunkering LNG ships.

At present, high-sulphur marine fuel oil and low-sulphur diesel grades are mainly used as fuel on ships. To maintain marine areas and the atmosphere in a favorable ecological state, the provisions of the International Convention for the Prevention of Ocean Pollution (MARPOL 73/78) and the requirements of the International Maritime Organization (IMO) have been adopted, which recommend a consistent transition to the use of LNG.

In addition to environmental reasons, the transition to LNG was supported by plans to accelerate the growth of LNG production in the Arctic and the Far North (gas production and liquefaction projects in the Nenets and Yamalo-Nenets Autonomous Districts). LNG production volumes in this region were estimated at up to 60 million tons by 2030. The cost-effectiveness of the approach was confirmed by large orders for the construction of new LNG-powered vessels by such

[233] Conversion of the Arctic fleet from fuel oil to LNG. Business magazine "Neftegaz.RU". October 14, 2019

companies as PJSC Rosneftand PJSC Sovcomflot. The state also actively supported the construction of such vessels[234], in 2021 the Government of the Russian Federation allocated funds to support the construction of 15 new gas carriers of the first stage, which are planned to be used on the Northern Sea Route (NSR)[235]. Most of the new LNG-powered ships will be assigned to the ports of Murmansk, Arkhangelsk, and Nenets Autonomous District, which are the beginning of the NSR.

Due to the changed political conditions in the world and the imposition of economic sanctions on the Russian Federation, investment plans for projects to produce LNG in the Arctic and the construction of ships may be adjusted in the new macroeconomic conditions.

The experience of building new and converting old ships to LNG has shown that, on average, greenhouse gas emissions are reduced by 20%, sulfur oxide emissions by 100%, nitrogen oxide emissions by more than 90%, soot and particulate matter by 98% compared to oil fuels[236].

Comparative characteristics (factors) of emissions when using fuel oil and LNG are shown in the following Table.

Table 37. Ship engine emission factors for fuel oil and LNG

Emission factor	***Ship emission factors by fuel type[237], kg/tonne***			
	LNG		***fuel oil***	
	2030	***2013***	***2030***	***2011***
CO2	2750	2750	3130	3130
NO_x	23	23	75	78
SO2	0	0	11	54

According to the LNA Skolkovo[238], with the year-round operation of the fleet on the NSR, with the consumption of about 250 thousand tons per year of fuel oil or 205 thousand tons per year of LNG, annual emissions can be determined. The following Table shows the annual volumes of fuel consumption, ship emissions and differences between the volumes for different types of fuel.

Table 38. Annual ship engine emissions for fuel oil and LNG

Emission factor	***Volumes of fuel consumption and ship emissions by types of fuel[239], thousand tons per year***		***Absolute volume difference, thousand tons per year***	***Relative volume difference, %***
	LNG	***fuel oil***		
Planned fuel consumption	205	250	45	18

[234] The concept of the subprogram "Development of the gas motor fuel market" of the State program of the Russian Federation "Energy Efficiency and Energy Development". http://oktregion.ru/upload/docs/ekonomika-i-finansy/zhilishchno-kommunalnoe-khozyaystvo/Kontseptsiya-Minenergo.pdf?ysclid=l19b300jrl

[235] Plan for the development of the infrastructure of the Northern Sea Route for the period up to 2035. Decree of the Government of the Russian Federation of December 21, 2019 No. 3120-r. http://static.government.ru/media/files/itR86nOgy9xFEvUVAgmZ3XoeruY8Bf9u.pdf

[236] Case: Tanker ship Bit Viking. LNG Conversion for environmental sustainability", Wärtsilä, 2012. https://www.wartsila.com/docs/default-source/services-documents/learning-center/references/services-reference-tar-bit-shipping.pdf?sfvrsn=600ee245_0

[237] A.Knizhnikov, A.Klimentiev. Introduction of alternative fuels for bunkering. From the Baltic to the Arctic. Discussion materials for the international conference "NEVA-2019", St. Petersburg. https://wwf.ru/upload/pdf/Rabochie-materialy-po-SPG-NEVA-sentyabr-2019.pdf

[238]Volume 3 "Northern Sea Route: history, regions, projects, fleet and fuel supply". https://energy.skolkovo.ru/downloads/documents/SEneC/Research/SKOLKOVO_EneC_RU_Arctic_Vol3.pdf

[239] Conversion of the Arctic fleet from fuel oil to LNG. Business magazine "Neftegaz.RU". October 14, 2019

CO2	560	780	220	28
NO_x	5	19	14	74
SO2	0	3	3	100
Planned emissions	565	802	237	~ 30

The planned results should be a final transport carbon footprint reduction of 237 thousand tons per year, which will be 30% of the total fuel oil emissions in accordance with the approved strategic plans for the construction of new LNG ships. A significant part of such a large-scale effect from the measures to switch the fleet of gas carriers to LNG can be localized in the Barents Region (including considering the formation of a market for CO2 quotas).

In accordance with the draft program[240] "Natural gas as a motor fuel for railway rolling stock for 2014-2020" in 2012, PJSC Gazprom and JSC Russian Railways signed an agreement to produce 40 gas turbine locomotives by 2020[241]. In 2019, there was a correction of plans, according to which 9 gas turbine trucks were to be manufactured by 2022 and 15 more by 2027. In 2021, only 2 gas turbine locomotives were in operation on the Sverdlovsk Railway, where they are undergoing testing[242]. In the distant future, by 2030, it is possible to start operating such locomotives in the Russian segment of the Barents Region, including for cross-border transportation. But since the scale of the introduction of new equipment on the Oktyabrskaya and Northern Railways has not been approved, the environmental effect of the introduction of gas turbine locomotives is not yet amenable to a final assessment.

Summarizing the main effects of projects in the field of transport carbon footprint reduction it should be noted that significant results can only be achieved within the framework of the implementation of large investment projects focused both on economic results and on compliance with the principles of a sustainable and circular economy. First of all, these are projects for the development of gas fields and the production of LNG, which involve the use of LNG as fuel for large-capacity gas carriers. In the context of the development of navigation on the NSR, this will have the greatest effect on reducing the carbon footprint.

Comparable importance for the transport carbon footprint reduction can be obtained by decisions on the conversion of railway locomotives to natural gas motor fuel. Given the current dynamics of this process, the results of such activities are expected no earlier than 2030.

