Asset Management and Climatic Risks

Alexey Ozerov
Head of Business Cooperation Dept.
JSC NIIAS
Russian Railways Assets

**Infrastructure:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of operational tracks</td>
<td>85,300 km</td>
</tr>
<tr>
<td>Length of electrified lines</td>
<td>43,100 km</td>
</tr>
<tr>
<td>Lines equipped with signalling equipment</td>
<td>62,196 km</td>
</tr>
<tr>
<td>Railway stations</td>
<td>5,428</td>
</tr>
<tr>
<td>Traction substations</td>
<td>1,402</td>
</tr>
<tr>
<td>Service units (track divisions)</td>
<td>742</td>
</tr>
</tbody>
</table>

**Rolling stock fleet:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight locomotives (electric and diesel)</td>
<td>11,191</td>
</tr>
<tr>
<td>Freight cars of all types and owners</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Shunting engines (diesel)</td>
<td>6,016</td>
</tr>
<tr>
<td>Long-distance passenger cars</td>
<td>24,100</td>
</tr>
<tr>
<td>Commuter cars</td>
<td>15,600</td>
</tr>
<tr>
<td>Motive power and car depots</td>
<td>411</td>
</tr>
</tbody>
</table>
Asset Management (ISO 55000:2014)

URRAN System

Management of Resources, Risks and Dependability at Lifecycle Stages (URRAN)

Railway Infrastructure Facilities

UIC ISO 55000 Guidelines Document
ISO 55001 Implementation Guidelines for Railway Infrastructure Organisations
Basic Processes of Railway Transport Maintenance

Objects of Technical Regulation:
- Electrification and power supply
- Track facilities
- Signalling and remote control
- Telecommunication facilities
- Fleet

Plan

Check

Act

Basic Processes of Railway Transport Maintenance:
- Maintenance of infrastructure facilities and rolling stock
- Modernization of infrastructure and rolling stock
- Procurement management
- Management of environmental, fire, industrial, and labor safety

URRAN normative and methodological framework — over 125 documents
ALARP Principle

ALARP (Risk As Low As Reasonably Practicable)

Acceptable risk level according to ALARP principle is such a level of risk that cannot be reduced further and so, expenditures spent to reach it are economically beneficial.
# Common Industrial Platform in compliance with ISO 55000:2014

## I. System for comprehensive management of operational assets at all lifecycle stages

*Intended for increased efficiency of company operations based on adaptive management under conditions of limited resources.*

<table>
<thead>
<tr>
<th><strong>1.1.</strong> Integrated automated system for recording, investigation and analysis of technical failures (KAS ANT)</th>
<th><strong>1.2.</strong> Integrated automated system for recording, investigation and analysis of process violations (KASAT)</th>
</tr>
</thead>
</table>
| • Reduction of the number of technical failures  
• Improvement of the quality of products acquired from suppliers  
• Reduction of downtime at mass production enterprises | • Improvement of the quality of business processes  
• Reduction of non-production losses  
• Improvement of work productivity and personnel motivation |

<table>
<thead>
<tr>
<th><strong>1.3.</strong> Corporate automated system for employee workplace and fire safety knowledge monitoring</th>
<th><strong>1.4.</strong> Integrated automated system for investment projects performance monitoring</th>
</tr>
</thead>
</table>
| • Reduction of labor effort of organization, holding and documentation of training  
• Elimination of the human factor in employee rating  
• Improvement of technical training planning efficiency | • Improvement of timeliness and efficiency of investment projects implementation  
• Improvement of accuracy and efficiency of information exchange among project managers, customers, supervisors, asset holders and contractors |

