TRACKING TIME BEHAVIOR IN BRIDGE – GENERAL CONSIDERATIONS

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***Abstract**: The substantial increase in the volume of civil, industrial, socio-cultural, hydraulic engineering, communication paths, etc., gradual substitution of traditional construction assembly and implementation of new processes put in front professionals need knowledge of the changes in more detail forms and position geometric constructions in space, both during the drafting of execution attempts elements and structures construction and execution during construction and operation. In the criminal behavior of buildings and land, the term construction will understand not only the building itself but also buildings, dams concrete, arocaments or earth dams, roads, warehouses and waste dumps, tailings ponds.*

***Keywords:** execution, exploitation, deformations, displacement, verification*

1. Introduction

Through ongoing collaboration branches of engineering, construction activity correlates very often supplemented with the adoption and application of geodetic methods and technologies that come to record, process and represent the behavior of buildings subjected to various disturbing factors.

Construction behavior monitoring is an activity that consists in measuring, recording, processing and interpretation of parameter values that define extent that buildings retain their requirements for strength, stability and durability.

2. Objectives of construction behavior

Construction behavior objectives are:

a) ensuring the safety and durability of construction, the timely detection of phenomena and the areas where they occur;
b) monitoring the development of predictable phenomena with possible adverse effects on the ability to service;
c) to achieve operational alert warning criteria or limit values given by instrumentation and control;
d) verify the effectiveness of all intervention measures applied;
e) verify the impact of construction on the environment;
f) providing a large volume of data and statistically safe

Depending on the class of constructions, the magnitude of movements per unit time (travel speed) and the real need for precision offset values, the buildings can be divided into three groups of precision. This degree of accuracy required for determining object displacements points as follows:

- Ord. 1 Precision - includes construction whose movement isϖ determined with an accuracy of a millimeter high dams of concrete and local materials (H> 50m), hydro, turbine foundations, galleries and underground chambers.
- Ord. 2 accuracy - includes construction whose movement is determined with a precision of 1-5 mm dams and rockfill dams in the lower PAAM or important components of pressure, service buildings, crane runways, high building
- Ord. 3 Precision - includes construction whose movements determineϖ with accuracy 1-2 cm: slam deposits, deposits of building materials, waste dumps, dams of land around reservoirs.

3. Verification Phase of Construction Execution and Exploitation

In the verification phase of construction execution and exploitation main goal is establishing behavior in time of construction under the action of a particular assay system such as: stress, displacement, displacement static or dynamic spins, bending moments, shear , axial forces. Only some of these quantities may arise directly or recording of indications provided by instrumentation, which constitute measurable quantities. Other sizes are to be deducted based on existing mathematical relationships between different sizes which characterize the behavior of a building.

In view of criminal behavior construction, will go through the following steps:

- geodetic network design and implementation tracking, tracking marks consisting of M and fixed points (S observation stations, checkpoints orientation points C and A); required before commissioning the construction or during use them when necessary restoration tracking network or impose supervision of the construction of new parts;
- topo-geodetic measurements in order to determine the horizontal and vertical movements;
- measurements processing and interpretation of results.

Depending on the placement of the instruments during the research, there are two kinds of methods to determine the displacements and deformations of construction:

- Physical methods;
- Geometric methods.

If physical methods of measurement appliances are installed in the building structure, moving with the construction as a whole as such can be measured displacements and deformations possible relative. Measurements of this kind can be made using mechanical, physical, electrical or electronic. In this case we can say that a model is defined relatively, because there is external support points, with only determinations of relative movement between points moved the same object. Depending on the parameters to be determined, this group includes:

- measure linear displacements and deformations (subsidence, arrows, horizontal movements) using arrows amplifier, comparator rod, wire comparator (remote transmission of movements);
- measuring angular displacements (rotations) using Inclinometers lever, Inclinometers with spirit level, Inclinometers pendulum;
- measure the relative displacement of sliding caliper or using comparator rod;
- specific strain measurement transducers using strain gauges and strain gauge electrical, mechanical, optical, mechanical, pneumatic or electro fotoelastice (with vibrant chord);

- measurement of displacements, velocities, accelerations and dynamic deformations using vibrometer, vibrografy, accelerographs seismic accelerometer electrodynamic or piezoelectric resistive sensor type seismometers, magneto recorder, oscillograph cathode; measuring deformations using teledilatometry expansion joints, heart micrometer.