In other areas related to the modernization of public transport and the use of gas-powered vehicles for municipal needs, the return in terms of the transport carbon footprint reduction is relatively small (the decrease in the transport carbon footprint reduction is less than 1% of this type of transport in the regions), but the positive impact of the use of "green" public transport on its perception by city dwellers. This contributes to the implementation of the goals of the Russian transport strategy on the priority development of public transport and the reduction of movement by private cars in urban agglomerations. The indirect effect of such measures can be estimated with a multiplier of at least 5–6 to the direct result of rolling stock modernization projects. Support for the implementation of this effect is carried out through the introduction of ITS modules related to the management and optimization of public transport.

[240] https://sdelanounas.ru/blogs/35552/

[241] https://company.rzd.ru/ru/9401/page/78314?id=157154

[242] https://rg.ru/2021/10/27/lokomotivy-perevodiat-na-chistoe-toplivo.html

2.2.3. Impact of project implementation on the connectivity of national transport systems

The solution of the problem of increasing the connectivity of national transport systems through the implementation of projects stands out (see section 2.1). After analyzing the structure of projects in the field of ITS and the transport carbon footprint reduction, implemented in the Russian segment of the Barents Region, it is advisable to note the following factors affecting the growth rate of systems connectivity:

1) Limited area of application of ITS

The implementation of ITS projects to ensure their effectiveness in terms of budget costs is concentrated in urban agglomerations and on the main federal highways. Local projects generate effects for traffic safety, effective traffic management and infrastructure life cycle management.

2) Potential for the development of ITS connectivity in various geographic locations

In the Russian segment of the Barents Region, there are currently no ITS projects being implemented that are linked to the management of full-fledged intermodal transport complexes within the framework of a whole subject of the federation, interregional communication or in commonwealth with the border areas of neighboring states. At the same time, the architecture, and approaches to the standardization of such systems imply the possibility of further linking (including data exchange according to the Datex standard II).

3) The lack of a developed infrastructure for refueling electric vehicles and the focus of the Russian Federation on gas motor fuel

In the Russian Federation, the development of electric transport and the use of ethanol, biodiesel, etc. (unlike Norway, Sweden, Finland) remains a secondary direction in the development of environmentally friendly modes of transport, the implementation of projects in the field of the use of gas motor fuels (CNG, LNG and LPG) is more significant. At the same time, in the Barents Region, due to the different levels of gasification of the regions (the Murmansk and Arkhangelsk Regions have a relatively low level of gasification), the road network is not completely covered by filling stations with gas motor fuel. The process of infrastructure development for them is at the beginning of the journey, which will take at least 3–5 years (including the commissioning of large LNG production capacities in the Arctic zone of the Russian Federation).

4) Lack of sufficient harmonization of standards for new communication systems (5G)

The development of new solutions in the field of V2X in the field of increasing the efficiency of passenger and cargo transportation on cross-border routes is limited by different frequencies for 5 G used in the Russian Federation and other countries of the Barents Region.

5) The presence of implemented projects of interregional MaaS services in the Russian Federation, which, when localized into the languages of the countries of the Barents Region, can be successfully used to organize routes in the Russian Federation.
6) Standardization of solutions for emergency communication systems between the countries of the Barents Region (valid since 2015)
7) Active digitalization of Russian railways, processes in seaports and customs

On the territory of the Barents Region, many federal-scale projects are being implemented on the digital transformation of key cargo routes for the import and export of goods and raw materials - railways and seaports. Such projects in the field of optimizing logistics, cargo traceability, increasing traffic safety, together with the digitalization of the circulation of documentation for customs declarations and cargo clearance, are an important component in reducing barriers to

cross-border trade in the East-West corridor. The development of cargo turnover on the Northern Sea Route will contribute to the demand for all these digital services.

Taken together, these factors show that ongoing projects are consistently building potential and new opportunities for the development of cross-border passenger and cargo traffic. The already formed architecture of the ITS makes it possible to exchange data between the systems of border countries and regions according to a single standard. New services are being formed for carriers and travelers, requiring agreements on language and information integration.

Maximum opportunities are being developed in terms of cargo logistics, where large-scale solutions for digital transformation are being implemented, as well as the use of new types of fuel (LNG) by system operators of the transportation and fuel market (JSC Russian Railways, Novatek, Rusatom Cargo, etc.).

At the same time, several areas require a systemic solution for the countries of the Barents Region to increase the connectivity of national transport systems and increase the flow of cross-border traffic. They concern:

- 5G communication networks that ensure the operation of ITS modules as part of the management of intermodal transport complexes,
- intensification of the development of connectivity of local projects for the development of ITS in the Russian Federation and further with the countries of the Barents Region in terms of the exchange of key data for organizing trips (meteorological information, the state of the road infrastructure, road congestion, the availability of rest points for drivers, etc.),
- achieving synchronization of policies in the field of ensuring refueling of environmentally friendly modes of transport (electric vehicles, vehicles running on gas motor fuel),
- implementation of multilingual applications within the framework of the MaaS concept for private and commercial users, including on the basis of data exchange between the ITS of the Barents Region,
- refinement of current local ITS projects in the Russian Federation to a mature technological level with their connection to a single platform for managing the transport system.

2.3. Analysis of the main climatic, technical, economic, political and social constraints and barriers to the implementation of projects in the field of ITS and carbon footprint reduction and their synchronization with similar plans of neighboring states of the Barents Region

As part of the analysis of data sources on the implementation of Russian projects in the field of ITS and transport carbon footprint reduction, including data from open sources, the results of inquiries and interviews with representatives of executive authorities of Russian regions (within the borders of the Ba-rents region), data from departmental reports, the main climatic, technical, economic, political and social constraints were identified and barriers to project implementation.

The identified constraints and barriers to the implementation of projects in the field of ITS and transport carbon footprint reduction are both opportunistic and systemic in nature, determining the nature of their impact on projects, opportunities, timing, financial and technical and economic parameters of their implementation.

Systemic constraints and barriers to project implementation are understood as those whose resolution requires a wide and systemic set of changes in the regulatory, financial, migration, industrial-technological and foreign policy of the state and / or large-scale and expensive infrastructure construction. In addition, systemic barriers include objective external barriers related to the geographical and climatic conditions for the implementation of projects, the existing system of population resettlement in the Russian segment of the Barents Region.

Market constraints and barriers to project implementation are those that are related to the current political and macroeconomic conditions for project implementation, approved regulatory documents and technical standards, the distribution of powers between project implementation participants and other issues.

The list of constraints and barriers to the implementation of projects in the field of ITS in the indicated sections is given in the Table below.