- Improvement of work productivity
- Intensification of company infrastructure utilization
- Reduction of industrial disaster risk
- Improvement of capital investment and operational costs efficiency
- Decision-making based on asset condition evaluation
- Improvement of condition and failure prediction accuracy
- Risk, income, costs management at all lifecycle stages of an asset
- Reduction of the number of technical failures
- Improvement of the quality of products acquired from suppliers
- Reduction of downtime at mass production enterprises
- Improvement of the quality of business processes
- Reduction of non-production losses
- Improvement of work productivity and personnel motivation
- Reduction of labor effort of organization, holding and documentation of training
- Elimination of the human factor in employee rating
- Improvement of technical training planning efficiency
- Improvement of timeliness and efficiency of investment projects implementation
- Improvement of accuracy and efficiency of information exchange among project managers, customers, supervisors, asset holders and contractors
II. Innovative technologies of supervision and control of technical safety

Intended for condition monitoring of fire, industrial and environmental safety, analysis and planning of related activities.

- Improvement of fire, industrial and environmental safety
- Reduction of charged penalties
- Optimization of insurance expenditures
- Improvement of the efficiency of capital and operational expenditures related to the above safety activities

2.1. Automated systems for industrial safety management of dangerous manufacturing facilities

- Reduction of charged penalties related to industrial safety violations
- Optimization of insurance of dangerous manufacturing facilities
- Electronic delivery of information on operational supervision of dangerous manufacturing facilities to the Federal Environmental, Industrial and Nuclear Supervision Service of Russia
- Ensuring accuracy and immediacy of information on dangerous manufacturing facilities
- Improvement of industrial safety

2.2. Automated system for fire safety management of protected facilities

- Improvement of efficiency of fire safety supervision of protected facilities
- Improvement of efficiency of fire prevention activities
- Reduction of charged penalties related to fire safety violations
- Improvement of efficiency of fire safety activities implementation through objective evaluation of fire risks

2.3. Automated system for environmental safety and nature protection activities management

- Improvement of efficiency of natural resources management supervision
- Improvement of the accuracy and immediacy of accountancy through automated document management
- Reduction of costs related to submission of reporting documentation to national executive authorities through electronic reporting
- Improvement of objectivity of natural resources management analysis
- Insurance of efficiency of environmental protection activities planning
- Insurance of efficiency of environmental protection activities
- Reduction of charged penalties related to environment protection legislation
- Reduction of natural resources management payments to the minimum possible level
Some Climatic Impacts on Railway Operations

- Icing of railway contact wires.
- Heavy snowfalls causing breaks of catenaries.
- Heavy rains leading to flooding of track.
- Thunderstorms and high wind leading to falling trees and breaks of catenaries.
- Fires during hot summer periods.

May 2017, Moscow
RZD Situational Centre
Primary Tasks of Situational Center

- Safety monitoring of railway infrastructure and rolling stock in operation
- Forecasting the risk of traffic incidents and other events, development of preventive measures
- Quick response to traffic incidents and emergencies, recovery operations
- Reporting to JSC RZD top management of traffic, operations, transportation and fire safety at JSC RZD infrastructure facilities

About 2,000 messages as regards traffic safety are processed daily by operational shift dispatchers

About 1,000,000 messages as regards traffic safety are processed monthly by analysis unit specialists
Key Functions of Situational Centre

- Traffic safety
- Transportation Safety/Security
- Fire Safety
- Monitoring of weather conditions
Selection of Approach Routes to Emergency Site

Information on the nearest location of emergency services: police, hospitals, traffic police, fire stations, etc.
Weather Monitoring and Forecasting

**Environmental conditions information**
Reporting of environmental conditions at railways facilities based on data supplied by JSC RZD weather and hydrological stations

**Identification of conditions threatening traffic safety**
Processing of reports and forecasts aimed at identifying hazardous weather conditions affecting railway operations and requiring preventive measures

**Planning of preventive measures**
Generation of the list of measures per railway facilities foreseen for the case of hazardous environmental conditions
Monitoring and Forecasting of Weather Conditions

- 250 weather stations monitored
- Analysis of the onset of weather conditions threatening traffic safety
«RZD Geoportal»
Industrial System for Geospatial Information Distribution

- Provides user access to up-to-date geospatial information
- ERS imagery is licensed for JSC RZD use
- Reduces ERS data cost by eliminating repetitive purchase of images
- RSD Geoportal is a platform allowing to display and analyze geospatial information referenced to operational (linear) coordinates

