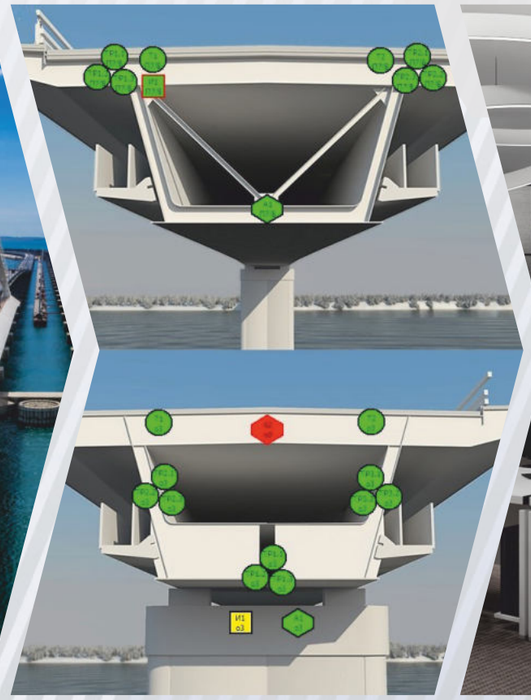
SMART BRIDGE DIAGNOSIS SYSTEMS (SBDS)



sbds
FIRST MONITORING COMPANY

SMART BRIDGE DIAGNOSIS SYSTEMS PVT.LTD,
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Be the change you want to see in the world
Mahatma Gandhi

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BRIDGE AND TUNNEL MONITORING SYSTEMS

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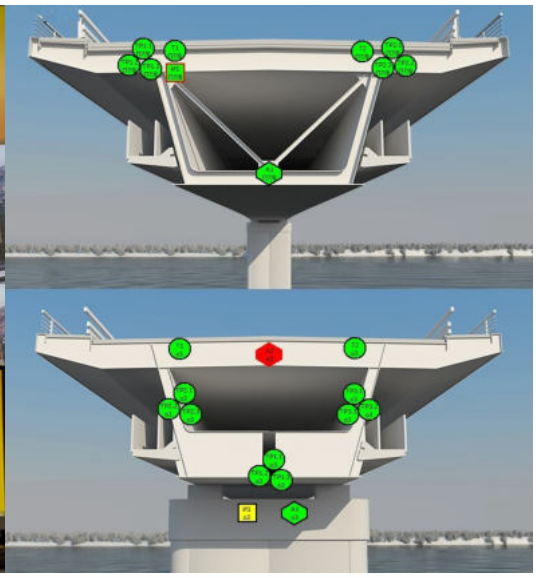
About the company

Smart Bridge Diagnosis Systems (SBDS) is a Russian-Indian company, a manufacturer of a wide range of high-precision measurement systems based on Russian advanced (breakthrough) technologies.

Smart Bridge Diagnosis Systems (SBDS), a leading international expert in the bridge monitoring field, implements complex projects for bridge technical condition monitoring during the entire service life - from design and construction to commissioning and operational support.



Our products quality and our engineers' experience is proved by successful completion of more than 400 monitoring projects in different countries around the world, including such famous projects as:

- Crimean Bridge (across the Kerch Strait);
- The bridge over the Moscow Canal of the Central Ring Road (CRR).

Our partners and customers:

- Giprostroymost Institute - Russia's largest organization in bridge and transport structures design;
- Avtodor State Company - a leader in the construction and operation of federal highways with toll sections;
- Norilsk Nickel (the world's largest manufacturer of nickel and palladium);
- Domodedovo International Airport;
- Leroy Merlin store chain in Russia

Smart Bridge Diagnosis Systems (SBDS) leading partners:

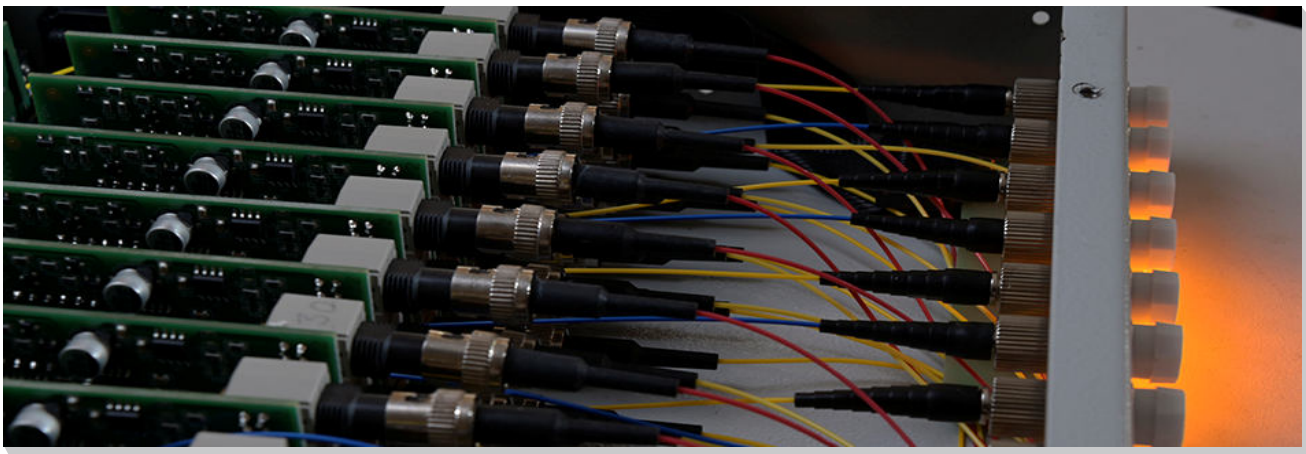
- СМИС Эксперт (Russia) is a high-tech company specializing in the development, implementation and technical support of software products and digital complexes for monitoring the condition of industrial facilities and the quality of their operation. It has extensive experience in scientific and technical support in the monitoring of bridge and tunnel technical condition which are under construction and in operation.

- Мониторинг центр (Russia) Research and Production Company specializes in the development and production of control and measuring systems and sensors for construction monitoring. The developer of a unique, unparalleled technology for monitoring the condition of bridges and tunnels based on fiber-optic sensors;

- HFCL (India) - a leading manufacturer of fiber optic cable and telecommunications equipment, supplier of next generation large-scale digital networks.

According to Smart Bridge Diagnosis Systems (SBDS) project implementation regulations

- development of measuring complexes and creation of software takes place in Russia;
- assembly of measuring systems is carried out in India.



BRIDGE STRUCTURAL HEALTH MONITORING SYSTEM (SHMS)

SCC&FA

SVOD

ISVOD

KID-S - Rod complex for measuring information

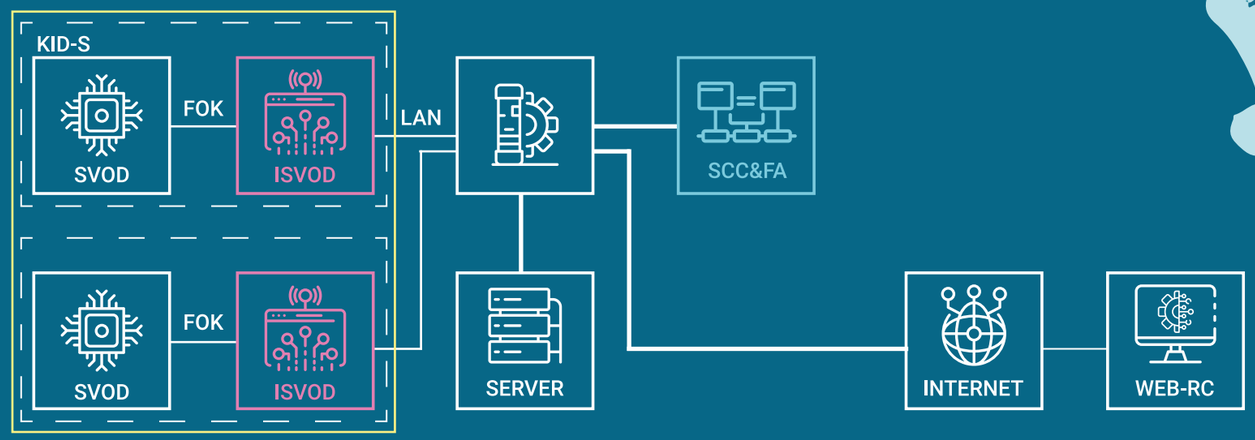
SVOD - Rod fiber optic strain gauge

ISVOD - Fiber Optic Strain Sensor Signal Meter

SCC&FA - State Control Center (SCC) or Federal Agency (FA)

FOK - fiber optic cable

WEB-RC - remote computer



BRIDGE STRUCTURAL HEALTH MONITORING SYSTEM (SHMS)

Bridge Structural Health Monitoring System (SHMS) is an automated structural health monitoring system that provides real-time assessment of bridge performance and reliability. Bridge Structural Health Monitoring System (SHMS) is currently recognized in various countries as one of the best ways to provide a high safety level and optimize the operation, maintenance and repair of bridges in an industrial economy.

Smart Bridge Diagnosis Systems (SBDS) uses advanced, unique measuring equipment (sensors) and control system focused on early detection of destructive processes. The system detects the smallest initial changes in significant bridge parameters which potentially lead to hazardous situations, incidents and accidents. For each incident, the limit stresses, deformations or displacements of structural elements are pre-defined in the digital bridge model.

Next-generation Smart Bridge Diagnosis Systems (SBDS) fiber-optic deformation sensors provide data about the current state of the bridge immediately in digital form, while the latest communication tools provide the information to the computing system for real-time processing. As a result, the registered deformations are sent to State Control Center or Federal agency in the sms- or email-message format.

Operator screen visualization takes place in the "traffic light" mode:

- parameters are normal
- exceeding the warning limits (increase the attention of managers)
- exceeding pre-emergency limits (it is necessary to set up a commission and organize a check-up)

BRIDGE STRUCTURAL HEALTH MONITORING SYSTEM (SHMS)

The monitoring system not only records the approaching values of the controlled parameters to the maximum permitted limits, but also allows to correctly analyze the causes of deformations and model the forecast of the object's "behavior" in general and its individual structural elements.

Notification function on changes in values of one or several parameters of the bridge or tunnel structure along with the precise determination of failure causes (accidents, failures) allow organizing timely control over the operational condition of the structure, taking prompt measures to prevent the deformations growth, preventing accidents, thus reducing the emergency downtime of traffic flows, and most importantly - preventing human and material losses.

Bridge Structural Health Monitoring System (SHMS), including modern sensors and communication means, can be installed on almost any bridge or tunnel structure and work without human participation, continuously monitoring deformation changes, replenishing and updating various information system databases.

Bridge Structural Health Monitoring System (SHMS) provides scalability in terms of performance and volume of processed monitoring data due to the possibility of additional installation of sensors during the operation of facilities without modifying the application software.

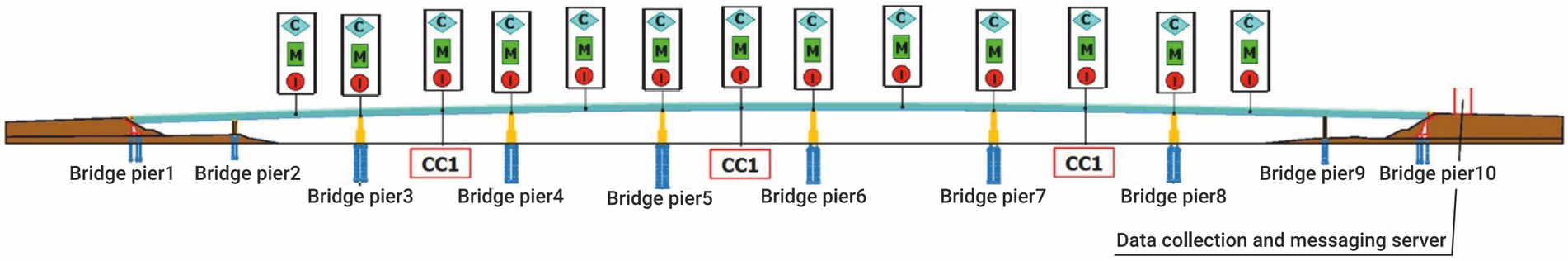
BRIDGE STRUCTURAL HEALTH MONITORING SYSTEM AS A SAFETY SYSTEM

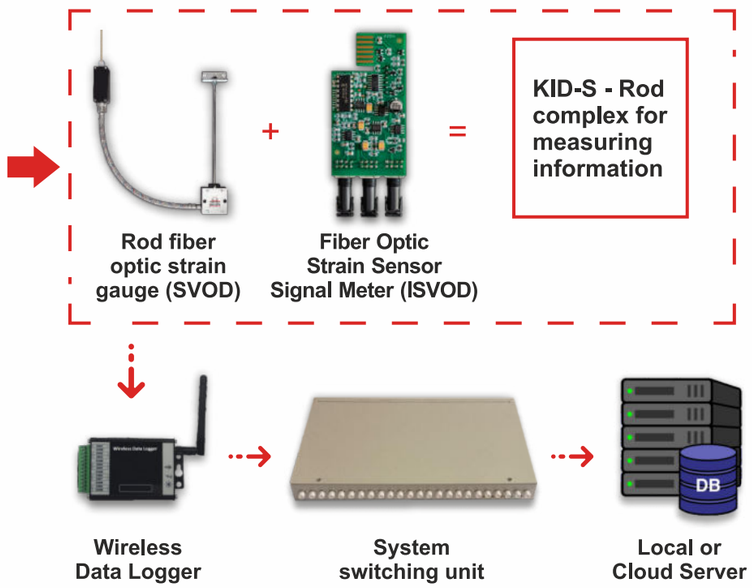
As time passes and loads increase, bridge structures face safety (collapse) problems, so effective deformation monitoring by the Bridge Structural Health Monitoring System (SHMS) is crucial, first of all, for the bridge safety and traffic and contributes stability of these critical infrastructural facilities.