3. Development of recommendations for the integration of Russian strategic plans and projects for the development of ITS and transport carbon footprint reduction in the Joint Transport Plan of the Barents Region and synchronization of such projects

In the new international political conditions that have developed since 24.02.2022, the nature of economic, social, scientific and educational contacts between Russia, Sweden, Finland and Norway has significantly changed, including expressed in the suspension of transport communications by air, rail transport, the withdrawal of the world's leading sea cargo carriers from the Russian market, the imposition of sanctions on the supply of certain types of goods and technologies in the Russian Federation. Together, this creates a long-term negative background for the implementation of cross-border projects and makes it impossible in the near future to integrate strategic plans and projects for the development of ITS and transport carbon footprint reduction into the Joint Transport Plan of the Barents Region.

Despite these negative factors, the presence of many years of accumulated experience of interaction, built value chains and supply chains of enterprises, similar socio-economic problems of the development of the border regions of the Barents Region in a harsh climate and the outflow of able-bodied population, the established social ties among the residents of the region, will lead in the medium term to a full-fledged resumption cooperation in the interests of all countries of the Barents Region.

Based on the experience of implementing projects in the field of transport, identified the relevant technological directions for the development of ITS and transport carbon footprint reduction in the Russian segment of the Barents Region, and taking into account possible directions for the development of trade, industrial and social ties, the development of tourist routes in the East-West direction, it is advisable to recommend the following projects and plans for integration into the Joint transport plan of the Barents Region:

1. **Development of connectivity of national transport systems and improvement of safety and convenience of cross-border travel and cargo transportation through the organization of data exchange between ITS and ensuring better awareness of the participants of transport communication about the traffic situation.**

The ITS systems implemented in the Barents Region operate in accordance with international standards and, within their architecture, support wide opportunities for exporting and importing traffic data, exchanging such data between local ITS using the Datex protocol II . At the moment, a similar data exchange has been established between Norway and Sweden[243], the Russian Federation does not participate in this exchange.

A promising recommended area of cooperation between the countries of the Barents Region is the construction of an effective data exchange network from local ITS on a wide range of information, including weather information, the state of road infrastructure, traffic congestion, the operation of tunnels and passes, road closures, the availability of rest points for drivers and parking lots, and other data. It is advisable to cover the data exchange network from local ITS with respect to the key routes of cross-border transportation of passengers and cargo, as well as cities - the main destinations in business and personal trips, for the purposes of seamless use of up–to-date data throughout the trip.

[243]According to the Joint Transport Plan for the Barents Region, 2019, https://mintrans.gov.ru/file/445202

Data exchange between ITS should also include their export not only to government, but also to commercial online services of local and international providers for use in MaaS solutions and logistics services.

In conditions of high dependence of transportation in the region on weather conditions (sieges, floods, ice, avalanche danger, blizzard) and limited alternative routes between transportation points, the new quality and volume of awareness of traffic participants will ensure a higher level of uninterrupted transportation and reduction in congestion, better safety and reduced accidents, higher accuracy of transportation schedule planning.

An additional area of data exchange is the organization of interaction between industry and facility ITS in sea trade ports on the territory of the region (situational centers and ship traffic control centers), as well as systems that provide information about ice formation, including information from UAVs in navigation areas, etc.

2. Development of macro-regional MaaS solutions in the Barents Region for a wide range of users

The development of a data exchange network between local ITS in the Barents Region creates opportunities for the emergence of a new generation of online services focused on the concept of Mobility as a Service (MaaS) and their effective silent use throughout the Barents Region.

The addition of local or national MaaS solutions with full-fledged information about the traffic situation and its forecast on all major roads of the Barents Region (within the framework of data exchange between local ITS) will allow introducing into MaaS solutions (services in their native language) the possibility of providing services for routing, trip planning, selection of cross-border transport services of the organization of-transportation, convenient use of public transport in neighboring countries, search for gas stations, including on environmentally friendly fuels (electricity, gas engine fuel, hydrogen, etc.).

Thus, the technological maturity of the regional transport system will grow, new opportunities will be formed for the creation of new types and directions of transport services (including carsharing, cargo delivery, taxis, transfers, etc.), the organization of multimodal movement of passengers and cargo across the region will be simplified, new markets and audiences for national online services and ecosystems in the field of transport (transport services+ fintech+ local services + navigation).

3. Harmonization of frequency bands in the field of cellular communications of the 5G standard and standards for V2X solutions

The development of V2X solutions within ITS, including to ensure the interaction of vehicles on the road with each other (Vehicle-to-Vehicle) and the interaction of vehicles with road infrastructure facilities (Vehicle-to-Infrastructure), is among the strategic plans and projects implemented throughout the Barents Region. Pilot projects on the movement of highly automated vehicles are an additional driver of development.

On the way to implementing effective and universal V2X solutions for the entire region, there are national differences in the frequency ranges for cellular communications of the 5G generation, as well as the lack of a single standard for the development of road infrastructure in relation to the V2X solution, the choice is made between ITS-G5 (based on WiFi) and C-v2x (based on cellular communications 5G).

Thus, the use of a globally harmonized frequency range for 5G – 4,8-4,9 GHz in the Russian Federation on the border territories requires legal approval from Finland and Norway due to their use in the military sphere, similarly, the use of standard 5G frequency spectra of 3,4-3,8 GHz is limited in the Russian Federation to their use for military and special needs.

As part of the implementation of transport projects for the development of V2X solutions in the transport infrastructure of the Barents Region, it is advisable to ensure cross-border compatibility of vehicle equipment and road infrastructure in accordance with common standards and 5G frequency spectra, forming common supranational requirements for connected cars and roadside communication devices V2X. This will make it possible to achieve a single infrastructure space, to acquire new opportunities for the movement of highly automated vehicles (unmanned), to reduce the costs of countries for the construction of digital road infrastructure using standardized equipment.

4. Development of digital tools to increase the speed of passage of checkpoints across the borders of states for cargo and passengers

The processes of digital transformation of customs activities are actively carried out in the Russian Federation, including electronic document management with participants in foreign economic activity, the development of automation tools for cargo inspection at border checkpoints. Harmonization and synchronization of such projects with similar projects in other countries of the Barents Region can create conditions for accelerating the movement of goods and raw materials within the East-West corridor, existing and new value chains between countries. The directions of development in this area can be:

- Development of cross-border cooperation regarding the development of the use of digital customs services, including standardization of solutions, provision of multilingual services and interfaces of online services, training of shippers and carriers in the use of digital systems,
- Implementation of coordinated modernization of checkpoints (automobile and railway) on the border between the European Economic Area and the Russian Federation in Karelia and the Murmansk Region with the use of new solutions for digitalization of customs, including IoT, artificial intelligence, means of accelerated vehicle inspection (using machine vision technologies, electronic tracking devices-research institute of cargo and other technologies)

The totality of measures will reduce the transaction costs of transportation participants for customs declaration and other procedures for the transport of goods and speed up the passage of borders.