«RZD Geoportal» operates in the industrial Intranet system
Radar Satellite Monitoring of Railway Infrastructure

- early detection of roadbed slumps, slope slides
- detection of karst and cryogenic processes appearances
- monitoring of landslide and rock-fall slopes
- monitoring of buildings and structures stability
- infrastructure protection measures efficiency monitoring
### Track Deformations, Damages and Obstruction Caused by Development of Dangerous Natural Processes and Phenomena

#### Causes of abrupt railway track deformations in coastal and mountainous areas

<table>
<thead>
<tr>
<th>Year</th>
<th>Washout</th>
<th>Landslide</th>
<th>Mudflow</th>
<th>Rock fall</th>
<th>Avalanche</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>2006</td>
<td>14</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>21</td>
<td>45</td>
</tr>
<tr>
<td>2007</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>13</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>2008</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>27</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>2009</td>
<td>12</td>
<td>-</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>2010</td>
<td>27</td>
<td>6</td>
<td>-</td>
<td>10</td>
<td>13</td>
<td>56</td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
<td>10</td>
<td>1</td>
<td>12</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>2012</td>
<td>12</td>
<td>-</td>
<td>15</td>
<td>4</td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>20</td>
<td>24</td>
<td>83</td>
<td>88</td>
<td>304</td>
</tr>
</tbody>
</table>

#### Hazardous natural processes and phenomena:
- Coastal abrasion
- Mudflows
- Floods
- Erosion processes
- Landslide and mud-gutter
- Rock falls and crumbles
- Karst depression
- Suffusion subsidences
- Icing
- Thermo karst
- Thermo erosion
- Solifluction
- Rupturing deformations
- Frost heave
- Avalanches
- Earthquakes

*Data provided by Center for Artificial Facilities – JSC RZD subsidiary*
Monitoring of Efficiency of Landslide Stabilization Measures

Surface displacements near the Mamaysky landslide (1956 km PK9 – 1957 km PK2)

Monitoring of protective structures stability
Identification of Active Geodynamic Process Areas by SAR Data Processing

Fragments of the general map of the Earth surface displacements over the Tuapse – Adler line based on the results of processing of COSMO-SkyMed data in 2008–2015

Line length - 115 km
SAR data swath width - 2 km
Total number of identified persistent scatterers of SAR signal - over 2 mln
Map of Spectra of Exogenous Geomorphologic Processes Composition

Map provides:
- analysis of specificity of processes development inside landscape allocations considering their mutual location and relief characteristics
- analysis of direction of processes influence considering relief characteristics and presence of way of influence transit (currents, roads)

It is utilized for linear zoning of railway track and efficient planning of detailed in-situ inspections, providing minimization of costs
Evaluation of Potentially Dangerous Processes for Railway River-flow and Erosion by Retrospective Satellite Data Analysis

River Sakmara meandering flow dangerous approach to railway at 126–127 km of Orenburg – Orsk line

Canopus-B, 02.04.2015

Landsat-5, 07.07.2008

Landsat-5, 30.09.1995

Landsat-5, 11.05.1984

Retrospective analysis of archive ERS data shows the dynamics of erosion process during last 30 years

Estimated distance of river bank to railway

- 02.04.2015 – 38 m
- 07.07.2008 – 100 m
- 30.09.1995 – 130 m
- 11.05.1984 – 230 m

railway line
Fire Risk Assessment for Railway Infrastructure

Map of fire risk for 2015 season based on analysis of statistics and vegetation index dynamics

Weather map, 06.04.2015 6:00 GMT

humidity

active forest fire
heat sources

railway

possibly dangerous fire

Zabaikalskaya railway, 06.04.2015, 05:15 GMT, detected fires possible impact on railway infrastructure in case of permitting weather

railway

possibly dangerous fire

RZD SAT system mockup

actual weather conditions (observed wind direction) do not favor fire impacts
Thank you

www.vniias.ru