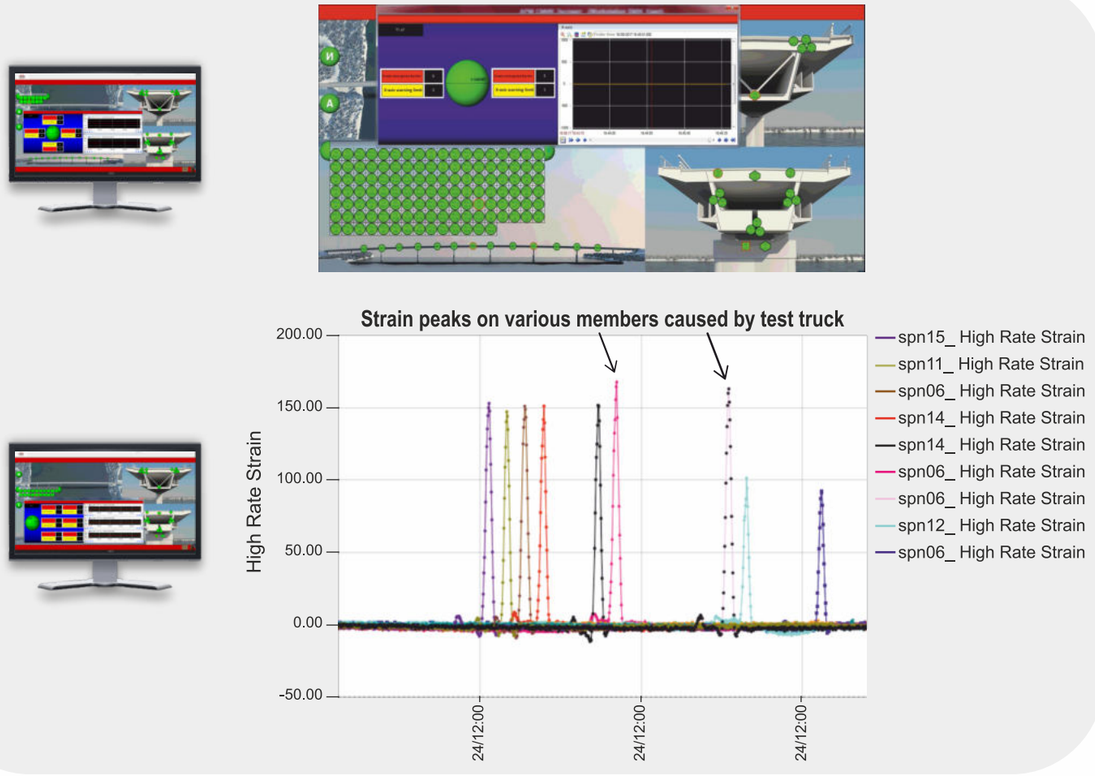
A large number of bridges in India today require advanced monitoring systems to ensure their safety and durability.

Bridge Structural Health Monitoring System (SHMS) primarily solves safety issues by providing real-time bridge condition monitoring, damage identification and structural assessment, meeting the high standards of safety, stability and efficiency of modern transportation infrastructure.

Our bridge monitoring systems detect potential hazards and offer a scientific basis for maintenance, repair and management decisions, reducing accidents and improving overall efficiency.







Relevance and technical task

Control of bridge stress-strain parameters is relevant due to the following reasons:

- bridges are subjected to intensive dynamic loading
- they are exposed to strict requirements for maintaining stability, strength and reliability parameters for long periods of time
- they are diverse in structural design
- bridges are operated in various environmental conditions
- bridges are a place where a large number of people and transport are gathered, and their safety is a priority task

In this connection the urgency of control system implementation, providing registration of bridge stress-strain state parameters in real time mode or according to the set survey schedule, increases.

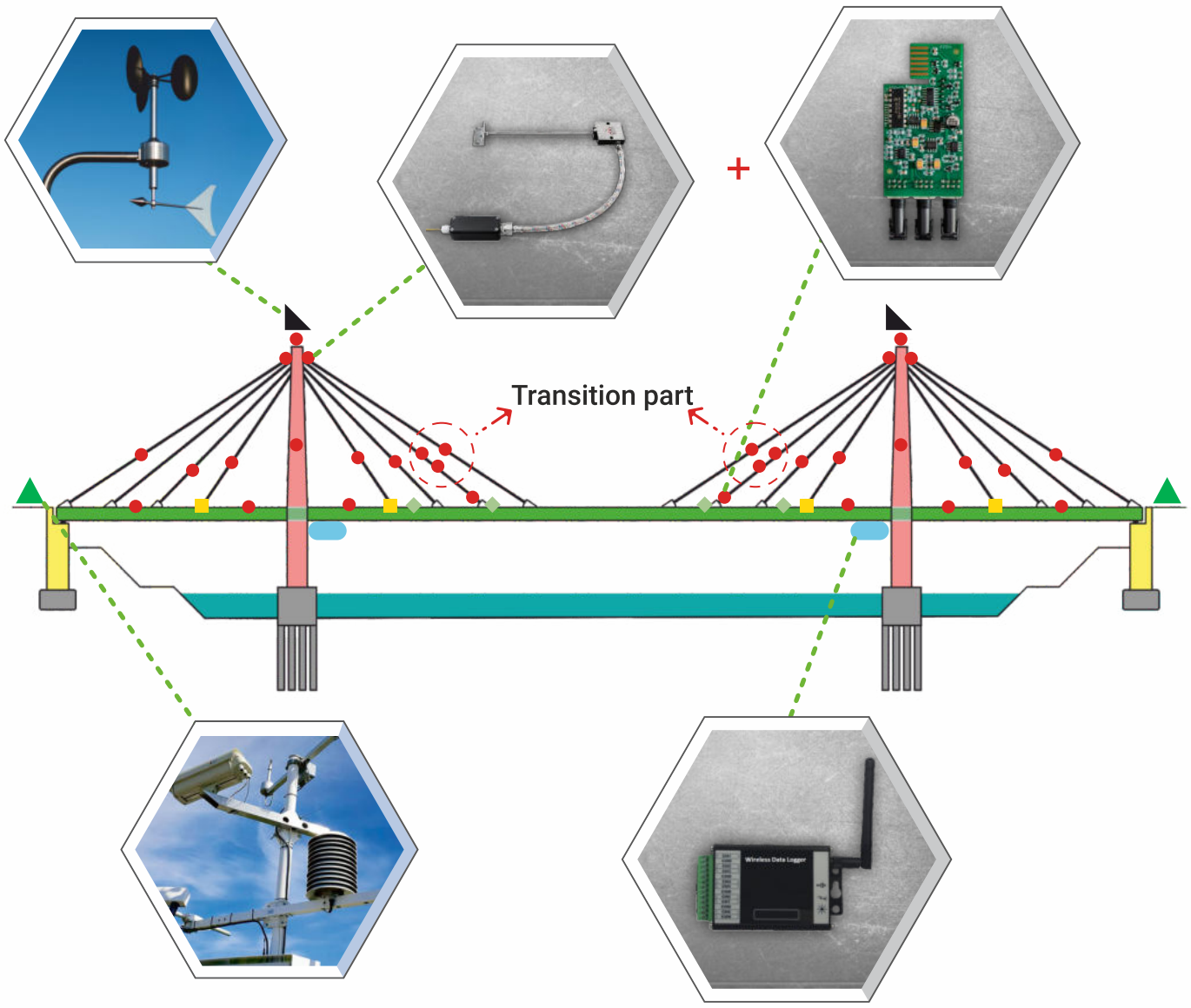
The main technical task of Bridge Structural Health Monitoring System implementation is to ensure, through timely control of the bridge technical condition and with minimum labor and material and technical resources expenditures:

- safety of human and traffic flows
- stable (continuous, reliable, safe and comfortable) movement of traffic flows over the bridge with the established design speeds and operational loads for the road within the design values
- stable operable technical condition of the bridge structure during the service life (durability) envisaged by the project, taking into account the increase in traffic intensity and vehicle weight

System output requirements

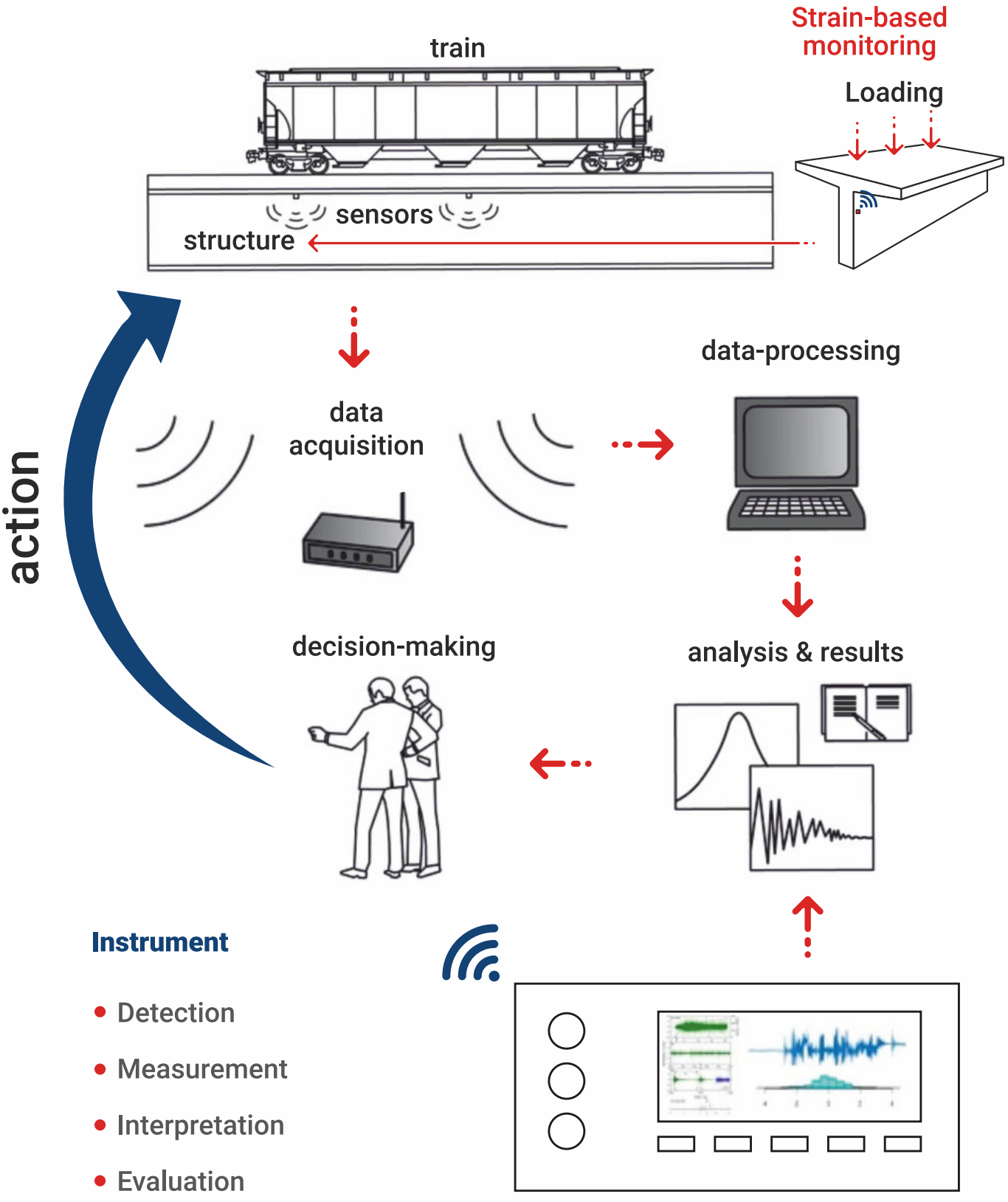
Reliable and timely information about the current state of bridge structural elements "health", tracking of external influences - meteorological conditions at the site (temperature, precipitation, wind speed and direction), as well as the ability to assess the residual durability resource ("age changes") of the structure allow to take prompt measures to prevent accidents leading to traffic downtime.

The use of **Bridge Structural Health Monitoring System** is the most effective way to diagnose and prevent various "diseases" of bridges, which provides safety and reliability of operation for the entire period of their life cycle



- Rod fiber optic strain gauge (SVOD)
- Wind sensor (speed, direction)
- Fiber Optic Strain Sensor Signal Meter (ISVOD)
- Weather station (speed, direction, T, P, RH)
- Wireless communication device (IIoT)
- Temperature sensors

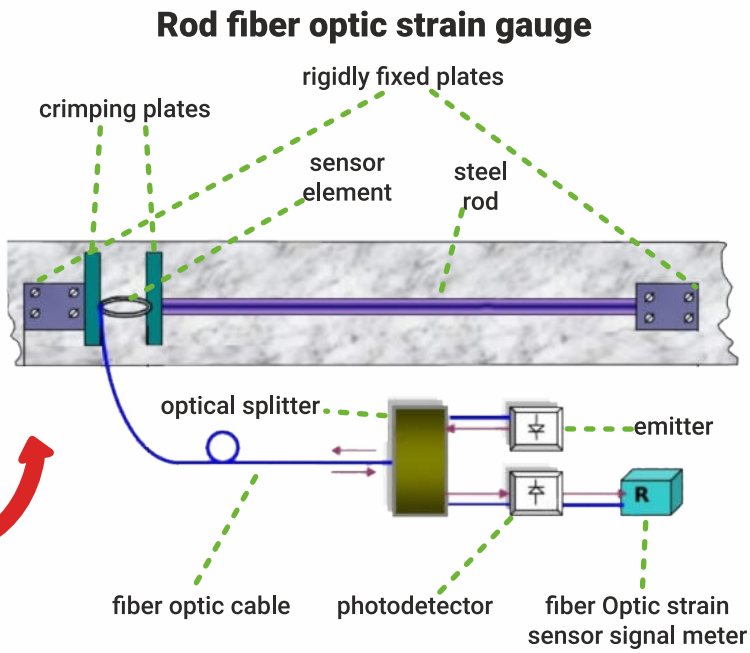
The methodology proposed by **Smart Bridge Diagnosis Systems (SBDS)** for calculating the economic effect from the introduction and use of the Bridge Structural Health Monitoring System applies a universal criterion - the cost of prevented losses from emergency downtime of traffic flow on a given bridge during the design period (compared to the average statistical cost estimate of the whole set of downtime at the facility in similar periods before the system was deployed).