5. Harmonization of the policy in the field of ensuring the refueling of environmentally friendly modes of transport during cross-border transportation in the Barents Region (electric vehicles, gas-powered vehicles)

The implementation of the principles of a sustainable economy, implemented through the sequential transfer of vehicles in the Barents Region to new fuels (electricity, hydrogen, gas engine fuel, etc.), in order to achieve real results in reducing greenhouse gas emissions, requires agreements of the countries of the region to ensure the possibility of cross-border movement of vehicles using new fuels (primarily total cars, railway transport, sea vessels) without constraints on the routes of movement within the main highways of the region.

The existing topography of the refueling infrastructure by type of fuel from country to country has significant differences in the vector of development and the principles of the location of facilities, as well as resource constraints related to the infrastructure problems of the regions (the presence of gas pipelines, gas liquefaction plants, power grids along the main roads outside cities, etc.).

It is advisable to ensure the development of synchronized roadmaps for the implementation of plans for the placement of refueling/bunkering/charging infrastructure facilities in the region in accordance with the priority directions (highways and sea routes) of cross-border movement of passengers and cargo between countries, taking into account the types of fuel consumed. Plans for refueling infrastructure should be linked to the development of energy supply and infrastructure for this (development of gasification, electric networks, LNG and green water production, bio-diesel supplies, etc.), as well as plans for the development of roadside infrastructure (primarily rest points for truck drivers).

The implementation of the recommendation should focus primarily on ensuring the need for the movement of cargo vehicles (ships, trains, trucks), which form most of the carbon footprint of transport.

The above set of recommendations provides key areas of action that allow the integration into a single transport fabric of the Barents Region of initiatives and projects that are being implemented in the Russian Federation in relation to ITS and transport carbon footprint reduction, can be effectively replicated in other countries or agreed with them on the main parameters, terms of implementation, technical characteristics and standards. In addition, these recommendations are aimed at eliminating the main technological, infrastructural, climatic, and other constraints that negatively affect the possibilities of seamless multimodal cross-border movement of goods and the organization of business and personal trips of residents and guests of the region.

Table 39. List of problems and constraints on the implementation of projects in the field of ITS

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
1	**System constraints and barriers**	
1.1	Geographical and demographic constraints	1) Climatic conditions Climatic conditions in the Russian segment of the Barents Region (especially in the Arctic Circle) are characterized by low and medium favorable conditions for life, long cold winters with heavy snowfall, short and cool summers, and the presence of permafrost. A combination of climatic factors affect: – the increase in the cost and timing of the implementation of complex projects for the development of ITS infrastructure due to the short construction season, – the increase in the cost of equipment and operating costs for the operation of ITS subsystems due to increased operational requirements for equipment in terms of climate conditions and the higher cost of such equipment and the more frequent need for maintenance and repair. 2) The system of settlement and distribution of productive forces in the Russian segment of the Barents Region is characterized by low population density outside the capitals of the regions and a large length of transport communications between urban agglomerations, large industrial and mining facilities, and border checkpoints, which creates the following constraints on the implementation of ITS: – the increase in the cost of ITS development projects outside urban agglomerations due to the need to use a large amount of equipment and the construction and operation of extended engineering networks to ensure the operation of devices and data exchange (communications, electric power), or the use of expensive technologies for ensuring the autonomous functioning of ITS elements at a distance from settlements (satellite communications, non-volatile devices, etc.), – difficulties with maintenance of elements of ITS subsystems outside settlements (on federal highways) and an increase in operating costs. – Non-compliance of most agglomerations of the Russian segment of the Barents Region with the requirements of the National project "Safe quality roads" and regulations on the distribution of subsidies

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
		from the federal budget for the creation of ITS (with the exception of the city of Arkhangelsk) with the criterion of population - more than 300 thousand people. This forms constraints on the speed, consistency, and quality of the implementation of the Unified transport system management platform subsystems in the years. Murmansk, Petrozavodsk, Syktyvkar, and satellite cities as part of agglomerations, since regional and local budgets are limited in their capabilities without federal co-financing of projects
1.2	Disadvantages of the public procurement system	The current legislation on state and municipal procurement (Federal Law "On the contract system in the field of procurement of goods, works, services to meet state and municipal needs" of 05.04.2013 No. 44-FZ): – makes it difficult to purchase technical equipment and system integration services within the framework of the development, implementation, and commissioning of ITS as a single lot, which worsens the conditions for the implementation of projects, reduces their integrity and increases the risks of implementation. – limits the implementation of projects due to the peculiarities of customers making decisions on the amount of project advances (including the use of post -payment as a financing mechanism), including in the context of volatility in exchange rates and growth in lending rates for businesses, significantly increases the risks for contract executing companies for the creation of ITS, increases the cost of contracts by the amount of risks of the performing companies. – affects the quality of preparation of planning documents in the field of transport and digitalization of urban and regional transport systems (including integrated traffic management schemes, programs for the integrated development of transport infrastructure, local projects of ITS subsystems) performed by various contractors selected through competitions within 44 -FZ and 223-FZ, which could occur with violations of the law or due to imperfect procurement mechanisms, gave access to the execution of work to insufficiently competent design organizations. In addition, the execution of contracts for the development of transport planning documents and the implementation of local ITS projects are carried out in the Russian segment of the Barents Region again, without relying on best practices and knowledge bases for such projects implemented beyond the Arctic Circle (due to the minimum volume of such practices in the world)

