• All-Russian Railway Research Institute VNIIZhT
• VNIIZhT was established in 1918  
• the largest railway scientific and research centre  
• comprises 20 scientific and research divisions  
• Branches in Yekaterinburg, Irkutsk, Nizhni Novgorod

- Experimental Loop in Shcherbinka (small town near Moscow)  
- High speed test track on Belorechenskaya – Maikop railway section of the Severo-Kavkazskaya railway  
- Design office  
- Information and analyses centre  
- Experimental Factory
TICKETING AND INSPECTION OF TICKETS

REGISTRATION OF LUGGAGE, BAGAGE AND MAIL

PASSENGER WAGON STOCK MANAGEMENT

AUTOMATED DISPATCHER CONTROL CENTRES

STRUCTURAL PATTERN OF THE TECHNICAL MEANS COMPLEX

INFORMATION SERVICE

ECONOMICS, FINANCE AND MARKETING OF PASSENGER TRAFFIC
INTEGRATED APPROACH TO ROLLING STOCK DEVELOPMENT

TRANSPORTATION PROCESS

TYPIFICATION OF ROLLING STOCK

Locomotives  Railcars  Passenger cars  Freight cars

INFRASTRUCTURE

Track  Power supply  Signaling and communication  Safety of running  Ecology

ECONOMICS
LOCOMOTIVES
PROSPECTS FOR CREATION OF NEW LOCOMOTIVES

Gas-fueled diesel locomotive with electrochemical generator on fuel cells

- High coefficient of efficiency (up to 60%);
- No wear parts;
- Noiseless performance;
- Ecological clearness.

Shunting gas turbine locomotive on liquefied gas

Annual costs for fuel purchase

Toxicity of emissions

Soot NOx CO
**Development of rapid traffic**

### Rolling stock

<table>
<thead>
<tr>
<th>Rolling stock</th>
<th>Year of manufacture</th>
<th>Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>ЧС200</td>
<td>1970</td>
<td>8</td>
</tr>
<tr>
<td>61-4170</td>
<td>2002</td>
<td>17</td>
</tr>
<tr>
<td>ЭР200-1</td>
<td>1973</td>
<td>14</td>
</tr>
<tr>
<td>ЭР200-2</td>
<td>1991-94</td>
<td>14</td>
</tr>
</tbody>
</table>

### Directions

<table>
<thead>
<tr>
<th>Directions</th>
<th>Length, km</th>
<th>max. speed, km/h</th>
<th>Journey time, hours, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moscow-S.Petersburg</td>
<td>650</td>
<td>250</td>
<td>4-15 3-30</td>
</tr>
<tr>
<td>St.Petersburg-Buslovskaya (Helsinki)</td>
<td>158</td>
<td>160</td>
<td>2-22 2-00</td>
</tr>
<tr>
<td>Moscow-Krasnoye</td>
<td>489</td>
<td>160</td>
<td>6-05 4-24</td>
</tr>
<tr>
<td>Moskw-Otrozhka-Rostov</td>
<td>1228</td>
<td>160</td>
<td>16-36 12-14</td>
</tr>
<tr>
<td>Moscow-Nizhni Novgorod</td>
<td>442</td>
<td>160</td>
<td>7-27 3-30</td>
</tr>
</tbody>
</table>
PROSPECTIVE NETWORK FOR RUNNING RAPID AND HIGH SPEED ELECTRICAL TRAINS ON MIXED TRAFFIC LINES
New wagons
**SPECIFIC FEATURES OF FREIGHT WAGON OF A NEW GENERATION**

- **CA-4 automatic coupling with a disconnecting drive of new design and welded stops** provides for 1 mln. km between overhauls, excludes possibility of breaking loose and coupler's drop on the track.

- **Car body from 390-450 class rolled metal** allows increase in carrying capacity by 1.5-2 tonnes due to tare reduction.

- **T1 and T2-class draft gears** provide for sound condition of goods carried and wagons at the action of longitudinal forces.

- **Cartridge bearings** provide for warranty-related run of 1 mln. km, reduce a number of maintenance shops (15,000-19,000 employees are being released).

- **Cast bogie parts with increased fatigue resistance** (1.8 instead of 1.4) provide for 500,000 km between overhauls with prospect up to 1 mln km.

- **Friction assembly with wear-proof components** provide for 1 mln. km between overhauls.