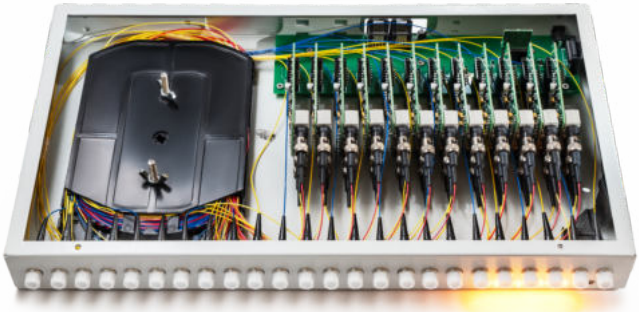


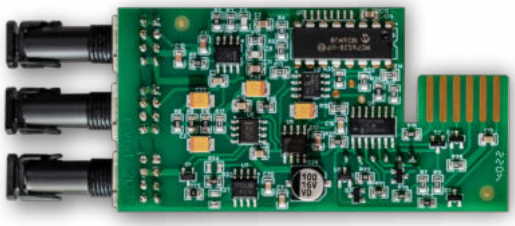
Sensors

The basic sources of information in **Bridge Structural Health Monitoring System**, which record various changes in the condition of bridge structures, are fiber-optic strain sensors.

They are the most effective for continuous monitoring during long term operation; they allow to obtain information about the internal condition at any point of the structure; they generate signals that provide accurate data on the localization of defects, the degree and type of deformations; they work effectively in interference conditions.







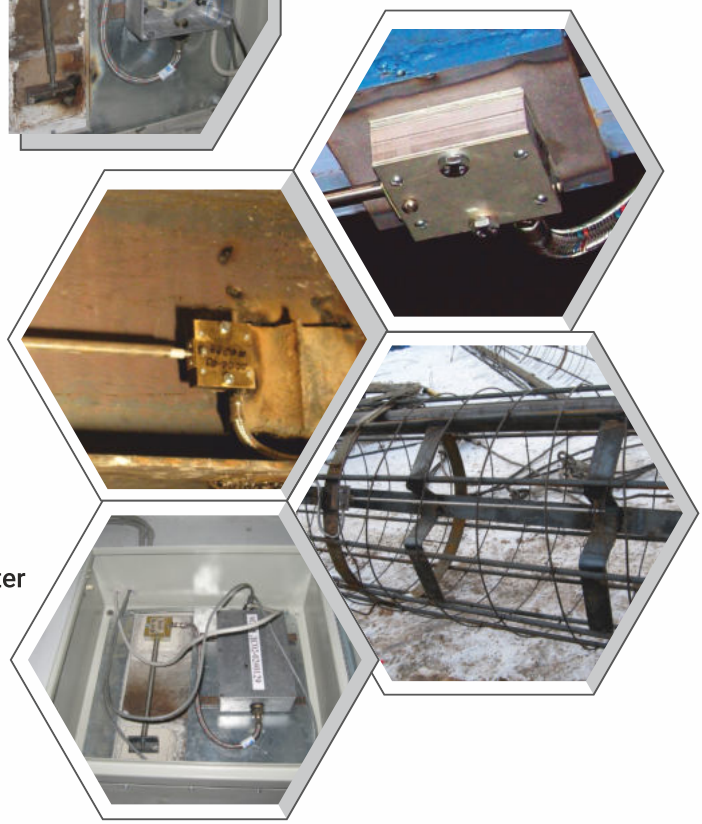
Operating principle of a fiber optic sensor

The deformation value of the bridge structural element controlled part is determined by the operation of the sensitive element of the fiber-optic sensor based on the light transmission coefficient dependence on the change in the curvature of the light guide section.

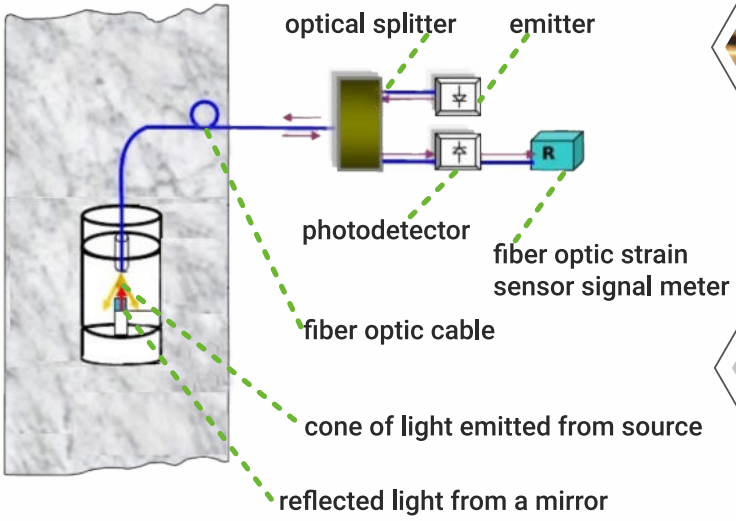
The intensity value of the registered light flux, converted by the photodetector into electrical voltage, after processing with the help of a special program, gives the deformation value.

Fiber optic strain sensors have obvious advantages over sensors operating on other physical principles:

- Measurement accuracy (10 times more accurate)
- Durability (service life not less than 20 years) 3
- Installation method and operation method that does not require destruction of the structure

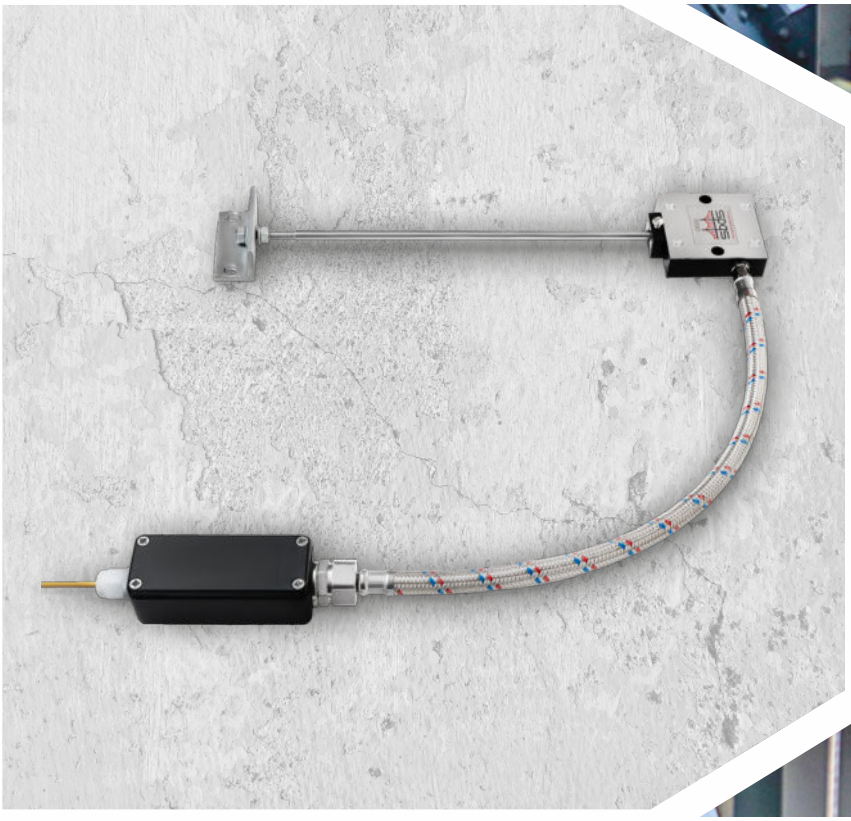


Scheme of operation of a fiber-optic strain gauge



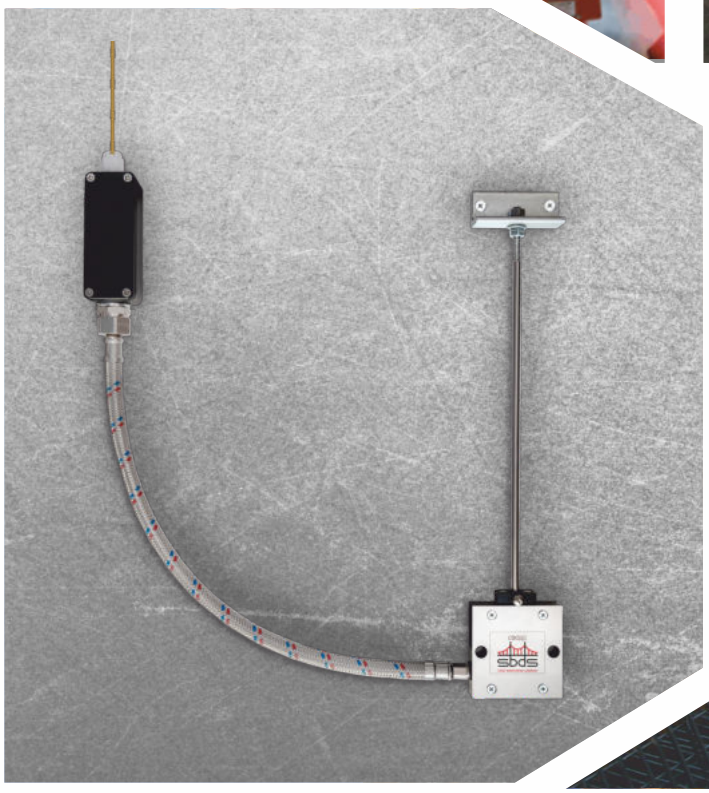
An additional advantage is compliance with stringent requirements related to operating conditions:

- maintain accuracy under environmental temperature fluctuations
- resistant to high humidity
- resistant to mechanical vibrations typical of bridges



In addition, in order to be able to create a Bridge Structural Health Monitoring System (SHMS) used on the bridge, the design of sensors as part of the measurement system should provide for:

- absolute fire and explosion safety
- ability to transmit data over a long distance without distortion (up to 3 km without additional equipment)
- a topology in which the failure of a sensor does not lead to the failure of the entire system
- the possibility of operation without power supply



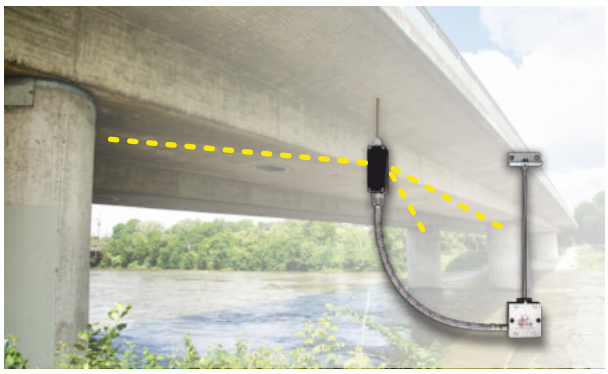
Measurement system

Strain measurement complex is designed to monitor the deformation of the controlled bridge structure. It consists of two structural parts: a rod fiber optic deformation sensor (RFODS) and a fiber optic sensor signal meter (FOSSM), which are connected by means of a fiber optic cable (FOC).

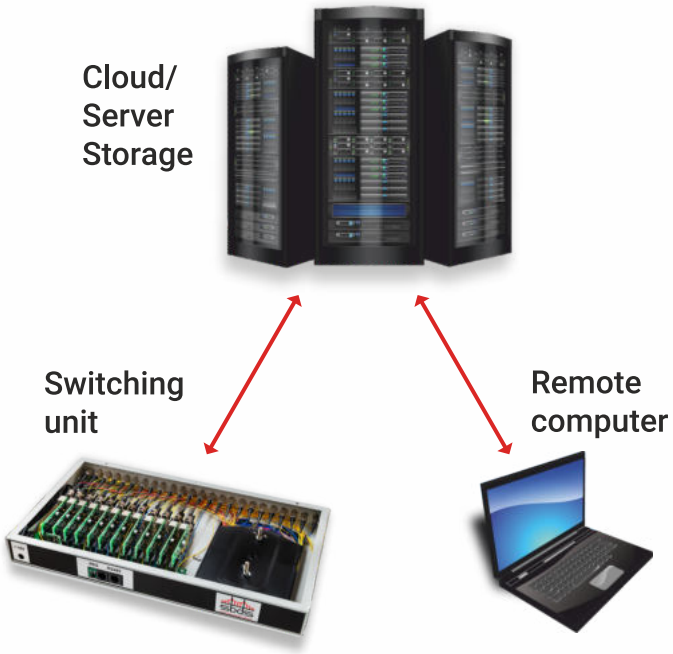
The RFODS converts the deformation of the bridge structure being monitored into a corresponding change in the characteristics of the radiation traveling in the fiber optic sensing element. FOSSM is designed to register the signal from fiber optic sensors and transfer the results to the server for data processing.