In order to perform performance monitoring construction, carry out surveying reporting the position of points rigidly fixed to the building, called trademarks tracking (M) fixed (S, C and A), located outside the building, on land stable and outside the area of influence of the construction, these two categories at follow-forming network. These methods are obtained absolute sizes of displacements and strains construction.

4. Determination of Displacements and Deformations of Construction

There are two possibilities for the determination of displacements and deformations of construction, depending on the placement of the instruments during measurement:

- physical methods: with measurement instruments installed in body construction; in this case moving apparatus with the construction as a whole and therefore be measured possible relative displacements and deformations. Measurements of this kind can be made using mechanical methods, physical, electrical or electronic. In this case we say that we have defined a model relative because there outer support points, having only relative movements between points determinations deplsate the same object. Physical methods are widely used to study the construction phase of conception and design, as well as tracking behavior in time of construction;
- geometric methods: in the case when using measurement instruments installed outside the building, measurements will be reported to a network of reference points located outside the area of influence of the factors acting on the building and the land on which it is placed. This procedure will determine the absolute values of horizontal and vertical displacements. The determinations in this category displacements and strains belong geodetic methods.

Topographic methods of measuring the purpose of prosecuting constructions behavior are strongly related to the type of deflections followed.

Depending on the character deformations, topo-geodetic methods are classified as follows:

A. Methods for determining horizontal displacements and deformations:
- trigonometric method-microtriangulation;
- alignment method;
- traverse precision method.

B. Methodology for determining vertical displacements and deformations:
- high precision geometric leveling method;
- trigonometric leveling method for high-precision;
- hydrostatic leveling method.

C. Methods for determining inclination higher buildings:
- vertical design method;
- horizontal angle measurement method, two or more basis points;
- Coordinate method;
- method of measuring horizontal and vertical angles of a single base point;
- measurement method zenith distances smaller two points arranged at the base construction;
- foundation subsidence measurement method.

Using these methods can be done separately or combined, depending on the nature of the parameters that are required to be put out for the construction studied. Tracking behavior in time is done in three ways:

- visually;
- through weekly measurements;
- through topographic measurements.

Visual supervision aims to direct observation of phenomena related scheme seepage and stability of the building, namely:

- a land deformations of the foundation, the beach or outer slope, cracks in the body construction;
- an appearance springs, ponds, wetlands or specific vegetation water surrounding areas;
- an emergence of drug suffusions;
- disorder of water discharged;
- any unusual phenomenon.

Week measurements consist of reading the height of water in piezometers, planted in profiles by drilling performed with drawing stability study. In special cases of exceptional heavy lifting or dangerous levels standpipes curve measurements are made twice a week. Surveying is carried out every 6 months or a year in order to determine the horizontal and vertical movements. In surveying enter the first evaluation of the safety of the building.

Under the forces of gravity of the building, due to changing moisture and soil temperature field the foundation, and from other causes he moves soil particles. As a result of building the foundation soil settles (soil compaction without changing the structure), it swells, it puts (lowering soil layers in the suburbs of rocks) and moves in a horizontal direction (slipping). Appropriate place land movements foundations and parts of buildings.

Building movements can be:

- plan;
- the altitude.

Constructions on elevation movements are called subsidence. If you travel to different points of the building are equal size and direction, they are called uniform, otherwise-uneven. Uneven movements of points are altering the shape and size of the building, so in their deformation. Construction experience has shown that all buildings and constructions are subject to displacements and deformations.

Stationary and non-deformable construction doesn't exist.

After building their character deformations are divided into:

- elastic;
- waste.

If termination of the pregnancy after the initial construction takes shape, the deformations are elastic. The elastic deformations occur until the load does not exceed a limit value determined. If the action task exceeds this limit, the size and shape of the building are restored. In this case the construction is unbalanced sustainability in construction elements appear cracks and ruptures in some cases it is also possible injury or destruction of buildings.

A building application subject to rules determined by its functional conditions, can undergo displacements and deformations:

- linear;
- angle;
- specific.