- **Wheels with increased wheel rim hardness** reduce rolling contact fatigue formation and wear of wheel tread and flange by 2 times.
Bogie designed for axle-load of 25 tonnes

Elastic roller side-bearings

18-194 model

Elastic side-bearings

Spring suspension with a bilinear characteristic

Wedge from a high durable VCh 120 cast iron with poliuritan pad

P25-120 model
Sleepers:
• SH3-K sleepers for sharp curves
• SH1-02 with enhanced resistance to lateral displacement;
• 3-string design for Sakhalin island

Fastenings:
• Screw-dowel type ZhBR 65
• Manufactured 70,000 sleepers for such design

Rails:
• New rail standard R 51685 introduced
• Rail profile grinding norms

Subgrade and ballast
• Methods for increase in load carrying capacity

Turnouts
• A number of turnouts that enables to considerably increase train speed
SURVEYED HEAVY HAUL ROUTS

- Moscow – St. Petersburg - Murmansk
- Moscow – Arkhangelsk
- Moscow – Novorossiysk
- Moscow - Astrahan
- TransSib
Optimization of train gross weight rate per one locomotive

East-Siberian direction: rational train gross weight 5600-5800 tonnes,
train gross weight for intensive operation 5800-6000 tonnes
System analyses of railway safety

Multy-level automated system of traffic safety control (MASU BD)

✓ Introduced on the Russian Railways
✓ Works under way on developing the MASU BD second-generation
✓ Users:
  ✓ Traffic safety inspectors of Railway divisions and Railway administrations
  ✓ Experts of Safety Department and ecology specialists of Russian Railways

SMOG – Hazardous Cargo Monitoring System

✓ Enables on-line location of wagons with hazardous cargo and find possible violation of safety rules
✓ Introduced on the Russian Railways
Wheel / Rail system-related problems

- Train weight
- Running speed
- Linear and axle loads
- Providing appropriate interaction in Wheel/Rail system
- Increase in carrying capacity
- Train safety
- Reduction of operational costs
- Intervals between track repairs
- Wheel life
Provides for reliable online automatic location of wagons and locomotives required for Automatically Railway Transportation Control Systems (ASU ZhT)

Solved tasks:
- Wagons and locomotive fleet control
- Identification related transfer of wagons between railroads in automatic regime

Installed: 400000 sensing devises
Equipped: 680 read-out points

Applied read-out devises
RESOURCE-SAVING TECHNOLOGIES

TECHNOLOGIES PROVIDING FOR PARTS SERVICE LIFE EXTENSION UP TO 600,000 AND 900,000 KM

Enable:
✓ Restore worn and faulty parts
✓ Depositing strengthening layers on new parts
✓ Increase wear resistance of restored parts 2-5 times

WHEEL FLANGE WELD-ON AND PLASMA-HARDENING TECHNOLOGIES

✓ Provides for: increase in wheel flange wear rate
✓ Increase in wheel sets life

IN-TRACK RAIL REPAIR WITHOUT TRAFFIC INTERRUPTION

➢ Increases rail life up to capital repair
➢ Decreases operational costs at current track maintenance
➢ Provides for rails saving
The mobile railway car-observatory
Objectives of “Car-Observatory” Project

Car-observatory is a multi-purpose tool for studying air chemical composition and ecological parameters of environment along railroads.

The car-observatory can be used to assess:

• effect of rail-related and non-railway sources on concentration of gases and aerosols in the air
• impact of cargo transportations on the environment
• influence of high-speed and mass transportation railway traffic on pollution of adjacent areas with aerosols and heavy metals
• possibility in extreme situations to prevent development of ecological and technical disasters
The photochemical generation of dangerous ozone concentrations

- Enhanced VOC contents in the atmosphere is an important cause of intensification of the photochemical ozone generation processes which are dangerous for human health
Laboratory complex

- Stands for tests of rolling stock bogie frames and its elements;
- Rail testing station and facilities for impact tests;
- Laboratory for study of friction characteristics of brake systems;
- Stands for static tests of cars for strength and collision;
- Laboratories for tests and study of electrical and mechanical elements of rolling stock and devices of power supply system, for tests of diesels for locomotives and fuel systems, etc.
SUBGRADE AND SUPERSTRUCTURE TESTING ON EXPERIMENTAL LOOP

- Vehicle/Track Interaction
- Rails of various international manufacturers
- Sleepers of new design
- Turnouts
- Fastenings
Based on test results proposals for design improvement are forwarded to manufacturers.

Electric locomotives:
- ЧС2К, ВЛ10К, ВЛ10М, ВЛ80М, ЭП10, ВЛ10П, ВЛ11М, ЭП1, ЭП200, ВЛ85

Diesel locomotives:
- 2ГЭ116МК, 2ГЭ10-ГЕ, ТЭРА1, ТЭМ18Г, ЧМЭ3К, ТЭМ2К, ТЭП70БС, 2ГЭ116К

EMU’s:
- ЭД4Э, ЭТ4Э, ЭТ2М, ЭМ2И, ЭМ4, ЭТ2МЛ, ЭД4, ЭД6, ЭН3, ЭТ2А, ЭР2-К, ЭР9П-К, ЭР200, ЭД4МК, ЭД9М, ЭМ2

DMU’s:
- РА1-001, РА1-002, РА1-003

Subway cars:
- Яуза 81-720 (4 модификация), СКИФ 81-740
Running tests of vehicles on Experimental Loop

VNIIZhT Experimental Loop is a unique facility for testing vehicles and their assemblies.

Up to 10-15 tests of vehicles are being conducted annually.
• All Russian
• Railway
• Research
• Institute

VNIIZhT