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
1.3	Dependence of project implementation on foreign components	The Russian component base for the implementation of ITS projects is limited by the technological capabilities of the microelectronic industry and relies mainly on imported components, which creates risks for the implementation of projects due to the volatility of the ruble exchange rate against major world currencies, the rupture of supply chains, the shortage of electronic components due to the pandemic, sanctions constraints
1.4	Shortcomings of the regulatory and methodological framework for the implementation of ITS projects	Insufficiently developed and formalized regulatory and methodological framework for the creation and operation of ITS (including national standards), as well as cooperative ITS, unmanned vehicles, the operation of v2x infrastructure, causes non-systematic (fragmentary) implementation of ITS elements in the regions without ensuring data integration various software and hardware systems (various departments), systemic linking of functional blocks and ensuring end-to-end tasks of safety and efficiency of traffic, thereby limiting the implementation of projects and reducing their quality. It is required to develop a legal framework and regulations that define: – the concept of digital road infrastructure, – mandatory requirements for equipping roads with digital infrastructure and its functionality, – unity of requirements, interaction protocols and physical connectivity of the digital infrastructure, – the order of interactions in the creation and use of digital infrastructure, – property relations, – financing arrangements, – expansion of the list of concession objects. There is a need to update the Federal Law 257-FZ of 08.11.2007 "On highways and road activities..." regarding the inclusion of mandatory digital infrastructure and requirements for it in terms of energy, telecommunications networks based on wired and wireless transmission technologies data, and in connection with the peripheral equipment used for monitoring, control and informing, with hardware and software resources for processing and storing data.
1.5	Staffing of ITS creation and operation projects	Due to the established system of long-term outflow of young people and highly qualified personnel from the Barents region to the largest megacities of the Russian Federation - St. Petersburg and Moscow due to higher wages

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
		and quality of life, as well as due to the great competition for personnel in the IT services market from large commercial ecosystems and system integrators implementing digitalization tasks in the field of commercial systems (fintech, media, delivery, marketplaces and commercial MaaS), the digitalization industry transport in the public sector is characterized by insufficient provision of highly qualified personnel in the field of ITS, affecting the quality of project implementation, the efficiency of ITS operation, as a study of regulatory and technical solutions and their implementation in the framework of complex projects for the development of transport infrastructure
1.6	Frequency regulation of 5G communication systems and differences in the bands used in the Barents Region	The use of 3,4–3,8 GHz frequency spectra for 5G communication systems, considered among the most promising, including for use in the framework of data exchange in ITS in urban agglomerations, is limited in the Russian Federation by their use for military and special needs. The 4,8-4,9 GHz frequency bands formed for testing 5G networks (as well as other spectra - millimeter-wave frequencies 24,25-24,65 GHz, 694-790 MHz band) do not correspond to world practice, reduce the efficiency of solutions, do not have developed ecosystem of equipment, and have technical constraints on use. The use of the globally harmonized frequency range 4,8-4,9 GHz in the Russian Federation in the border areas will require lengthy legal approval procedures with Finland and Norway due to their use in the military sphere. The use of different frequency bands for 5G communication systems will create difficulties in the interaction of equipment during the cross-border movement of passengers and goods
1.7	Budget constraints on the implementation of ITS projects	The integrated architecture of the Unified transport system management platform implies the implementation on the territory of urban agglomerations of a large number of transport management subsystems, ensuring traffic safety and managing the life cycle of transport infrastructure, while without co-financing projects from the federal budget, the implementation of complex projects for the implementation of ITS is difficult due to financial limitations of regional and local budgets, including in the new conditions of the need to attract highly paid specialists in information technology for such projects and the purchase of imported equipment and components of ITS in the face of changing external economic conditions and the volatility of the ruble against other world currencies
2	**Market constraints and barriers**	

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
2.1	Problems of distribution of state executive and local authorities in the implementation of ITS creation and operation projects	– The distribution of powers for the implementation of ITS projects between various executive bodies of state and local authorities, which requires a significant amount of work to reach agreements and regulate the transfer of powers (preparation of interdepartmental regulations for interaction in the field of ITS, traffic management, road safety), – Various owners and operators of ITS subsystems being created and in operation, which reduces the possibility of system integration of solutions and the benefits and effects for users of the transport system from the collection, analysis, and exchange of data on traffic flows and infrastructure
2.2	Technical and technological problems of implementation of ITS creation and development projects	– Incompleteness of integration of ITS subsystems into a single system within the framework of the approved APUS architecture, lack of a single functioning traffic control center; lack of a unified information exchange system between functional subsystems, – Low level of coverage of the territories of urban agglomerations by existing elements of ITS, – The use of inefficient outdated traffic light control technologies (most traffic light facilities implement control only according to fixed plans, without taking into account the current change in the traffic situation, i.e., adaptive control), – Lack of communication of a significant number of traffic light objects with the control center ("connectivity"), which not only limits the ability to control traffic light objects, but also significantly reduces the efficiency of traffic flow management and causes the center to lack operational information about the abnormal functioning of traffic light objects, which directly affects safety traffic, – Current failures of outdated infrastructure, causing frequent failure of coordinating equipment, – Lack of integration of the ITS of the urban agglomeration with the ITS of adjacent other highways (federal highways).
2.3	Constraints on the supply of certain types of equipment to the Russian Feder-	Constraints within the framework of the decisions of the EU, the USA, Japan, Korea and a number of other developed countries, caused by the special military operation of the Russian Federation in Ukraine, as well as the sanctions that came into effect until 2022, formed a number of significant barriers to the development of ITS in the

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
	ation, constraints on calculations affecting the achievement of new levels of ITS maturity (sanctions)	Russian Federation and reduced the possibility of achieving new levels of technological maturity of ITS in accordance with the Methodological recommendations of the Ministry of Transport of the Russian Federation, approved the Order of the Ministry of Transport of the Russian Federation AK-74-r dated March 21, 2022, including: – Constraints on the implementation of joint projects in the border areas due to the suspension of this type of cooperation, – Shortage of components (monitors, optics, display of variable information, etc.), microelectronic components and server equipment for building hardware complexes as part of the implementation of ITS modules, – Rise in the cost of component hardware systems up to 30-45% due to the change in the ruble exchange rate against major currencies and changes in supply logistics (including the emergence of intermediaries from third countries), which may lead to a change in the volume of contracts under budget constraints, or their failure, – Suspension or a significant increase in the timing of the implementation of current projects due to the suspension and / or lengthening of logistics supply chains from countries producing electronic components and equipment. – Constraints on the use of specialized foreign software for automating the management of transport systems and vehicles, – Constraints on the supply of certain IT technologies and solutions based on them to the Russian Federation.
2.4	Imbalances in the global electronics market as a consequence of the Covid-19 pandemic and constraints on the supply of ITS components	Due to the rupture of supply chains due to the Covid -19 pandemic and the resulting imbalance in supply and demand for electronic components, conditions have been formed for supply limitation and a significant increase in the cost of such components and equipment based on them used in the construction of ITS infrastructure (sensors, server equipment, optics etc.), as well as high-speed mobile Internet access infrastructure. This reduces the potential for implementation within the ITS of the V2X project area and connected cars, as well as the development of telematics systems as part of the ITS

N p/p	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
2.5	Constraints on ITS interactions in the border territories of the Barents Region	The suspension in 2022 of cross-border cooperation projects, joint work of international groups on harmonization of ITS standards will affect the formation of opportunities for organising data exchange between ITS systems in the border territories of the Russian Federation, Norway, Finland, and Sweden according to the Datex II standard, etc. to ensure safe and efficient movement of passengers and cargo along the East-West transport corridor

The list of problems and constraints on the implementation of projects in the field of transport carbon footprint reduction is given in the Table below.