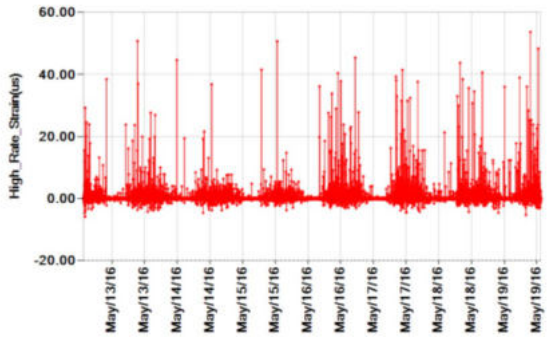
structural deformation, monitoring expansion, crack progression

monitoring pier movements, foundation settling, bearing movement



monitoring stress-strain on members

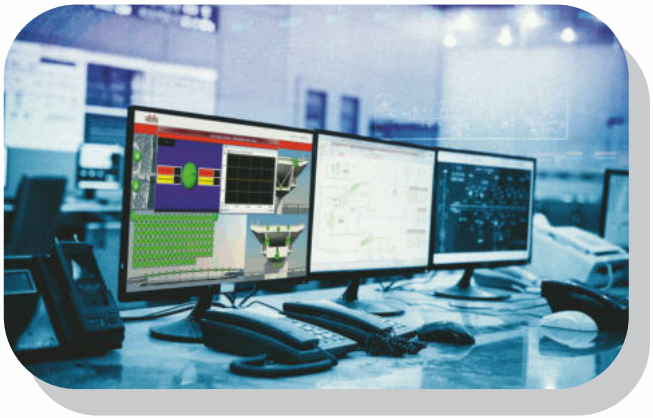


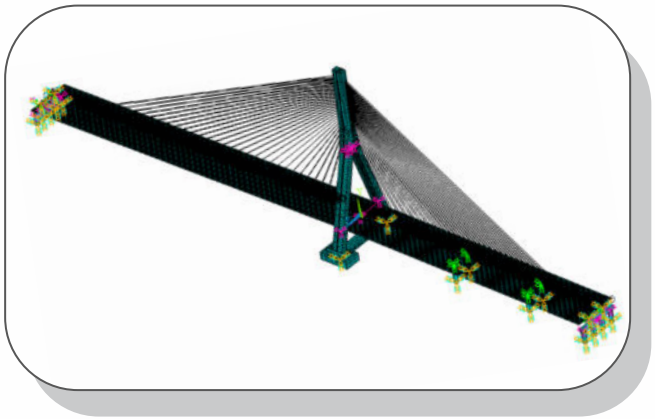


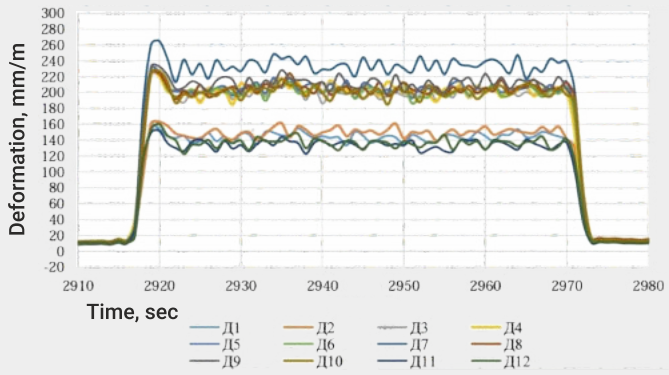
Installation of sensors (topology) is regulated at the project stage in the points of potential source of destruction of the structure (areas of the highest loads, places of support, joints, attachments).

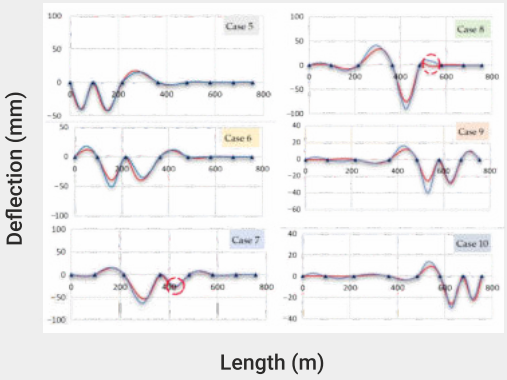
The electronic signal processing unit receives constant information about the condition of the structure at the set control points. Sensors are polled automatically and at a set time interval of once every two seconds. Comparison of this information with the design data in a constant mode allows to draw conclusions about the technical condition ("health") of the bridge structure.

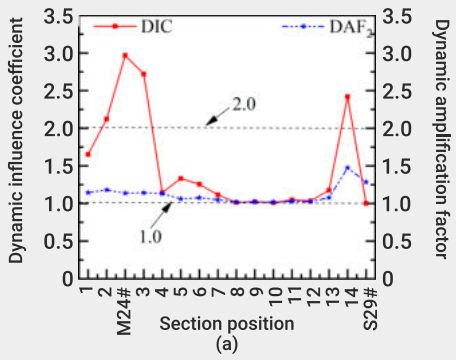
At the same time, the analysis is performed by numerical modeling of the state of the bridge structure with actually measured data, which are put into the calculation. The obtained result allows to understand how the bridge structure as a whole has deformed. The principle of **Bridge Structural Health Monitoring System (SHMS)** data extrapolation: information is provided only on local deformations, and conclusions can be drawn on changes in the bridge structure in general

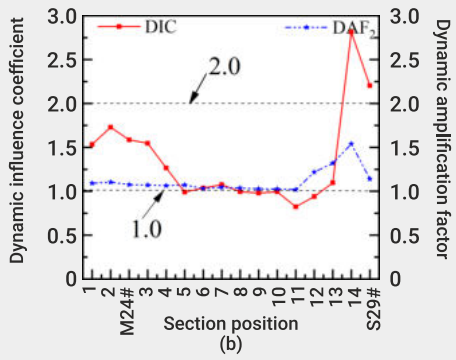








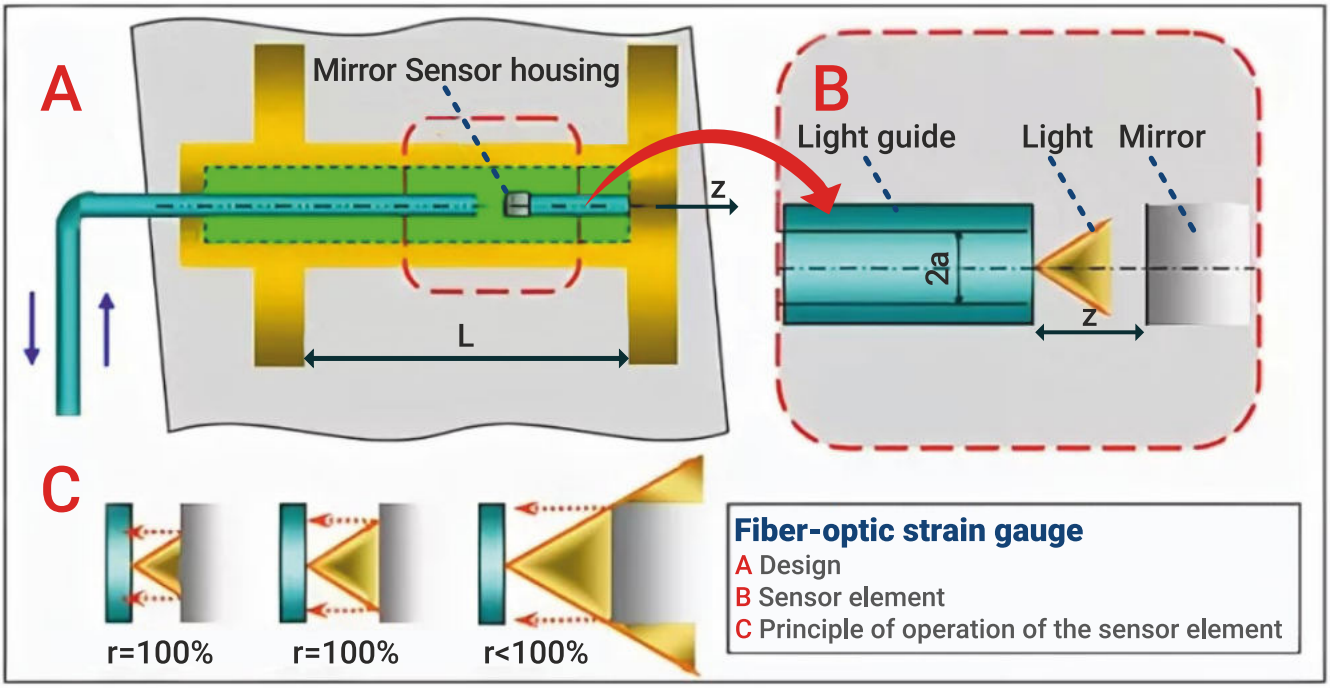


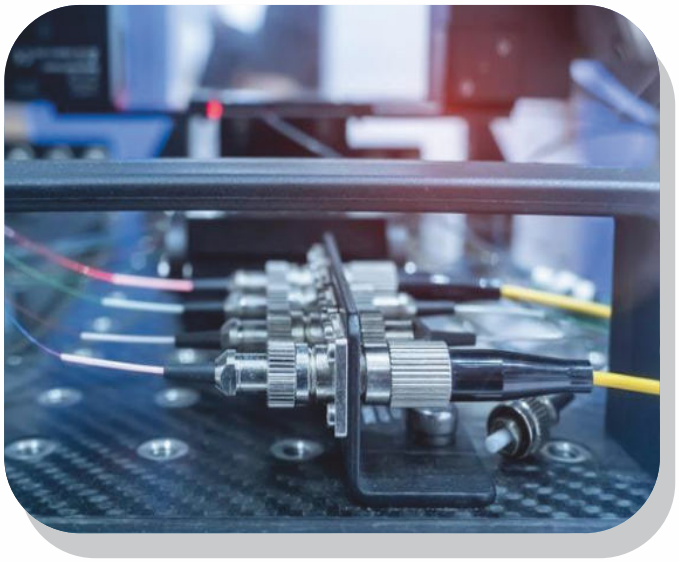


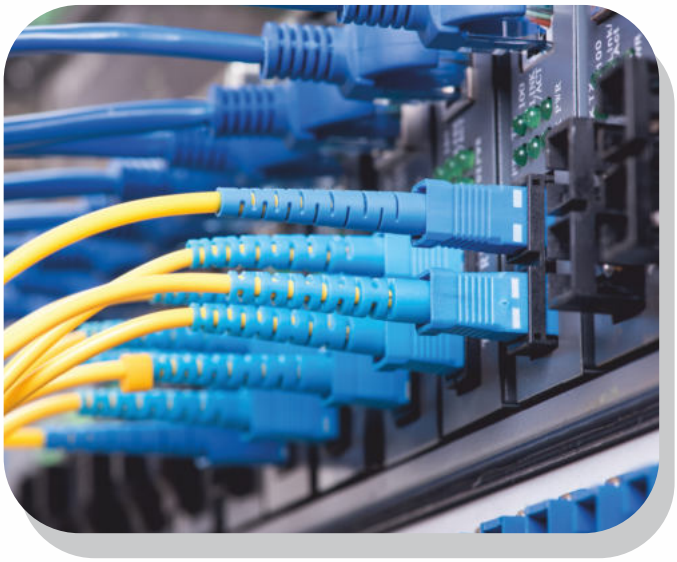
General scheme of Bridge Structural Health Monitoring System (SHMS) measurement system operation:

Operation description of the Bridge Structural Health Monitoring System (SHMS) measurement system

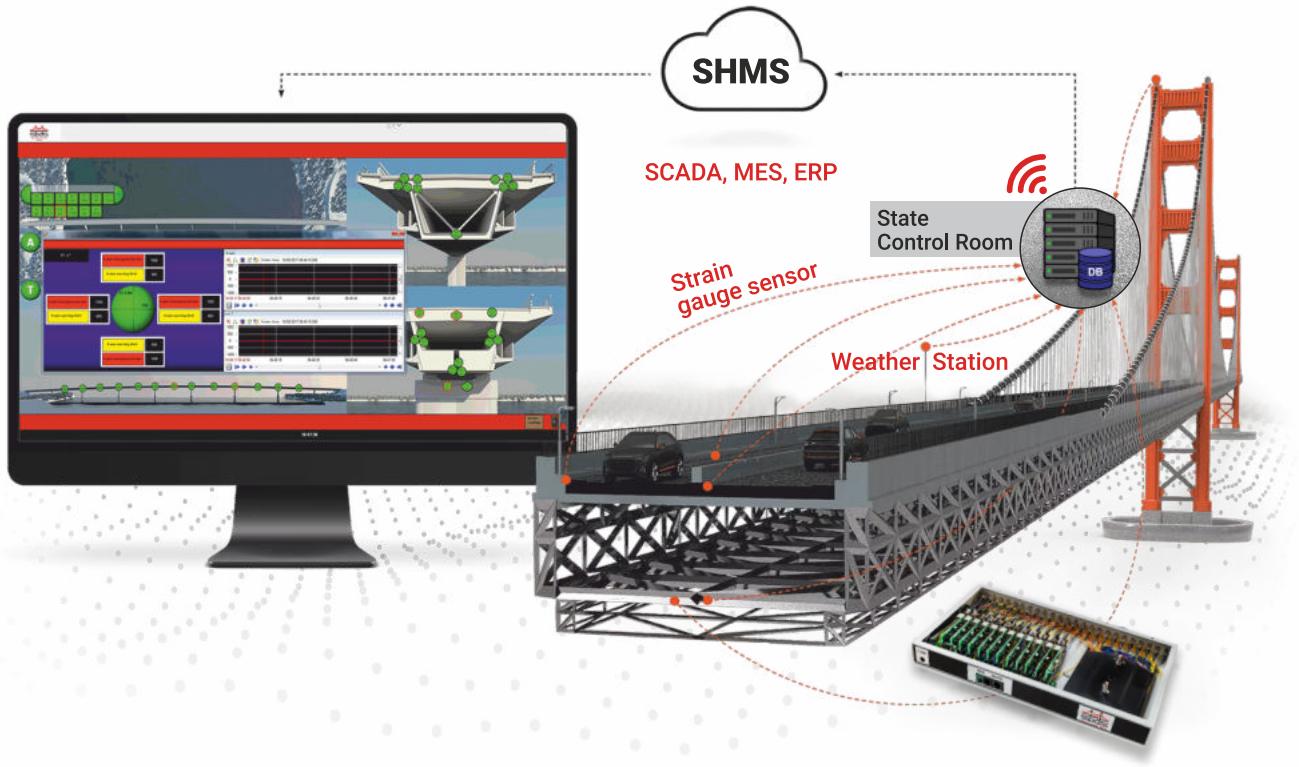
- The signal meter (FOSSM) generates a light pulse sent to each RFODS strain sensor for interrogation
- The primary transmitter of each sensor introduces a perturbation to the sent signal according to the parameter to be recorded
- The photodetector of the fiber optic sensor signal meter detects the return (analog) pulse, converts it into an electrical signal, and transmits it to the Bridge Structural Health Monitoring System (SHMS) server

