



**MINISTRY OF TRANSPORT OF  
THE RUSSIAN FEDERATION**

**Assessment of the impact of climate change  
on the functioning of the transport system  
of the Russian Federation.**

**Adaptation measures of transport infrastructure  
to the predicted climate change.**

**Director of Development Programmes Department  
Egorshev Sergey**



## Regulation of the issues related to the impact of climate change on the transport system of the Russian Federation

**Climate Doctrine of the Russian Federation for the period up to 2020**

**Comprehensive Implementation Plan of the Climate Doctrine of the Russian Federation for the period up to 2020**

**Action Plan for realization of state policy for ecological development of the Russian Federation for the period up to 2030**

**National Adaptation Plan to the adverse effects of climate change**

**Transport Strategy of the Russian Federation for the period up to 2030**

**Comprehensive plan for modernization and expansion of trunk infrastructure for the period up to 2024**

**Documents defining the action plan of the Russian Federation on the issues of climate change adaptation**



## Comprehensive Implementation Plan of the Climate Doctrine of the Russian Federation for the period up to 2020

1. Reduction of the risk of loss of reliability and durability of buildings, transport system and infrastructure because of the movement of the southern border of the permafrost zone to the north.



- search for calculating risks methods and estimating damage from climate change, scenarios of adaptation of the transport system and a set of measures to minimize the effects of displacement to the north of the southern boundary of the permafrost zone.

2. Emission limitation in transport sector



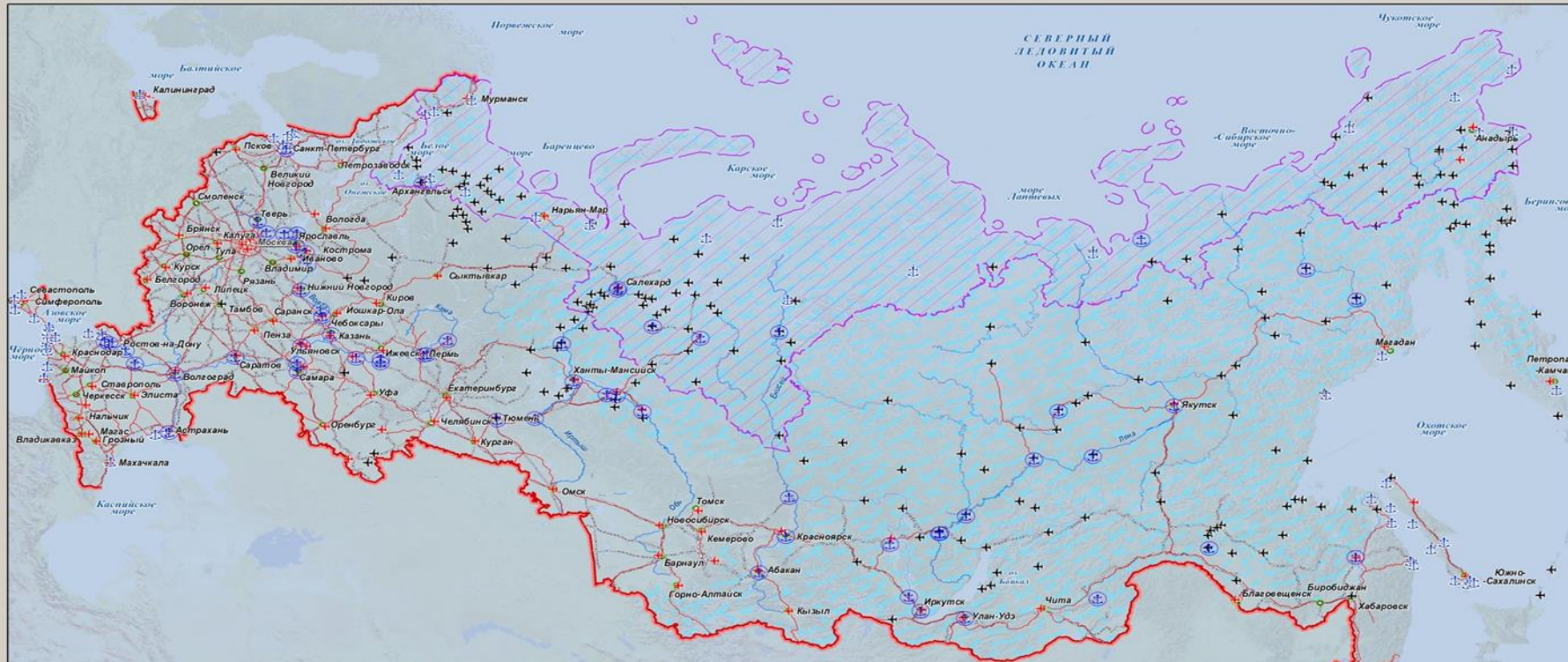
- Increase of fuel economy of vehicles;
- Increase in production of cars with hybrid engines;
- Transfer of vehicles to alternative fuels;
- Renewal of the fleet of vehicles;
- Development of technical regulations establishing requirements for safety of highways taking into account requirements to reduction of harmful emissions.