Table 40. List of problems and constraints on the implementation of projects in the field of transport carbon footprint reduction

№	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
1	**System constraints and barriers**	
1.1.	Infrastructure constraints	The insufficient level of gasification (primarily the Murmansk and Arkhangelsk Regions) of the regions of the Russian segment of the Barents Region and the absence of these regions among the priority ones for the implementation of programs for the use of natural gas motor fuel, as well as the insufficient development of the infrastructure for small-scale production of LNG and CNG for regional needs creates serious obstacles to: – development of refueling infrastructure for vehicles, including CNG filling stations on highways on the main cross-border routes between Russia and the border with Finland and Norway, – development of bunkering of sea and river vessels with gas motor fuel (except for the port of Murmansk), – development of equipment stations for refueling gas carriers on the railway; – mass transfer of commercial, municipal, and private vehicles to environmentally friendly fuels, – reduction in prices for environmentally friendly fuels when the market is saturated with commercial batches of locally produced fuel, – availability of gas motor fuel in rural areas.
1.2	Geographic constraints	1) Climatic conditions Climatic conditions in the Russian segment of the Barents Region (especially in the Arctic Circle) are characterized by low and medium favorable conditions for life, long cold winters with heavy snowfall, short and cool summers, and the presence of permafrost. A combination of climatic factors form a limitation on: – efficient operation of electric vehicles on batteries due to their faster discharge rate and low efficiency (compared to traditional internal combustion engines) during the cold season and the insecurity of using outside settlements at low temperatures (the threat of freezing when the battery is discharged), – year-round use of non- motorized modes of transport (including means of individual mobility - electric scooters, unicycles, etc.) and the development of infrastructure for them in settlements.

№	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
		2) The system of settlement and distribution of productive forces in the Russian segment of the Barents Region is characterized by a low population density outside the capitals of the regions and a large length of transport communications between urban agglomerations, large industrial and mining facilities and border checkpoints, which determines the increase in the cost of projects to develop a network of fuel filling stations with low carbon next (first of all, gas motor fuel and electricity) outside large cities due to the need to build a large number of new facilities at a distance from cities and difficulties in ensuring fuel supplies to such filling stations and expensive installation of electricity in conditions of limited demand from consumers.
1.3	Staffing of transport carbon footprint reduction projects	Due to the existing system of long-term outflow of young people and highly qualified personnel from the Barents Region to the largest megacities of the Russian Federation - St. Petersburg and Moscow due to higher wages and quality of life, projects in the field of sustainable development and transport carbon footprint reduction are experiencing an insufficient supply of local highly qualified personnel. This limitation affects the quality and timing of the implementation of transport carbon footprint reduction projects, the quality of the development of regulatory and technical solutions and their implementation within the framework of integrated projects for the development of transport infrastructure in regions and cities
1.4	Insufficient amount of federal subsidies to cover the difference between the cost of gas-engine and diesel equipment	Functioning in the Russian Federation since 2013 (with updates) measures of state support for the purchase of gas-powered vehicles, subsidizing the difference between the cost of vehicles running on natural gas and diesel fuel, are assessed by transportation participants as insufficient and have been decreasing in recent years. These measures are decisive for increasing sales of gas-powered vehicles. In some cases, the volume of subsidies, taking into account the decrease in recent years, does not cover the difference in cost between similar CNG and diesel models and leads to the purchase of cheaper diesel-powered vehicles by transport companies
1.5	Budget constraints at the regional and local level on the modernization of equipment and the transition to a higher environmental class	Implementation of transport carbon footprint reduction measures in terms of replacing the rolling stock of public transport, utility and emergency urban/regional services with new models using gas motor fuel, as well as modern models using gasoline and diesel fuel, and corresponding to Euro-5 and Euro-6 environmental classes (with reduced greenhouse gas emissions), requires significant financial resources from regional and local budgets. In the context of unstable external economic conditions, sanctions, and inflationary phenomena (a 35-40% increase in vehicle prices in Q1 2022 alone), in the economy of the program to modernize the fleet of state and municipal

№	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
		organizations without subsidies from the federal budget or other support mechanisms (preferential leasing, etc.) will be deferred to future periods, keeping the level of greenhouse gas emissions at the current level
1.6	Low competition in the gas engine fuel supply market	The implementation of development programs in the Russian Federation for the use of natural gas motor fuels is carried out mainly by the affiliated company of PJSC Gazprom, LLC Gazprom Gas Motor Fuel, and is associated with the development of gasification programs for Russian regions implemented by LLC Gazprom Mezhregiongaz. Low competition in the gas engine fuel supply market does not ensure competitive pricing, which in the future creates serious economic risks of fuel cost growth and loss of economic benefit for organizations and individuals from the operation of gas engine fuel automotive, marine and railway equipment. The absence of the expected economic effect from the operation of vehicles running on gas motor fuel reduces the incentives for re-equipment of vehicles and the purchase of new vehicles for this type of fuel
2	**Market constraints and barriers**	
2.1	Changes in the supply structure and payment system for natural gas and oil/petroleum products in Europe in 2022	Sanctions by the European countries against the Russian Federation on the supply of natural gas, oil and oil products in 2022 may lead, if they are maintained for a long-term period, to a significant change in raw material flows, a decrease in hydrocarbon production in the Russian Federation and a shift in the timing of the implementation of projects related to the development of LNG production, the construction of large-capacity LNG-powered vessels, the production of green hydrogen, the development of refueling infrastructure for electric vehicles, while maintaining the level of consumption of traditional types of automotive fuels, and minimizing incentives to switch to new environmentally friendly fuels
2.2.	Limited opportunities for the production and supply of electric vehicles and gas-powered vehicles in the Russian Federation	In the new macroeconomic conditions of the introduction of sanctions against the Russian Federation by developed countries and the resulting breaks in the supply chains of high-tech components, plans for the production and supply of new gas-fueled buses and trolleybuses (including autonomous running) to the regions of the Russian segment of the Barents Region for the modernization of public transport rolling stock may be postponed or disrupted. Projects to produce new models of passenger electric vehicles for private consumers and use in carsharing services and taxis (commercial MaaS) may also be suspended.