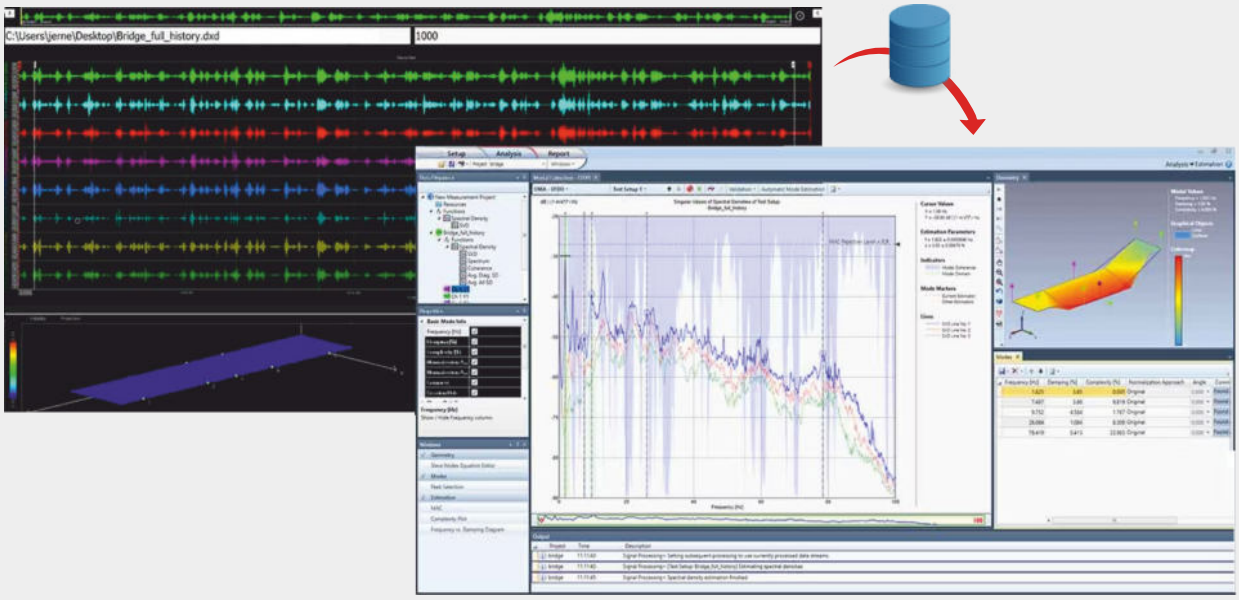






- The Bridge Structural Health Monitoring System (SHMS) server provides processing of the received data from the measuring system, saves it to the database, and compares it with the specified limit values
- The bridge operator's displays information on changes in the stress-strain state of the bridge structure in the form of relative (actual) deformations
- Notifications on exceeding the limit values for each bridge are sent to the State control room or Federal agency for management decisions





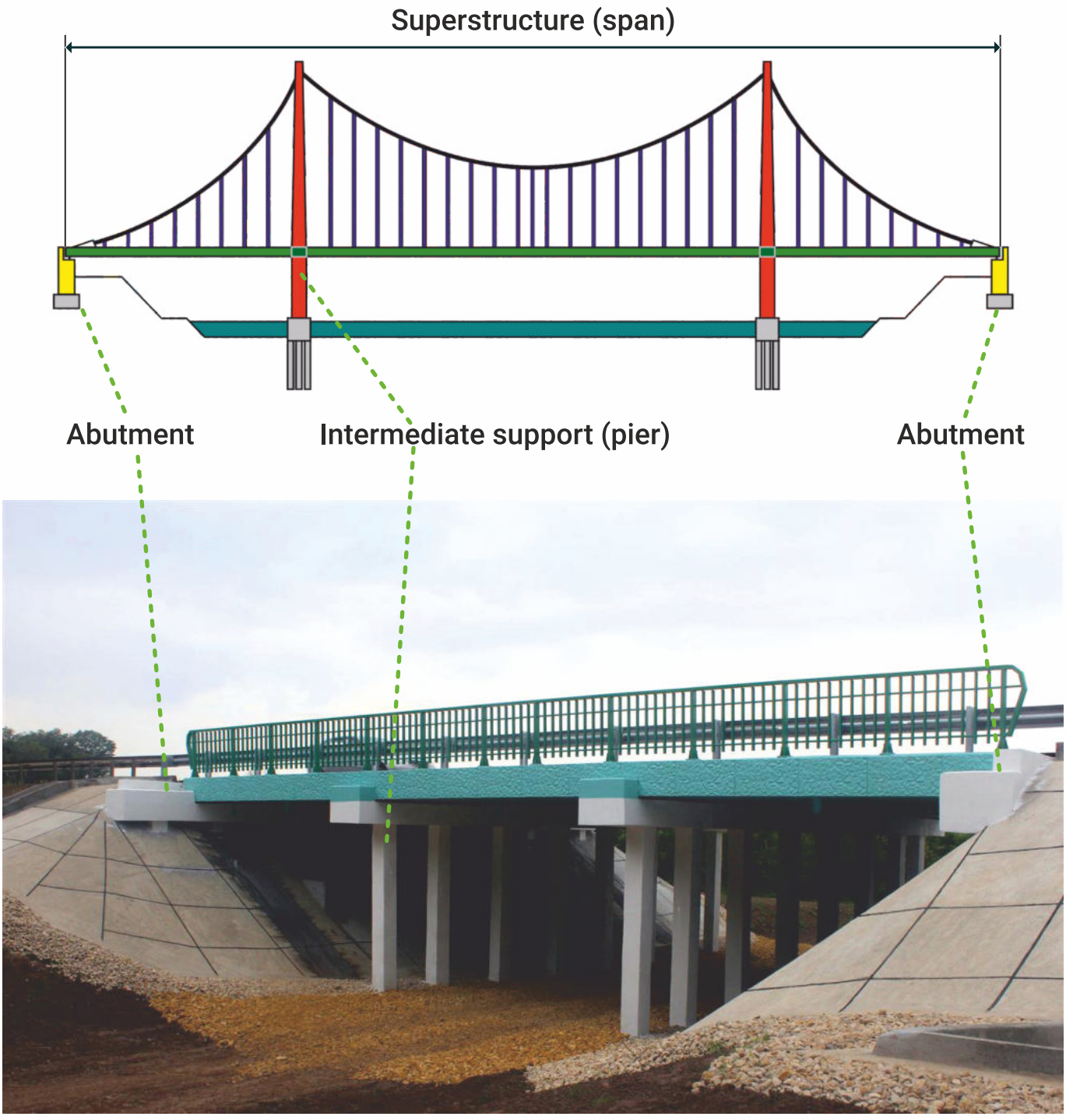
Bridge monitoring principle

Classification of bridges according to the scheme of static operation of the span

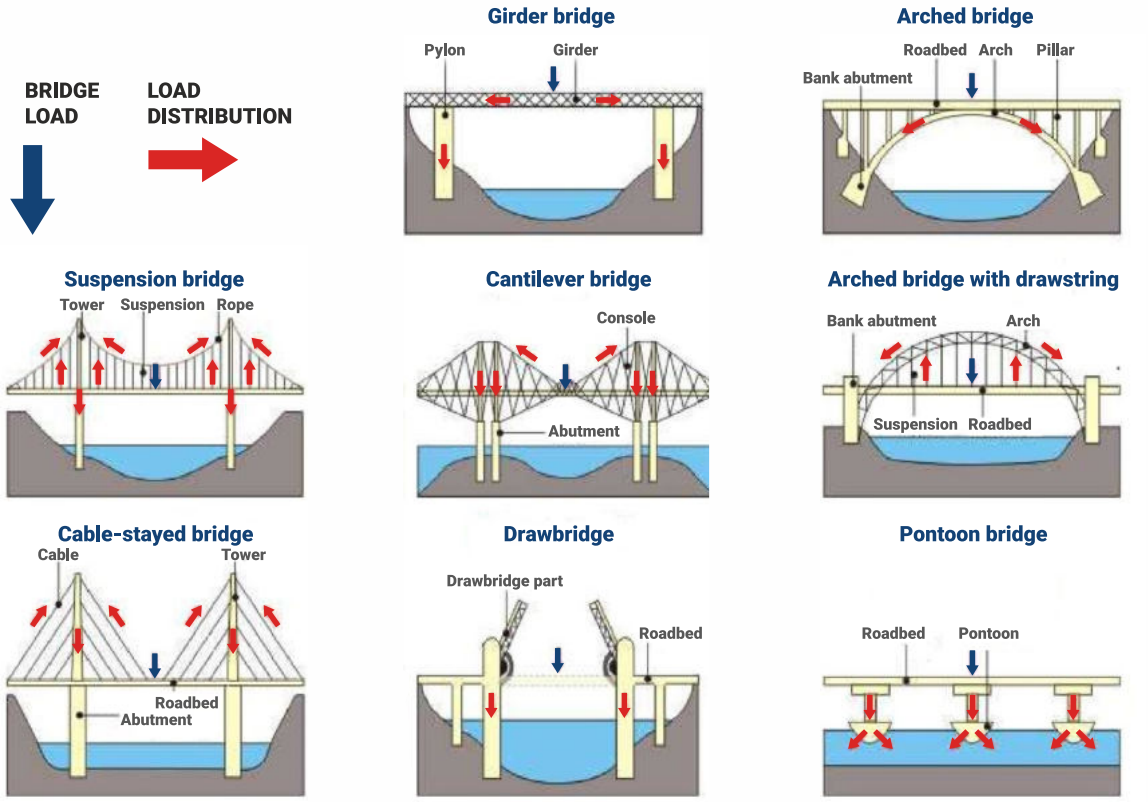
The main elements of a bridge are supports and spans.

The span is the main load-bearing structure designed to absorb permanent and temporary loads from road traffic, human traffic, rolling stock and transfer them to the supports.

The support part is designed to provide deformation freedom of the span and transfer the load from the span to the support in a strictly fixed place.

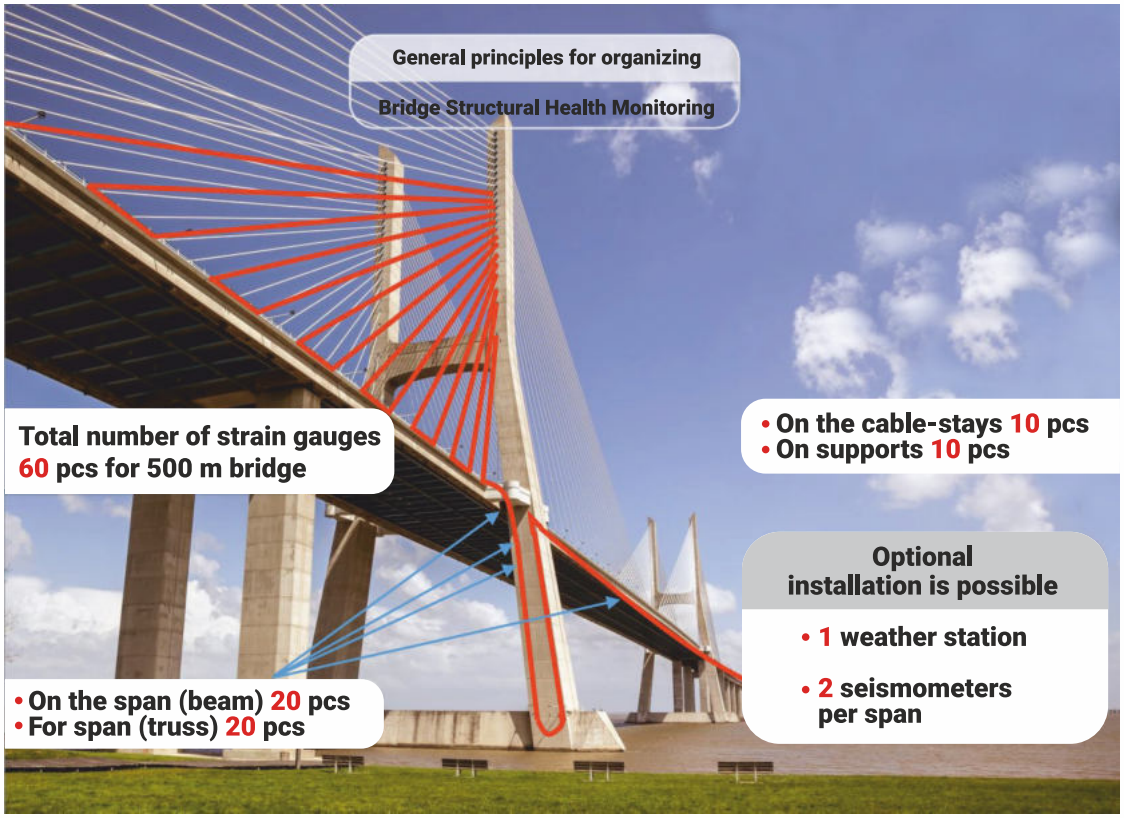


Basic schemes of bridge loads



General principles of bridge monitoring system organization

Based on the above described bridge design, the following monitoring system configuration is optimal:



The specified distribution is only general. The exact number and installation locations are determined by the design solution.