3. Implementation of the obligations of the Russian Federation under the International Convention for the Prevention of Pollution from Ships of 1973. Taking into account the change envisaged by the Protocol of 1978, including the development of a set of measures to improve the energy efficiency of Russian sea and river transport vessels, ensuring the reduction of emissions.





## Permafrost zone in Russian Federation



The area of permafrost in Russia is 11.1 million square kilometers (65% of the total area of Russia). About 6 million people live in this area (about 4% of the total population of Russia). There are sea and river ports, roads and railways, airports. Due to climatic change, including permafrost thawing, most of the transport infrastructure objects are exposed to the risk of total or partial loss of functionality.



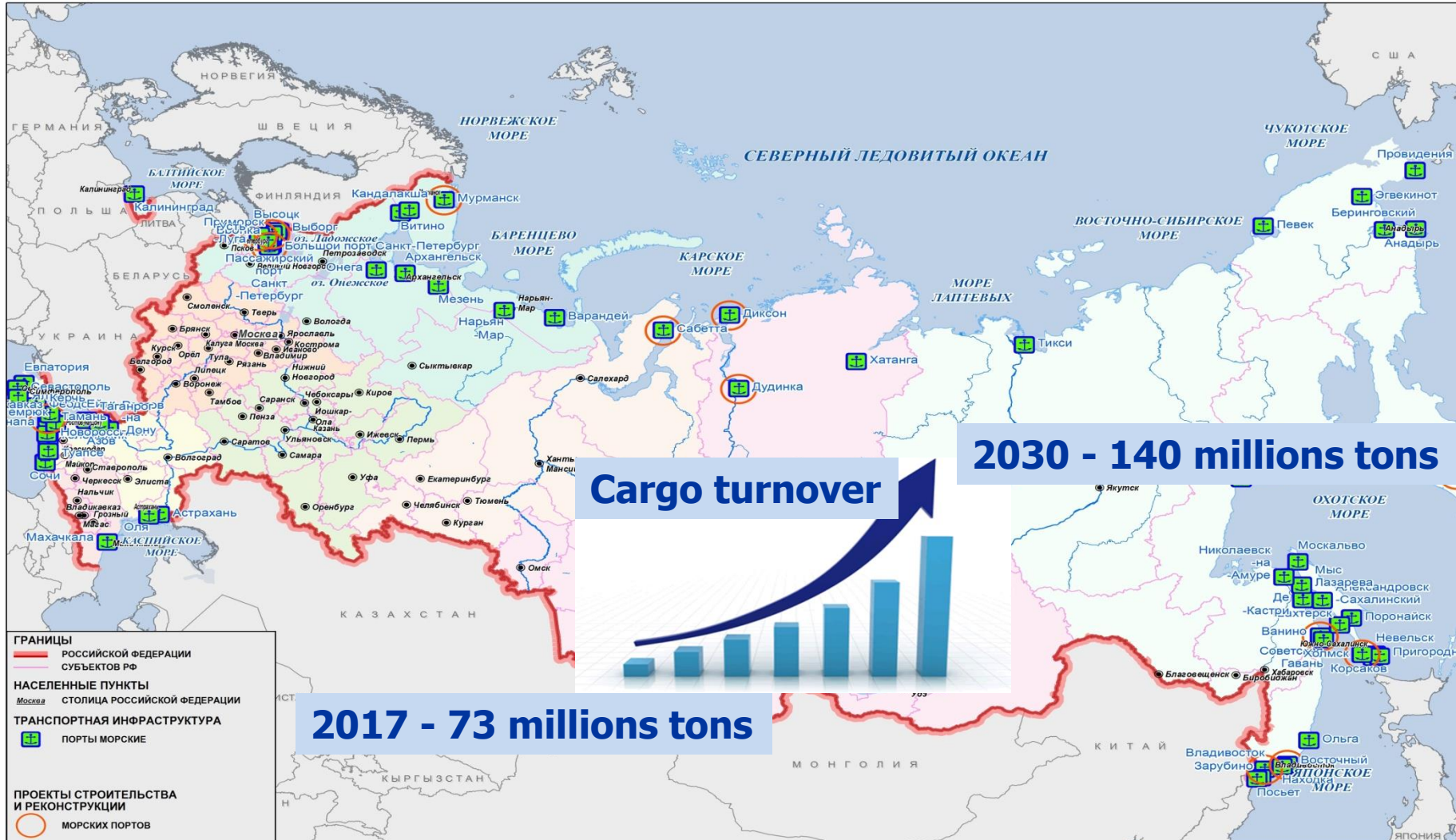
- ГРАНИЦЫ**
- РОССИЙСКОЙ ФЕДЕРАЦИИ
  - СУБЪЕКТОВ РФ
- НАСЕЛЕННЫЕ ПУНКТЫ**
- Москва — СТОЛИЦА РОССИЙСКОЙ ФЕДЕРАЦИИ
  - Тамбов — СТОЛИЦЫ И ЦЕНТРЫ СУБЪЕКТОВ РОССИЙСКОЙ ФЕДЕРАЦИИ
- ТРАНСПОРТНАЯ ИНФРАСТРУКТУРА**
- АВТОМОБИЛЬНЫЕ ДОРОГИ
  - ЖЕЛЕЗНЫЕ ДОРОГИ
- ⊕ — ПОРТЫ РЕЧНЫЕ
- ⊕ — ПОРТЫ МОРСКИЕ
- ✈ — АЭРОПОРТЫ
- ✈ — АЭРОПОРТЫ ФЕДЕРАЦИИ
- ⊕ — ТЕРРИТОРИЯ АРКТИКИ
- ⊕ — ТЕРРИТОРИЯ РАСПРОС







