METHODOLOGY FOR DISTANCE AUTOMATIC ON-LINE MONITORING OF BUILDINGS AND ENGINEERING CONSTRUCTION FRAMES

COORDINATING CENTRE: ECNTRM, Moscow, Russian Federation

REPORT ON THE RESULTS OBTAINED WITHIN THE COORDINATED PROJECTS FOR 2014

The Brochure layout "**Methodology for Automated Real-time Monitoring of Load-bearing Structures of Buildings and Constructions**" was prepared in Russian and translated in English. There was given more precise title of the Methodology from the linguistic point of view.

The load-bearing structures of buildings and constructions (further on referred to as 'facilities') are subject to wear-caused loss of operability. Exploitation of facilities with damaged construction elements may lead to emergencies, which are likely to cause loss of life. This is confirmed by unexpected collapses of facility construction elements in Russia, Germany, Poland, and other countries, which resulted in extensive casualties.

The methodology is designed for setting up an automated real-time system for monitoring load-bearing structures of buildings and constructions. This system will provide the respective services with remote real- time access to the information on the condition of the load-bearing structures of buildings and constructions, and therefore save the facility from collapsing unexpectedly.

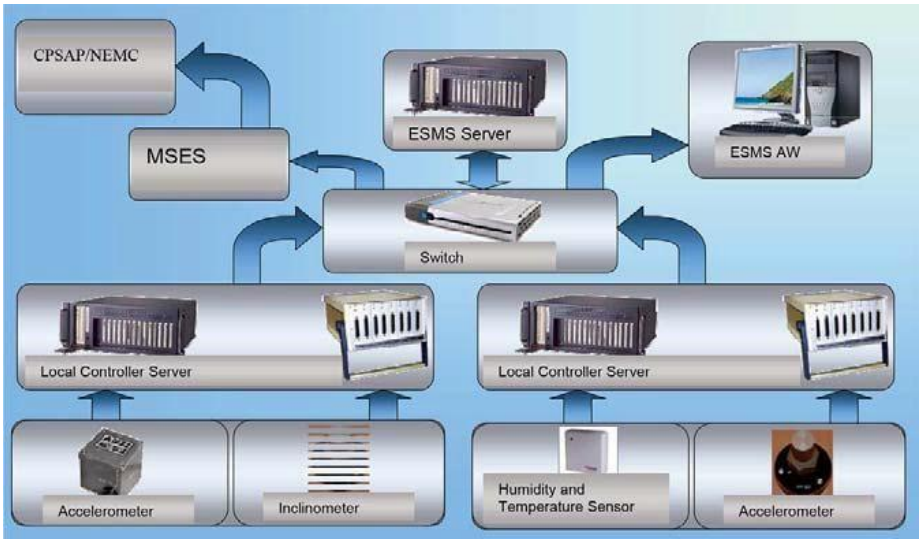
The methodology is designed for the institutions providing scientific and technological support for development and exploitation of the systems for automated monitoring of loadbearing structures of buildings and constructions and also for the companies monitoring the facilities under exploitation.

The ESMS is designed for:

– Timely automated remote notification of the emergency and dispatching services on the condition of the facility's load-bearing structures, using the following criteria: 'normal condition', 'higher risk', 'emergency';

– Monitoring and documenting changes in the condition of the load-bearing structures caused by accumulated exploitation defects, which may lead the building or construction to an extreme condition mandating corresponding repairs or bringing the operation to a halt, throughout the whole facility operation period.

The ESMS structure is illustrated by:



The ESMS is comprised by equipment for monitoring changes in the condition of foundations and engineering structures of buildings and constructions; engineering protection facilities, and also, if there is any corresponding hazard, for monitoring the areas of possible mudflows, mudslides and avalanches in the building or construction operation area. It includes:

– ESMS servers, local servers and controllers;

– ESMS automated workstations (AW);

– Data gathering and transferring network equipment;

– Sensors monitoring changes in the condition of foundations and engineering structures of buildings and constructions; engineering protection facilities, and also areas of possible mudflows, mudslides and avalanches.

The ESMS has the following functional subsystems:

1) The signaling monitoring subsystem, which continuously operates:

– To monitor the integral characteristics of the facility loadbearing structures in an automated real-time mode;

– To notify the facility operations control desk and CPSAP personnel on the critical changes in the condition (deformed condition) of the facility structures in an automated real-time mode;

2) The intermittent monitoring subsystem, which is launched by notifications (incident, accident) coming from the signaling monitoring subsystem or under a regulation. In an automated mode it:

– Assesses the technical condition of the facility load-bearing structures and issues recommendations for reinforcement (reconstruction);

– Controls and adjusts (if necessary) the signaling subsystem.

ESMS installation is advisable for the following types of facilities:

– Facilities constituting nuclear and/or radiation hazard (nuclear power plants, research reactors, fuel cycle facilities, temporary and long-time warehouses for nuclear fuel and radioactive waste), facilities using nuclear energy;

– For production, use, processing, generation, storage, transportation and disposal of hazardous materials in the volumes exceeding the limits under the Law;

– For chemical and other hazardous waste disposal and burial;

– Having large warehouses for storage of oil and oil products (over 20.000 tons) and isothermal storage facilities for liquefied gases;

– For production of melts of ferrous and nonferrous materials and alloys based on these melts;

– For mining, minerals processing, subsoil operations, including companies performing subsoil and open-pit (mining depth over 150 m) extraction and processing of solid minerals;

– Using cableways and funiculars;

– For production, generation or processing of liquid or solid materials with explosive features or prone to spontaneous decomposition with a possible explosion energy equal to 4.5 tons of TNT;

– Power transmission lines and other grid facilities with the voltage of 330 kilovolts or more;

– Space infrastructure facilities;

– Airports and their infrastructure facilities;

– Public railway system facilities;

– Metros,

– Sea ports excluding specialized sea ports for sports and pleasure boats maintenance;

– Thermal power plants with the capacity of 150 megawatts and more;

– Offshore oilfield facilities;

– Mainline gas, oil and product lines;

– Gas distribution system facilities using, storing or transporting natural gas or liquefied hydrocarbon gas;

– Waterworks of class 1.2 and 3;

– Large industrial facilities with more than 10.000 workers;

– Capital construction facilities with the design documentation comprising at least one of the following features: height over 100 meters; flights over 100 meters; console over 20 meters;

– With depth of the subsoil part (in full or in part) more than 10 meters below the grade (ground) elevation;

– With constructions and construction systems, which have unconventional design methods applied to them to consider physical or geometric non-linear features or have specialized design methods developed for them;

– Facilities with maximum design capacity of 500 people and more: entertainment, sports facilities, multifunctional office centers and shopping malls, health facilities, hotels;

– Life-supporting facilities: units, warehouses, storage facilities, waterworks and engineering protection facilities and communications whose destruction (damage to) may disrupt the life of people (stop water, gas, heat, power supply, cause flooding, damage residential communities, cause failure of waste water and sewage water treatment facilities) resulting in an emergency.