№	Type and name of constraint/barrier	Characteristics of identified constraints/barriers
2.3	Withdrawal from the Russian market of key foreign suppliers of equipment and software for the transport sector	The change in the military-political situation in 2022 led to the withdrawal of a number of large technology vendors from the market, incl. company Gurtam, the owner of the Wialon platform, the leader in the supply of satellite monitoring systems for rolling stock (more than 1 million connected cars in the Russian Federation) for corporate fleets (optimization of traffic has a direct impact on reducing greenhouse gas emissions from vehicles), and the withdrawal from the Russian market of leading suppliers of software and hardware solutions for ship and aviation navigation. Refusal to use foreign systems and their replacement with analogues (including Russian ASM Glonass, Scout solutions, etc.) will lead to the diversion of resources of transport companies from the subject of sustainable development and the use of solutions with the lowest possible technological maturity in the face of a shortage of financial resources. This, in turn, will affect the effectiveness of transport carbon footprint reduction activities in the management of corporate vehicle fleets
2.4	Imbalances in the transport carbon footprint reduction measures for the transition to the use of new fuels with a low carbon footprint	In the Russian Federation, including in the Russian segment of the Barents Region, there are a number of imbalances associated with the advanced development of the infrastructure of gas stations for gas-powered vehicles at their low load (about 34% according to Gazprom Gazomotornoe Fuel), which requires the expansion of subsidies to increase the fleet of vehicles on GMT. At the same time, the development of GMT consumption (including bunkering / equipment infrastructure) on the railway network and in sea/river ports is not adequately ensured due to the lack of appropriate vehicles (JSC Russian Railways only tests equipment) or their minimum number (sea transportation), despite the fact that these types of transport can provide significant reduction in greenhouse gas emissions in absolute terms during the transition to GMT

The identified serious constraints and barriers to the implementation of projects in the field of ITS and transport carbon footprint reduction require a comprehensive review, systemic measures, and synchronization of actions of all interested parties, including federal executive authorities, regional governments, scientific and educational organizations, the public and the largest corporations operating in the Barents Region.

Overcoming market problems associated with the consequences of the macroeconomic and military-political crises of 2020-2022 will allow focusing on solving systemic problems related to the methodological and legal support for the implementation of complex projects in the field of ITS, issues of developing the production of gas motor fuel and refueling infrastructure for cars, but primarily for ships, forming staffing for the implementation, operation, and modernization of ITS.

It is advisable to define the key points of concentration of efforts in the current conditions:

- overcoming logistical and technological constraints to complete the initiated projects for the implementation of ITS subsystems in urban agglomerations of the Russian segment of the Barents Region,
- ranking initiatives for the next stages of development of ITS subsystems in the context of budgetary and technological constraints, the selection and implementation of those that are focused on maximum socio-economic effects and complementarity with the implemented subsystems,
- completion of ongoing projects for the modernization of public transport rolling stock in the largest cities of the region,
- development of a competitive gas engine fuel market and incentives for technology upgrades.

Taken together, this will ensure an increase in the efficiency and attractiveness of urban transport systems, primarily for public transport users, forming a cumulative effect on the environment and the urban environment and the economy associated with an increase in the quality of life from the use of sustainable comfortable urban ground transport and a reduction in environmental damage from automotive equipment.

Appendix 1. List of strategic planning documents in the field of ITS and transport carbon footprint reduction

Documents of international cooperation in the Barents Region:

- Joint Transport Plan for the Barents Region (draft). Published April 15, 2020;
- Priorities of the Chairmanship of the Russian Federation in the Arctic Council in 2021-2023.

Federal strategic planning documents:

- Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the national development goals of the Russian Federation for the period up to 2030";
- Decree of the President of the Russian Federation of October 26, 2020, No. 645 "On the strategy for the development of the Arctic zone of the Russian Federation and ensuring national security for the period until 2035";
- Strategy for the socio-economic development of the Russian Federation with a low level of greenhouse gas emissions until 2050 (Decree of the Government of the Russian Federation of October 29, 2021, No. 3052-r);
- Concept for the development of hydrogen energy in the Russian Federation (Decree of the Government of the Russian Federation dated August 5, 2021, No. 2162-r);
- Transport strategy of the Russian Federation until 2030 with a forecast for the period until 2035 (Decree of the Government of the Russian Federation dated November 27, 2021, No. 3363-r);
- Road Safety Strategy in the Russian Federation for 2018-2024 (Decree of the Government of the Russian Federation of January 8, 2018, No. 1-r;
- The national project "Safe High-Quality Roads" and federal projects within it: "Road Safety", "Modernization of passenger transport in urban agglomerations", "Development of the federal highway network", "System-wide measures for the development of the road sector", "Regional and local road network»;
- National program "Digital Economy of the Russian Federation", approved by the Protocol of the meeting of the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects dated June 4, 2019, No. 7. It includes the Federal Project "Information Infrastructure";
- National project "Ecology". The passport of the national project "Ecology" was approved by the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects (Protocol of December 24, 2018, No. 16). The national project "Ecology" includes the federal project "Clean Air";
- State program of the Russian Federation "Development of the transport system" (Decree of the Government of the Russian Federation of December 20, 2017, No. 1596);
- Decree of the Government of the Russian Federation of April 15, 2014, No. 321 (as amended on March 31, 2021) "On approval of the State program of the Russian Federation "Development of the energy sector" with the introduction of a new subprogram "Development of the gas motor fuel market" into its structure;

- Long-term program for the development of liquefied natural gas production in the Russian Federation, approved by the Decree of the Government of the Russian Federation dated March 16, 2021, No. 640-r;
- Decree of the Government of the Russian Federation of February 13, 2021, No. 350-r "On approval of the roadmap for the development of the market for small-scale liquefied natural gas and gas motor fuel in the Russian Federation for the period up to 2025";
- National action plan for the first stage of adaptation to climate change for the period up to 2022 (Decree of the Government of the Russian Federation dated December 25, 2019, No. 3183-r);
- Strategy for the development of the customs service of the Russian Federation until 2030 (Decree of the Government of the Russian Federation dated May 23, 2020, No. 1388-r);
- Concept for the development of production and use of electric transport in the Russian Federation for the period up to 2030 (Decree of the Government of the Russian Federation of August 23, 2021, No. 2290-r).