## Seaports of the Arctic Basin of the Russian Federation



In 2017, the cargo turnover of sea ports of the Arctic Basin increased 1.5 times in comparison with 2016 and reached 73 million tons. The volumes of transshipment of oil and oil products, coal, nonferrous metals, mineral fertilizers and cargoes in containers grow in seaports.

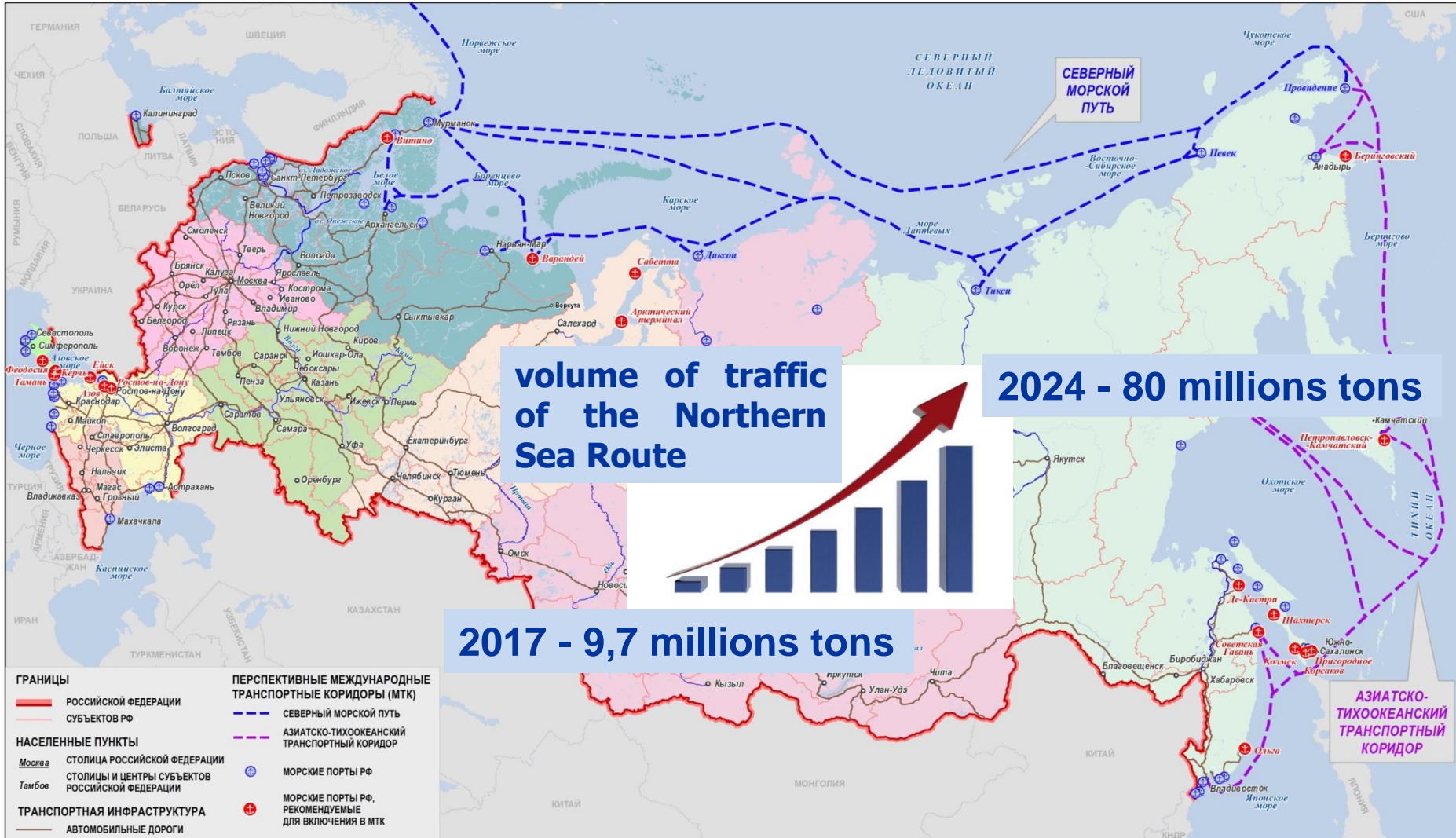
Taking into account the prospects of development of Arctic fields, it is predicted that by 2030 the cargo turnover of sea ports of the Arctic basin will increase by 1.9 times – up to 140 million tons.







## Rise in cargo turnover of the Northern Sea Route



The volume of freight traffic along the Northern Sea route in 2017 increased by 34% and reached 9.7 million tons. The main share of transportations was oil and oil products, general cargoes, liquefied natural gas condensate.

By the 2024 of the planned increase of cargo flow along the Northern Sea route to 80 million tons due to growth of extraction of natural resources, volumes of delivery of goods for northern regions and transit transportations.





## Possible impacts of climate change on transport infrastructure objects

| Factors  | Consequences   |
|--|--|
| <b>1. Temperature change:</b> <ul style="list-style-type: none"><li>- Increase of average temperature;</li><li>- Increase of periods of abnormal heat;</li><li>- More frequent change of warm/cold days;</li><li>- Degradation and melting of permafrost;</li><li>- Reduction of the area of Arctic ice.