The subsidence is a vertically down the movements foundations and foundation of land and it may be:

- uniform when every foundation construction moves in the same time with the same value;
- uneven foundation construction points when moving to different values.

This category of deformations are not accompanied by a radical change in the structure of the field.

Leaving the field are deformations that have the character of collapse and are caused by the radical change of the structure of the field. The most common cases are:

- compaction macro porous land where their moisture by large amounts of rainfall;
- affinity compacting sandy land in an earthquake;
- thawing of frozen land that was built etc.

Bulging or lifting is traveling vertically up the foundations of buildings or bottom of the pit dug for the foundation of a building, due to changes in the structure of equilibrium pressures of the foundation soil.

Arrows of construction elements like beams, pillars, slabs, subject to vertical or horizontal load that causes flexing their median axis of respective parts in the central removing from the initial position with a maximum called arrow.

Inclinations are due to uneven subsidence without breaking the integrity of the building geometric elements and their components, in practice being known like tilting and tilting construction of the foundation. Tilting the building is characterized by its axis deviation from the vertical line and the value is expressed by linear, angular or relative.

Tilting the Foundation is its sole flat surface deviation from the horizon and is expressed through a straight or relative size.

Bumps construction maximum subsidence measured by differences uneven installments of two neighboring leaned relative to the distance between them.

Cracks and tears which are breaks in the plane of the building or in separate parts, as a result of non-uniform subsidence and the occurrence of additional stresses;

Horizontal movements of elements of construction or in whole, due mostly horizontal forces (pushing the earth, pushing water) or modification the balance of the construction of the foundation soil. Sometimes measure horizontal movements of areas of land in pursuit of stability. Deformation of works construction are the most common subsidence. The subsidence no influence on the stability and uniform construction stiffness, but when these values are important final settlement that is exceeding the total calculated design or settlement at a certain time, can cause complications the construction and operation to contribute to the emergence of other deformations.

Uneven subsidences are more dangerous than those uniforms and have important repercussions on the integrity and stability of the building.

Deformations are specific elongation or shortening a construction element (piece of concrete, reinforcing a piece of concrete, metal bar etc) under tension or compression effect that item; using the relationship between the stress acting on the play and specific deformation resulting expressed in respect of a maximal efforts by law Heeke his work in elastic material, it can assess the state of existing efforts in the construction element.

5. Deformations Bridges

The deformations bridges are:

a) Arrows

Arrows are calculated using elastic analysis in grouping common shares.

Deformations during execution is controlled so as not to damage the concrete during casting and curing due to its uncontrolled movements and required geometry to be achieved in

the long term. Deck designed so that deformation to be uniform along and have no or sudden changes in cross section leading to increased impact. Avoid sudden changes in slope and level changes on the deck expansion joints.

Vertical deformations are calculated using the appropriate combination of actions and taking into account the operating criteria indicated.

b) Vibration

Vibrations road bridges may have different origins, especially from actions traffic and wind action. Vibrations from wind actions are taken into account where relevant, (especially bridges Hoban where the natural frequency of vibration is close to the frequency of any mechanical excitations produced by wind or passing vehicles over expansion joints). Actions due to traffic vibrations are considered comfort criteria.

For road bridges, checking limit states operating on the deformations and vibrations shall be considered only in exceptional cases. Frequent combination of action is recommended to evaluate strains.

6. Conclusions

The existence of important buildings in our country diverse such as dams, bridges, silos, furnaces, chimneys, cooling towers, tall buildings etc draw after them some deformations that may occur both during construction and after them. Their systematic measurement are of special scientific and practical significance.

7. Bibliography

1. *Neamtu M., Complements of surveying engineering.Institute of Civil Engineering. 1983;*
2. *Dima, N., Pădure, I. - Mine surveying Publishing "Corvin" 1996;*
3. *Dima, N., Pădure I. - Mining Topography, Guidelines for the preparation of the diploma project. Lithography Mining Institute of Petrosani 1974;*
4. *Filimon, R., Botez, N., Surveying General, Technical Publishing House, Bucharest 1958;*
5. *Oprescu, N..ş.a, Manual engineer surveyor, Vol.I-II-III, Technical Publishing House, Bucharest, 1972,1973,1974.*