Tunnel monitoring principle

Tunnels are complex and expensive artificial underground structures with lengths significantly exceeding their transverse dimensions. Tunnels are designed for the traffic passage, communication placement and other purposes for a significant period of operation.

Classification of tunnels by purpose:

Tunnels on the passage-ways (transportation):

- railroad
- subways
- urban underground railroads
- navigable, historically earlier than others appeared on communication routes
- road tunnels, including urban tunnels for street traffic interchanges
- combined transportation roads for simultaneous passage of different modes of transportation
- crosswalks under city streets

Classification of tunnels by location:

- Mountain tunnels: constructed in mountainous terrain to overcome high altitude obstacles
- Urban: constructed in cities under streets, squares, built-up neighborhoods
- Underwater: constructed to overcome water obstacles

The main types of tunnel loads

Loads and impacts:

Permanent loads:

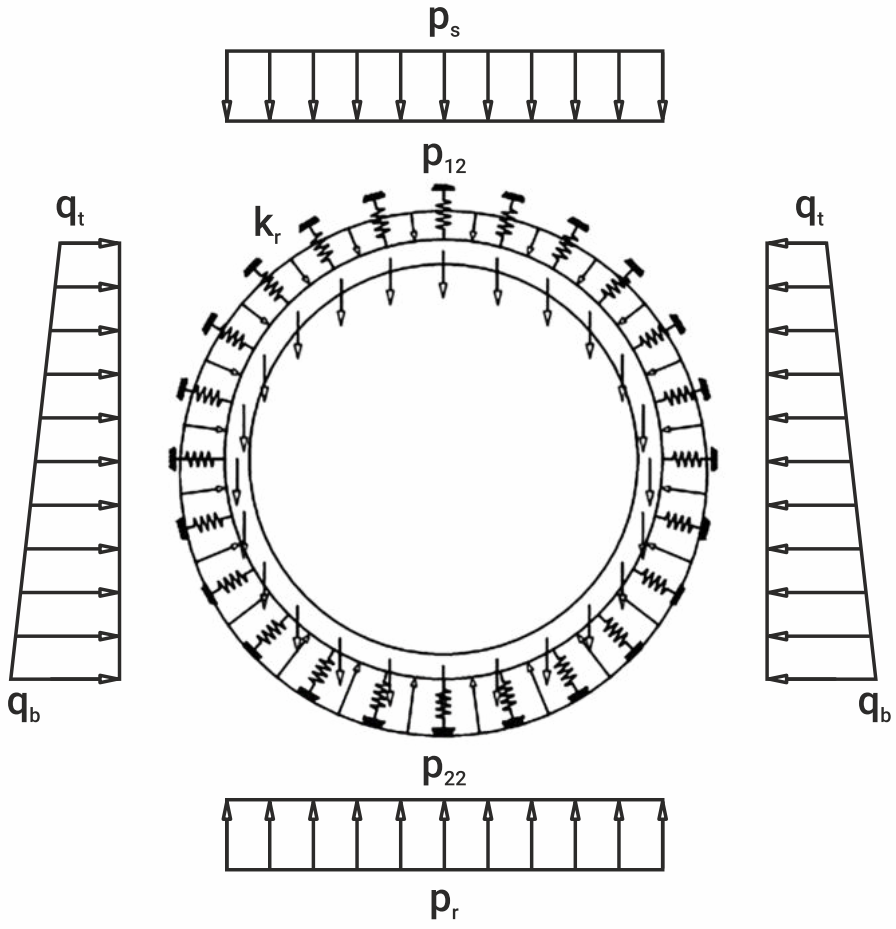
- dead weight of the structure
- hydrostatic pressure
- ground pressure

Short-term loads include:

- loads and impacts from intra-tunnel and surface transportation (during tunnel operation)
- construction and installation loads (jacking pressure, weight of lifting and transportation equipment, etc.)

*Special loads include seismic and explosive effects as well as non-uniform deformations of foundations.

Loads applied on the tunnel linings

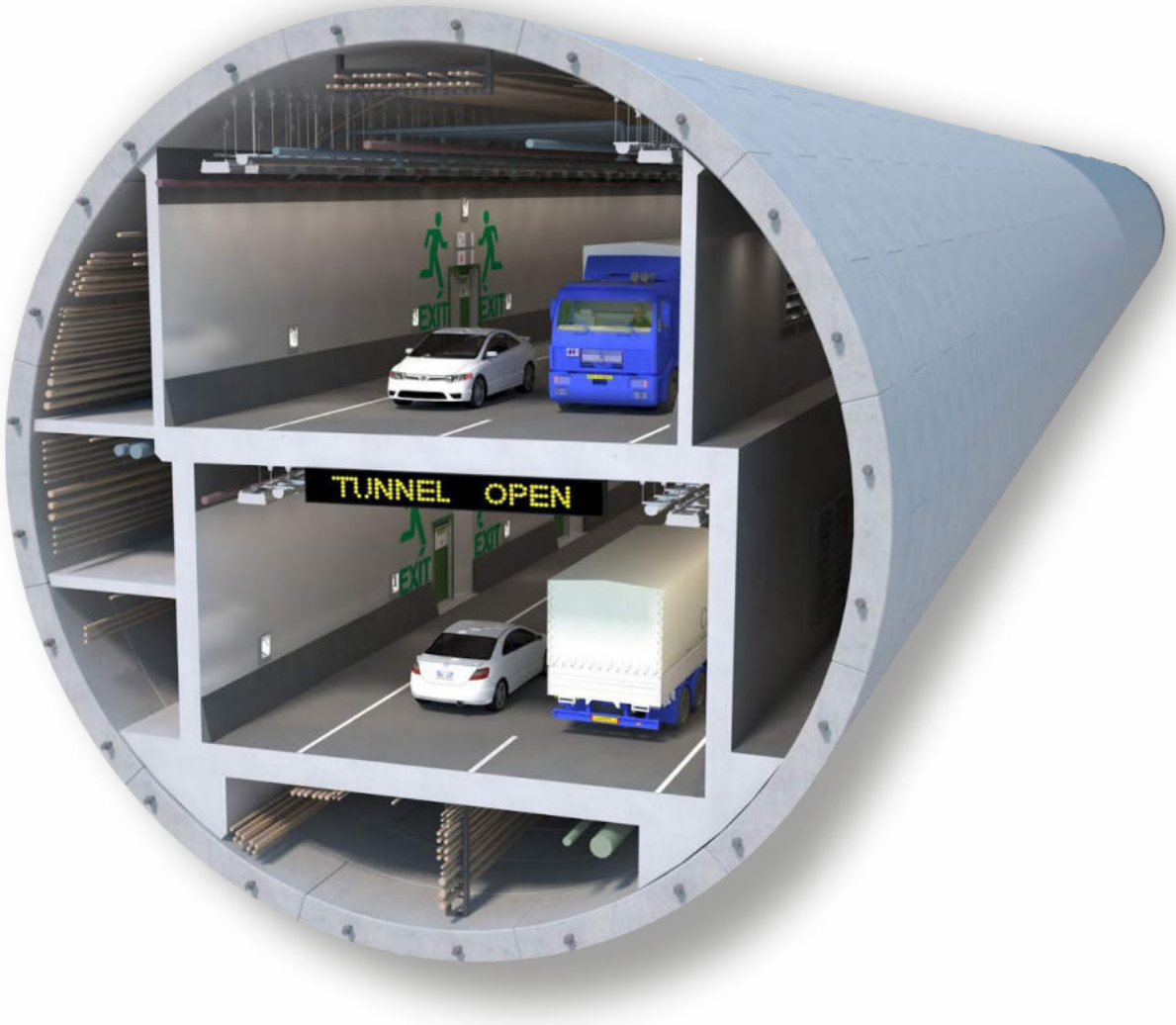


**The load pattern is a combination of structural design and external loads.

General principles of tunnel monitoring system organization

In order to ensure comprehensive safety during construction and operational reliability during subsequent operation of transportation tunnels, it is particularly important to continuously monitor the deformations and stresses occurring in the surrounding soil mass.

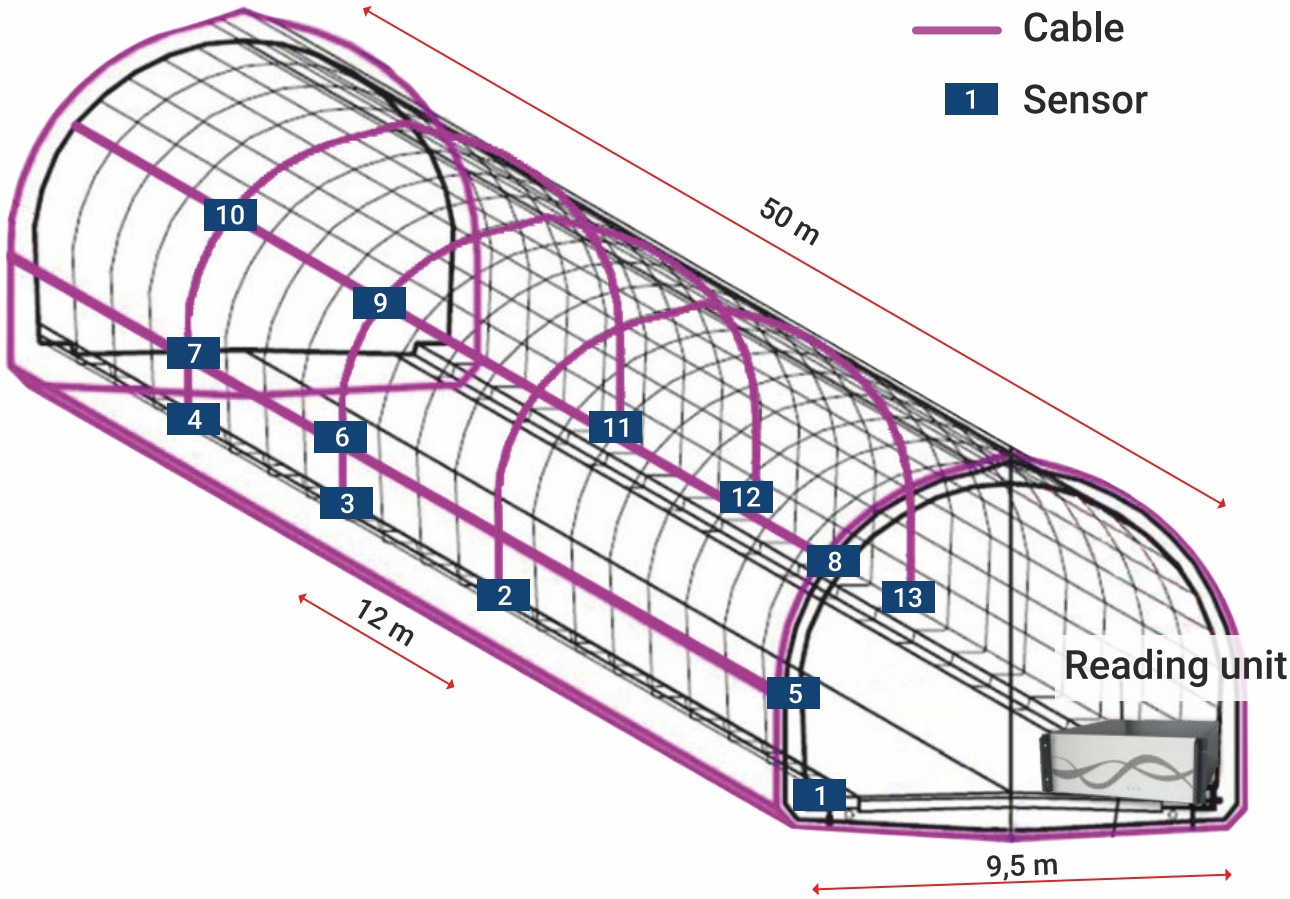
The settlement of the soil mass caused by tunnel construction depends on: the size and depth of the tunnel, the methods and speed of mining operations, hydrogeological and geological conditions, the timeliness of filling the voids behind the tunnel lining and a number of other factors.



Example of arrangement of strain gauges in a tunnel section

The automated monitoring system is a group of deformation sensors, which allows to determine a wide range of data from both the tunnel itself and the surrounding soil mass. One of the significant advantages of this approach is the flexibility in selecting the number and location of the system sensors at the site.

High accuracy of measurements is related to the characteristics of the sensors used and the mathematical algorithm of the programs used in their processing. Based on the obtained monitoring data, recommendations are developed to ensure regular and safe operation of the transportation tunnel.



Dispatching and analytics

Example of usage Bridge Structural Health Monitoring System (SHMS)

“Initiation of a report on a violation of the structures normal technical condition"

Context: A dispatcher is viewing the interface and sees the color indication on one of the sensors change from green to yellow.