</li></ul> | Deformation of roads and paths; The instability of the slopes and the destruction of embankments; Overheating/failures in the operation of infrastructure and rolling stock; Fires on the slope and failure of equipment; Problems with electronics and signaling devices; Increased energy consumption; Speed limit; Heat load on coating/wear; Rut Thermal damage of bridges; more frequent landslides; Reduction of intervals between repair works; Increased costs for construction and repair work; restriction of internal navigation; Disruption of the infrastructure of sea and river ports and airports. |
| <b>2. Precipitation:</b> <ul style="list-style-type: none"><li>- Change in the intensity/frequency of extreme precipitation (floods and droughts).</li></ul>   | Flooding; Erosion of bridge supports, problems with drainage systems and tunnels; Landslides; Flooding of underground objects; Destruction of embankments; Increase of landslides, cases of destruction of slopes and earthen cloth and failures of equipment; Visibility, resulting in an increase in the number of accidents; Increase in the incidence of mud flows; Flooding of the ground infrastructure; Damage to goods and equipment; Restriction of navigation on inland waterways.   |
| <b>3. Changing the frequency and intensity of winds.</b>   | Destruction of fences; Traffic accidents; Damage to infrastructure and contact networks; Interruptions In operation, problems with navigation and tie-down in ports.   |
| <b>4. Changing the frequency and intensity of storms:</b> <ul style="list-style-type: none"><li>-Increasing the destructive force of storms/storm surges;</li><li>-Change of force and direction of waves.</li></ul>   | Increased risk of flooding and erosion of coastal areas, causing damage to roads; Flooding, inability to use roads during storm surges; Bridging of Bridge supports, damage to infrastructure/contact networks, limitation/disruption of railway operations; Silting of port/navigable canals.   |