Industry and corporate documents of strategic planning, regulation and standardization in the field of ITS and transport carbon footprint reduction (including international ones):

- International Convention for the Prevention of Ocean Pollution (MARPOL 73/78);
- Order of the Ministry of Transport of Russia dated March 21, 2022, No. AK-74-r. "On Approval of the Methodological Recommendations for the Development of Applications (including Local Projects for the Creation and Modernization of Intelligent Transport Systems) of the Russian Federation Subjects for Receipt of Other Interbudgetary Transfers from the Federal Budget to the Budgets of the Russian Federation Subjects for the Purpose of the Implementation of the Measure "Implementation of Intelligent Transport Systems, Providing for the Automation of Road Traffic Management Processes traffic in urban agglomerations, including cities with a population of over 300 thousand people" within the framework of the federal project "System-wide measures for the development of the road sector" of the State program of the Russian Federation "Development of the transport system";
- Decree of the Government of the Russian Federation of February 3, 2022, No. 169-r "On approval of changes that are being made to the distribution of other interbudgetary transfers to the budgets of the constituent entities of the Russian Federation" in order to introduce ITS, which provide for the automation of traffic control processes in urban agglomerations, including cities with a population of over 300 thousand people, within the framework of the federal project "System-wide measures for the development of the road sector"... "
- Decree of the Government of the Russian Federation No. 2216 of December 22, 2020 "On Approval of the Rules for Equipping Vehicles of categories M2, M3 and vehicles of category N Used for the Transportation of Dangerous Goods with Satellite navigation equipment";
- Decree of the Ministry of Transport of the Russian Federation dated May 31, 2021, No. VS-105-r "On Approval of the Digitalization Program in the Road Sector in the Russian Federation";
- Decree of the Government of the Russian Federation of March 25, 2020, No. 724-r "On approval of the Concept for ensuring road safety with the participation of unmanned vehicles on public roads";

- Decree of the Government of the Russian Federation of December 3, 2014, No. 2446-r (as amended on April 5, 2019) "On approval of the Concept for the construction and development of the Safe City hardware and software complex";
- Decree of the Federal Road Agency (Rosavtodor) dated March 3, 2021, No. 773-r "On approval of the strategy for the development of innovative activities in the field of road infrastructure for the period 2021–2025";
- Urban Digitization Project "Smart City";
- Development Strategy for the Air Navigation System of the Russian Federation until 2030 (developed by the Federal State Unitary Enterprise "State ATM Corporation");
- The concept of introducing automatic dependent surveillance based on a single standard with the development to the functionality of multi-position surveillance systems in the Russian Federation for 2017–2022 (Decree of the Ministry of Transport of the Russian Federation dated April 25, 2018, No. MS-68-r);
- The main provisions of the "System Project of the Coverage Field of a System of Multi-Position Surveillance Systems Based on a Unified Standard for Automatic Dependent Surveillance in the Upper and Lower Airspace of the Russian Federation", approved by Deputy Minister of Transport of the Russian Federation A.A. Yurchik (hereinafter referred to as the System Project);
- Order of JSC Russian Railways dated May 12, 2014, No. 1143p "Environmental strategy of JSC Russian Railways for the period up to 2017 and for the future up to 2030";
- Decree of the Government of the Russian Federation dated March 19, 2019, No. 466-r "Long-term development program for the open joint-stock company Russian Railways until 2025";
- Action plan ("road map") "EnergyNet" of the National Technology Initiative. Approved by the Presidium of the Council under the President of the Russian Federation for the modernization of the economy and innovative development of Russia (Protocol No. 4 dated September 28, 2016);
- GOST R 56294–2014 Requirements for the functional and physical architecture of intelligent transport systems;
- ESG - strategies of the largest corporations of the Russian Federation, carrying out financial and economic activities on the territory of the Russian segment of the Barents Region (Gazprom, Gazprom Neft, Norilsk Nickel, Fosagro).

Documents of the regional and local level:

- Strategies for socio-economic development of subjects of the federation and municipalities (including urban districts - the capitals of the regions);
- Strategies in the field of digital transformation of sectors of the economy, social sphere and public administration for the subjects of the federation belonging to the Barents Region (Arkhangelsk and Murmansk Regions, Nenets Autonomous District, Republic of Karelia, Republic of Komi), approved in 2021, including for the industry transport and logistics:
    - Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Arkhangelsk Region for the period up to 2024. Decree of the Government of the Arkhangelsk Region dated August 10, 2021, No. 344-rp;

    - Strategy in the field of digital transformation of sectors of the economy, social sphere, and public administration of the Murmansk Region. Approved by the Governor of the Murmansk Region on August 20, 2021;
    - Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Karelia (2022–2024). Approved by the Order of the Government of the Republic of Karelia dated August 19, 2021, No. 607r-P;
    - Strategy in the field of digital transformation of sectors of the economy, social sphere and public administration of the Republic of Komi. Approved by the Order of the Government of the Republic of Komi of August 19, 2021, No. 402.
- State programs of the subjects of the federation in the field of transport development and digitalization of regions;
- Programs for the integrated development of the transport infrastructure of municipalities (capitals and largest cities of the regions of the Russian segment of the Barents Region);
- Regional project "System-wide measures for the development of the road sector":
    - Regional project "System-wide measures for the development of the road sector (Arkhangelsk Region)" (03.12.2018 - 31.12.2024);
    - Regional project "System-wide measures for the development of the road sector (Murmansk Region)" (01.01.2019 – 31.12.2024);
    - Regional project "System-wide measures for the development of the road sector (Republic of Karelia)" (03.12.2018 - 31.12.2024);
    - Regional project "System-wide measures for the development of the road sector (Republic of Komi)". Decree of the Government of the Republic of Komi dated August 19, 2021, No. 402-rg. (03.12.2018 - 31.12.2024);
- Regional program for gasification of housing and communal services, industrial and other organizations:
    - Regional program for gasification of housing and communal services, industrial and other organizations in the Arkhangelsk Region for 2021-2030. Approved by the Decree of the Government of the Arkhangelsk Region of February 11, 2021, No. 65-pp;
    - Regional program "Gasification of housing and communal services, industrial and other organizations in the Republic of Karelia for 2022-2030". Approved by the Order of the Government of the Republic of Karelia dated February 15, 2022, No 120r-P;
- Decree of the Government of the Republic of Komi No. 467-r dated October 8, 2021 "On approval of the action plan ("road map") "Use of natural gas motor fuel and development of gas filling infrastructure in the Republic of Komi (2021–2025)".