Level: User Objective

Primary Actor: Bridge dispatcher

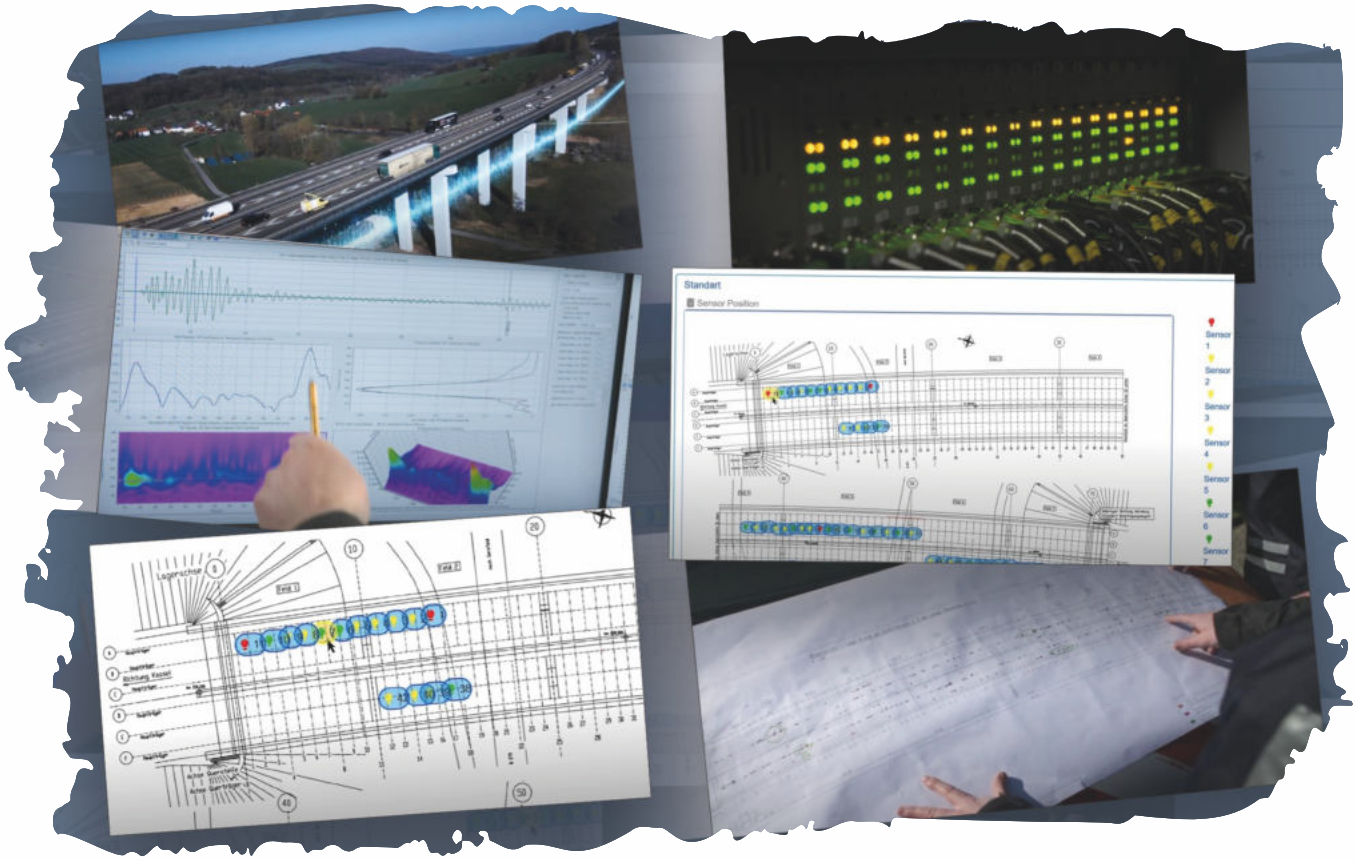
Scope: Bridge Structural Health Monitoring System (SHMS)

Stakeholders and Interests:

- The dispatcher wants to:
  - Inform the operations supervisor of the event;
- The chief operations manager wants to:
  - verify that the bridge is safe to operate
  - inform the supervisor of the dispatch center

Guarantees of success:

Stakeholders are informed, technical condition of the structure is determined, unscheduled operation restriction is eliminated.



Main scenario:

The dispatcher initiates a visual inspection of the structural condition at the sensor location

After completing the visual inspection report, the dispatcher reports the system alarm to the bridge operations supervisor

The Chief operations manager engages the Bridge Structural Health Monitoring System (SHMS) developer for scientific support (database analysis)

Based on the results of the database evaluation, taking into account the recommendations received, the Chief operations manager generates a comprehensive report and sends it to the dispatch center manager

If necessary, instrumental inspection is initiated, after which measures are taken to restore the serviceable condition of structures in a planned manner

CLOUD SOLUTION FOR DISPATCH CENTER

Bridge Structural Health Monitoring System (SaaS) is a new class of ready-made cloud-based solution for regional dispatch centers in a single interface, which allows to collect data from distributed bridges of the region, remote monitoring and assessment of technical condition of any number of objects simultaneously.

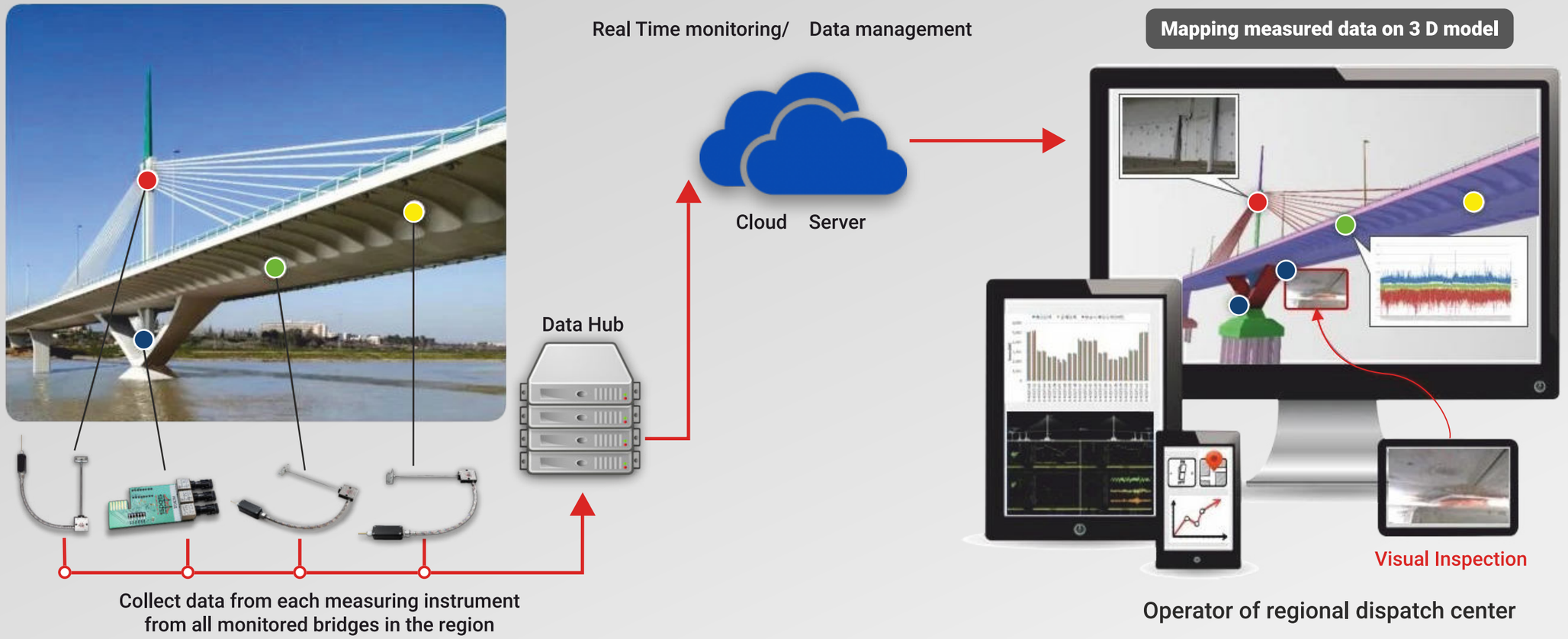
Deployed in the dispatch center data processing center or Cloud-server, Bridge Structural Health Monitoring System (SaaS) monitoring software complex provides users (operators of regional dispatch centers) with access via SSH remote access network protocol to the north of data processing, which is received simultaneously from all monitored bridges in the region.

If the sensor indications are exceeded, the system will not only color the problem area of the bridge on the dispatcher's workstation, but will also generate an entry in the regional dispatcher's event log with the name and location of the bridge, type of event, response regulations and contact details of the responsible person at the site.

Bridge Structural Health Monitoring System (SaaS) allows to register messages from the public about observed hazardous situations or detected defects, to set operational control tasks on their basis, to communicate them to the responsible persons of the bridge both via remote access to Web-service and via email messages, and to control their fulfillment.

Advantages of the cloud solution for the dispatch center:

- Affordable, simple, convenient and effective tool for control by regional centers of safe operation of bridges of the whole region
- Cost savings on implementation and support of your own full-fledged bridge monitoring system (payment by subscription)
- Reduction of maintenance and repair costs through quality bridge condition management



PROVEN TECHNOLOGY AND EXPERT SOLUTION DEVELOPERS

Scientific basis, years of research and proven monitoring methodology adopted at the state level.

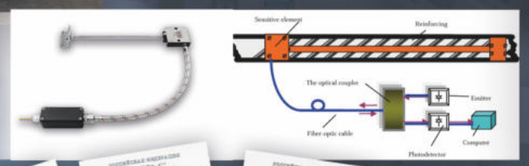
The methodology of bridge and tunnel monitoring we use is based on the experience of research and development work in the field of technical monitoring of complex structures and systems over the last twenty years, as well as state industry normative and technical documents (GOSTs, SNiPs, Rules, Guiding Documents, etc.), some of which were co-authored by Bridge Structural Health Monitoring System (SHMS) developers.

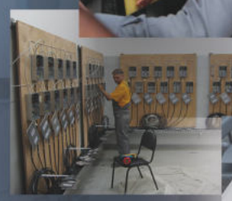
This Bridge Structural Health Monitoring System (SHMS) methodology was developed by the author's team of developers of Monitoring-Center Scientific and Production Company - leading Russian physicists - specialists in the field of next-generation control and measurement systems, using many years of practical and theoretical experience of construction scientists. Monitoring-Center specialists have developed a series of systems for monitoring the condition of building (including bridge) structures based on fiber-optic sensors.

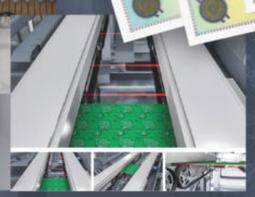
Russian Federation Patent No. 2290474 "Method of control and diagnostics of a construction element"
Russian Federation Patent No. 66524 "Structure in which the possibility of complex monitoring of the structure is provided"
Russian Federation Patent No. 57893 "Strain measurement sensor"
Russian Federation Patent No. 64772 "Optical Strain Sensor"
Russian Federation Patent No. 63928 "Fiber optic sensor for remote measurement"
Russian Federation Patent No. 2319941 "Stress Determination Means"
Russian Federation Patent under application 2006122050 "Strain meter and methods of strain measurement (variants)"

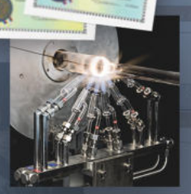
SMIS Expert has extensive experience in the development of special software and implementation of software and hardware complexes (systems) for continuous monitoring of bridge structures at all stages of their life cycle using high-precision measuring instruments and software developed by the company

SMIS Expert is a member of the state technical committees TC 071 and TC 269 and participates in the development of the most important regulatory and technical documentation governing the development and implementation of monitoring systems for construction projects. We closely cooperate with the leading Research and Development Institutes (R&D)

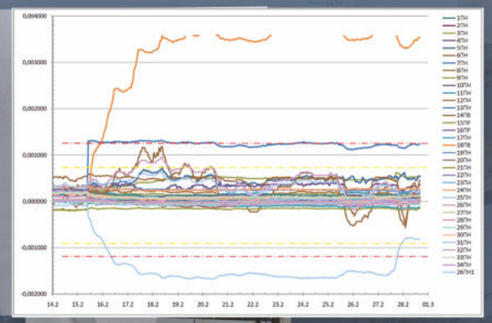


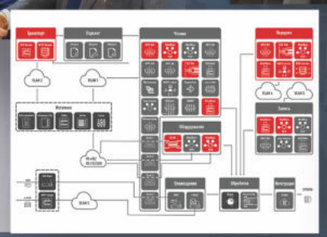






Example of emergency situation registration by the Monitoring System. Destruction of farm elements as a result of an accident





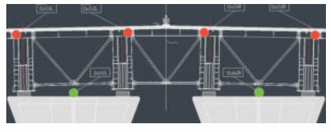
COMPLETED PROJECTS - CRIMEAN BRIDGE

The task to build a road and rail bridge across the Kerch Strait was set by Russian President Vladimir Putin for the Ministry of Transport on March 19, 2014.
After the Republic of Crimea became part of the Russian Federation, a transportation artery connecting the mainland and the peninsula was needed for stable cargo and passenger traffic.