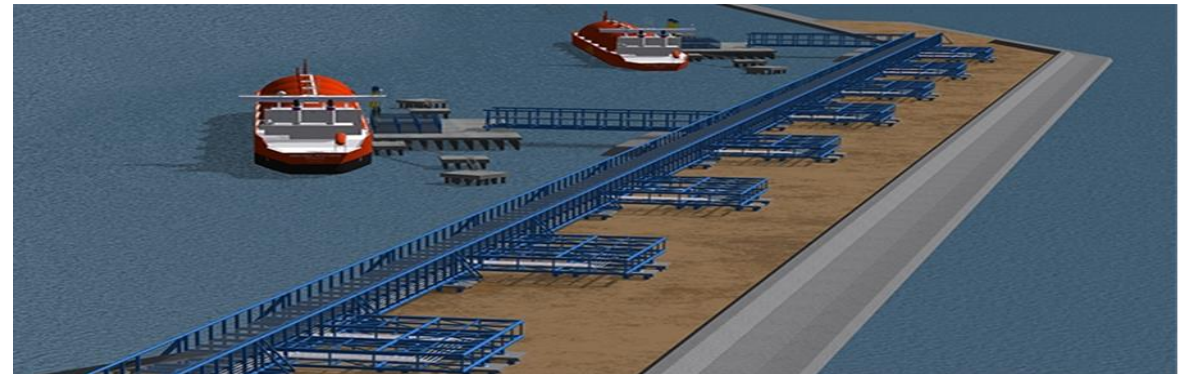




## Scenarios for adaptation of sea and river ports to climate change



Shore protection and water area protection



Anti-flood and ice barriers





## Methods and techniques of remote monitoring of the transport infrastructure facilities

Measuring circuit  
(tensometers, accelerometer,  
etc.)

Outline Global Navigation  
Satellite Systems (GNSS)  
(tensometers, accelerometer,  
etc.)

Telecommunication and power  
circuit  
(methods and techniques of  
communication, current supply)

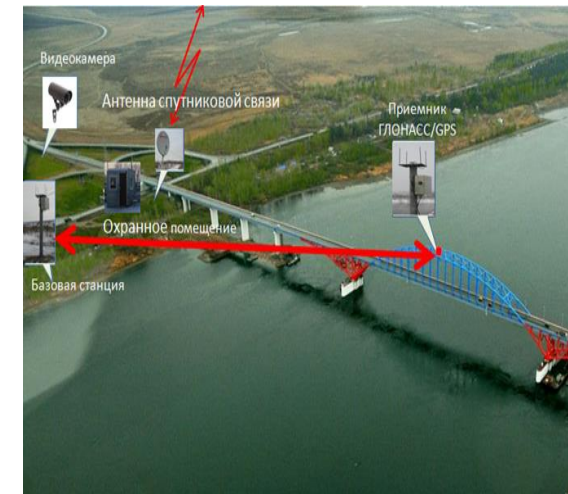
Remote monitoring of  
technical condition of the  
railway bridge over the Yenisei  
River

Integrated Automated System of the remote  
monitoring of transport infrastructure objects in the  
Arctic zone of Russia

Digital ground model,  
laser scanning

Earth remote scanning

Special software





МИНИСТЕРСТВО ТРАНСПОРТА  
РОССИЙСКОЙ ФЕДЕРАЦИИ  
Минтранс России

**Thank you for your attention!**