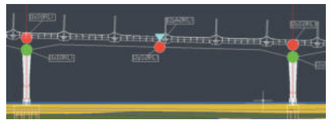
Project tasks:

- Development of working documentation
- Implementation of the structured monitoring system for engineering systems and structures of the Kerch Strait road transport crossing
- Construction and assembly works for installation of equipment

The monitoring system includes a suite of sensors:

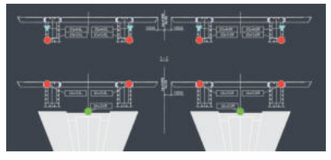


- strain gauges. Strain gauges measure tension in structural elements subjected to static and dynamic loading. Installation locations - on the arch arch vault and the lower chord of the arch span



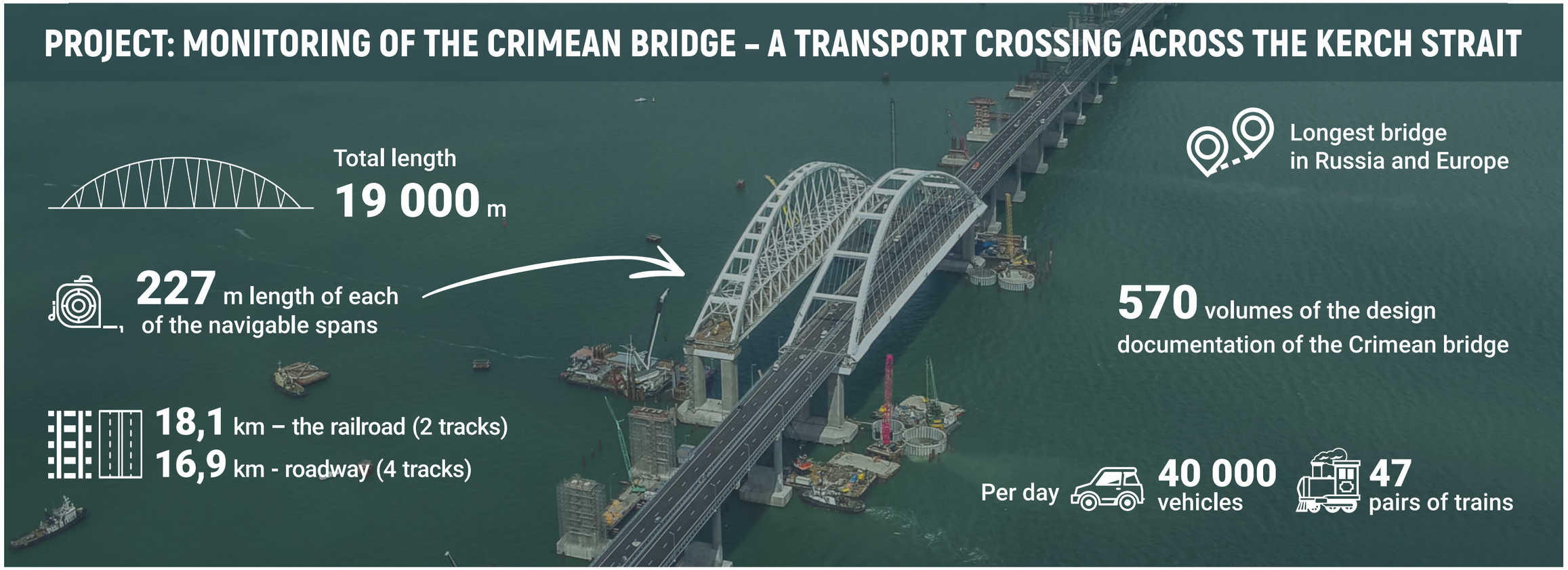
- accelerometers. The sensors measure vibration /acceleration within specified limits, make it possible to analyze the shape of vibrations. They are installed on flexible hangers, arch arch vaults and the lower chord of the arch span

- inclinometers. The sensors are designed to measure small angles of inclination and inclined displacements of the object along two coordinates. The installation locations are sub-floor platforms of the bridge fairway piers



- anemometer (weather station). The device measures wind speed and direction, precipitation volume, atmospheric pressure, air temperature and relative humidity. The place of installation is in the upper point of the arch

All these elements are connected into a single system that improves the safety and efficiency of the Crimean Bridge operation.place of installation is in the upper point of the arch



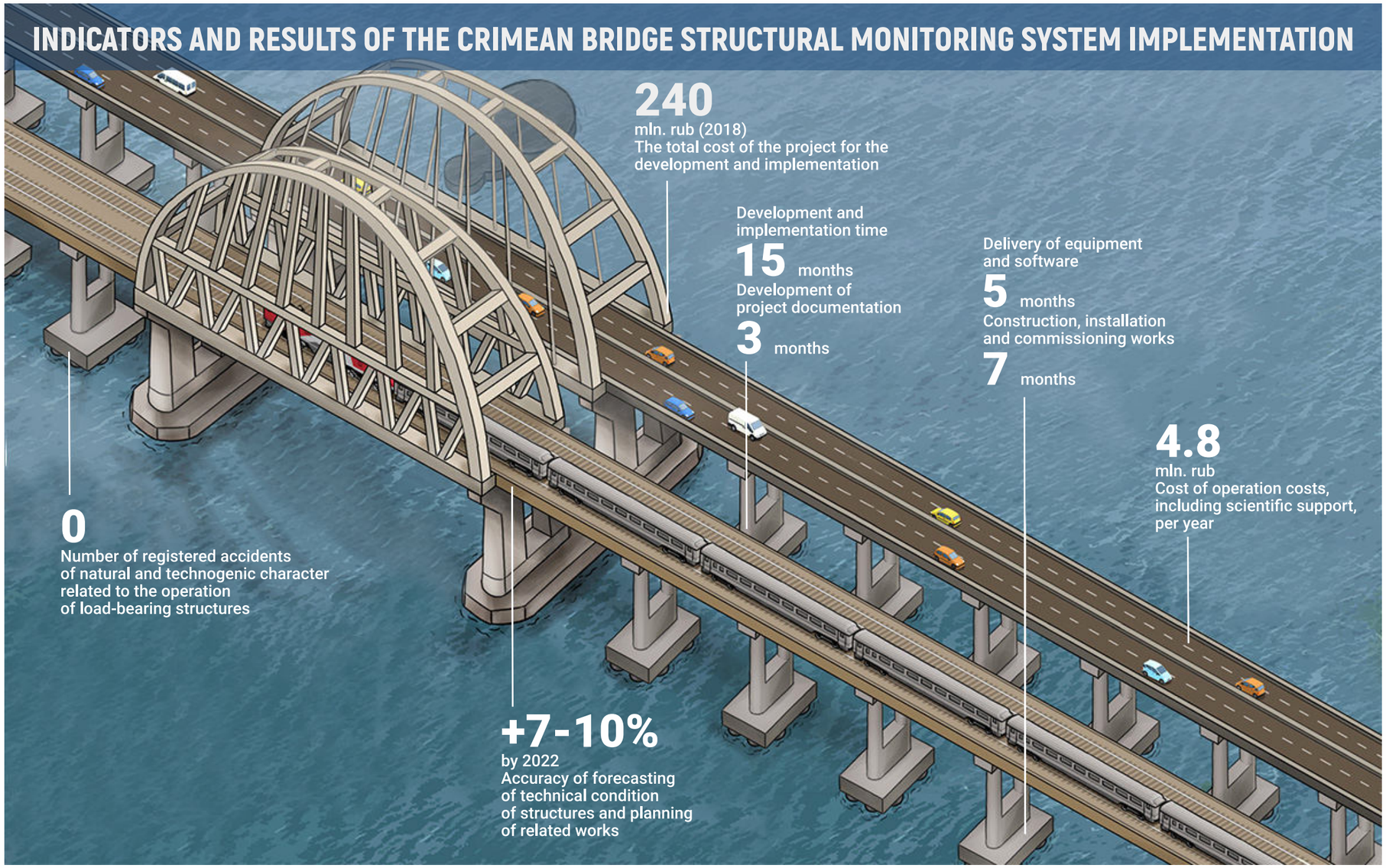
COMPLETED PROJECTS - CRIMEAN BRIDGE

Results and prospects:

IIn 2015, the team of "SMIS Expert" and "Integrated Monitoring Systems" Scientific and Technical Center developed all documentation for monitoring system of engineering systems (MOES) and monitoring system of engineering structures (MSES) for the Crimean bridge.

All control over the integrity of bridge crossings is carried out from a single dispatch center in real time. The operator automatically receives information about the stress-strain state of the bridge structural elements and for prevention of their transition to a limited serviceable or emergency state.

When developing the bridge project, the designers determined the permissible range of deformation values, vibration frequencies and inclination angles of the most critical structural elements arising from vehicular loads, wind loads and earthquake loads. And monitoring of engineering structures helps to ensure safe operation of the bridge in real time.



Customer review

To the General Director
of SMIS Expert LLC
Sergey Andreevich Levin

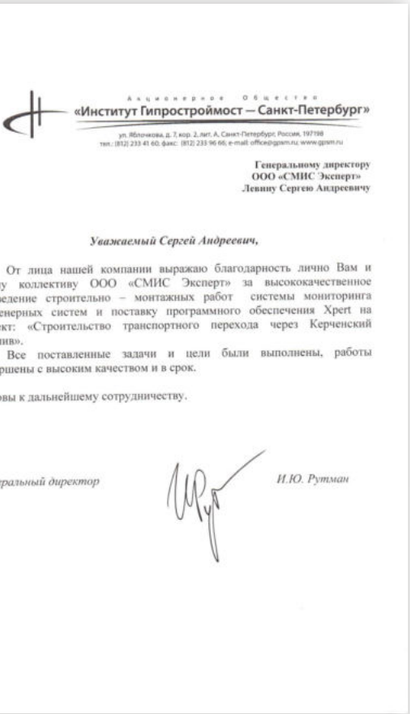
Dear Sergey Andreevich!

On behalf of our company I would like to express my gratitude to you personally and the entire team of SMIS Expert LLC for high quality construction and installation works of the engineering systems monitoring system and delivery of Xpert software for the "Construction of the Kerch Strait Transportation Crossing" project.

All set tasks and goals were fulfilled, the work was completed with high quality and on time.

We are ready for further cooperation.

Director General: I.Y. Rutman
"Institute Giprostroymost - St. Petersburg" JSC



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Генеральному директору
ООО «СМИС Эксперт»
Левину Сергею Андреевичу

Уважаемый Сергей Андреевич,

От лица нашей компании выражаю благодарность лично Вам и всему коллективу ООО «СМИС Эксперт» за высококачественное проведение строительно – монтажных работ системы мониторинга инженерных систем и поставку программного обеспечения Xpert на объект: «Строительство транспортного перехода через Керченский пролив».

Все поставленные задачи и цели были выполнены, работы завершены с высоким качеством и в срок.

Готовы к дальнейшему сотрудничеству.

Генеральный директор *И.Ю. Рутман*

COMPLETED PROJECTS - THE BRIDGE OVER THE MOSCOW CANAL

1.5-kilometer bridge over the Moscow Canal (CRR. Launch Complex No. 3) is the largest artificial structure of the entire Central Ring Road (CRR).

Parameters and tasks of the bridge structural monitoring system:

The main parameters of load-bearing structures are continuously monitored in real time.

The main parameters to be monitored are:

- absolute and relative displacement of structures
- dynamic parameters (dynamic coefficient) affecting structural wear
- stress-strain state of the span, including the truss

Total weight of steel structures
9500 tons

Center span length
150 m

Height at peak point
28 m

Total length
1410 m

The bridge crosses 4 transport arteries at once

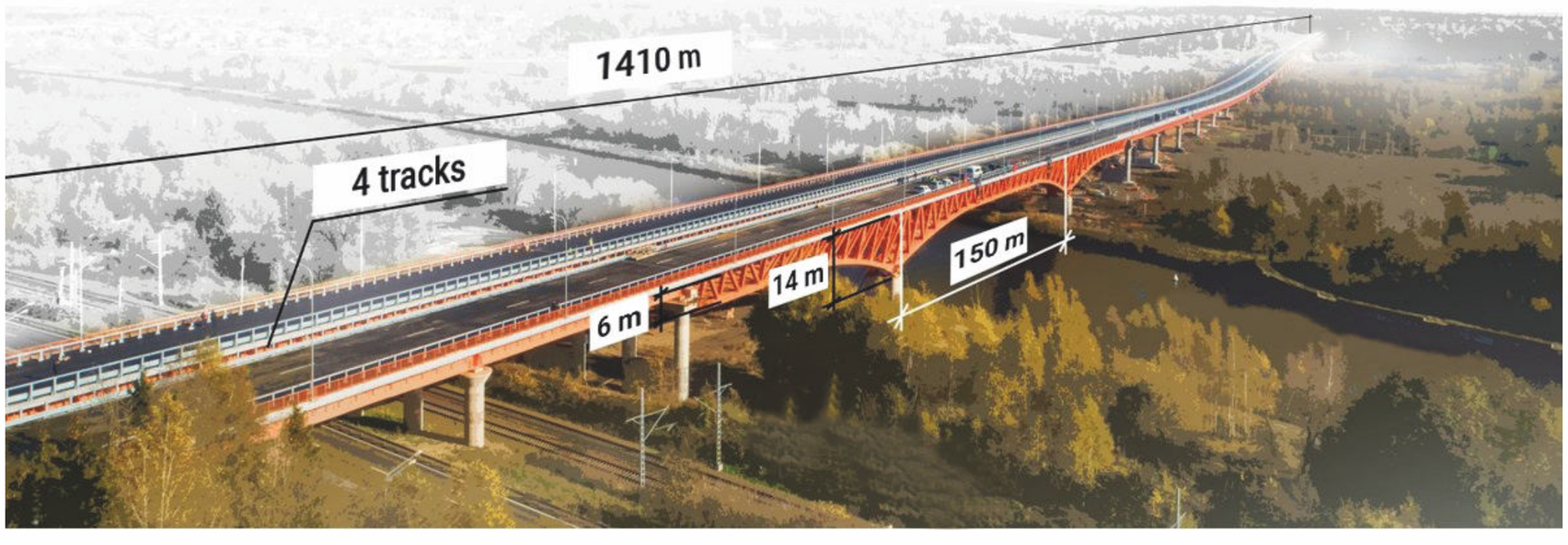
- Dmitrov highway
- Savelovsky railway tracks
- The Moscow Canal
- Regional highway 46K-8221

CRR-3 - the longest section of the Central Ring Road.

It is part of the Europe-Western China international transportation corridor.

Total length
105.9 km

Traffic intensity
40,000 vehicles/day



The structure of the monitoring system includes:

- automated working station (AWS)
- information processing and interfacing server
- local controllers (Analog-to-digital conversion (ADC)
- cable networksubsystem for monitoring of structures
- structural monitoring server
- sensors for monitoring changes in the engineering (load-bearing) structures condition

The system transmits information to:

- to the facility officials (in the form of SMS messages)
- to the regional duty dispatch service (in the form of XML messages)

Technical solutions:

Diagnostics of stress-strain state of bridge spans is performed by strain gauges, which are installed on the most loaded elements of the structure.

Bridge truss deformations are monitored at the most loaded and subject to maximum deformations points of the truss: the support strut on the piers, struts and struts in the zone of truss height change in the span between the piers.

Dynamic diagnostics of span is carried out with the help of accelerometers installed in the middle of each span, which provide determination of the reaction to the impact of vehicular traffic and other external factors.

Smart Bridge Diagnosis Systems

Enabling quick and informed decision making for immediate action by bridge operators