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The Method of Direct Grading and the Generalized Method of Assessment of Buildings Technical Condition

Olexander Terentyev[1], Mykola Tsiutsiura[2]

[1]Kyiv National University of Construction and Architecture, 31, Povitroflotskiy Ave, Kyiv 03680, Ukraine

Abstract: ***Objective assessment of technical condition of buildings is one of the main objectives of the system of technical supervision. Its implementation is based on periodic and unscheduled inspections of structures with identifying and fixing their flaws and faults, determining the extent of damage (wear) structures and further calculation that summarizes the condition of the structures with respect to their importance in the composition of the object on the technical condition of the latter.***

Keywords: examination, the technical condition of the building, an assessment method category.

1. Introduction

When there is no possibility to determine the values of certain parameters experimentally or registered data rely on subjective assessment. In such cases most often use the opinion of experts. Such an expert should consist of experts with deep knowledge of the process that is modeled and empowered to make responsible decisions. Identifying individual points of view and formation on their basis of consensus of experts can be accomplished in several methods.

2. The Problem

The method of direct estimation is the most common in the practice of decision-making. It allows the examiner to apply a more sensitive instrument intercomparison options. Using this method, the expert seeks to assess the qualitative property criteria indicator in points (pre-set range of changes of this assessment). The latter should reflect the degree of compliance options properties that are considered. Points is an artificial numerical evaluation of qualitative properties.

The entire set of estimates one option solutions experts $\{B_i^l\}$; *l-1,m; l-1,L,* that are assigned to different specialists, can be displayed on the relevant scale. In Fig. 1 shows an example of placement of the ratings option on a property, *L,* is defined by *12* experts. First, you must decide on the acceptability level of mismatch of experts, that are in the range B_1-B_{12}. If the ODA considers it to be valid, the overall evaluation (the result of processing of expert opinions) can be applied National average B_{cep} or the median *M*. [1].

$$B_{cep} = \sum_{i=1}^{m} B_i / m \qquad (2.1),$$

where B_i –the value of the indicator in the evaluation of the *i-th* expert.

All the answers of experts, in ascending order of their values, have a PA to the global scale and determine the areas of optimism (zone 3), zone of pessimism (zone 1) and zone of the average ratings (zone 2). In zone 1 and in zone 2 include 1/4 exhibited evaluations. The median *M* is defined for the Central zone of the estimates.

A necessary condition for the reliability of the obtained estimate is a sufficient level of consistency of expert opinions. It check based on the analysis of the variance estimates between B_1-B_{12}. If the ODA considers unacceptable the degree of divergence exhibited evaluations, the authors of the evaluations included in the zone 1 and zone 2 are invited to argue their point of view. This can be carried out in writing or through joint discussion of the results. After that, the procedure of expert assessment is repeated (Fig. 1).

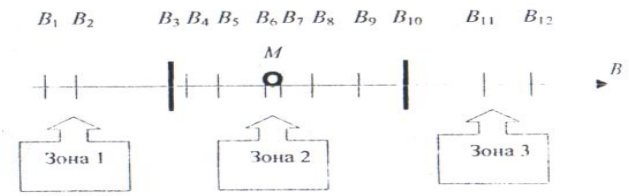

Figure 1: Scale experts

Best solution will meet the condition:

$$max\ \{B_{Jcep}\}\ або\ max\ \{M_j\}, \qquad (2.2),$$

where M_l - the median estimate of experts of the *j-th* solution.

As noted earlier, some possible variants of the method of direct grading. For example, instead of using medians and areas of the state can take the average value and the standard deviation.

In this case, the coordinator informs the members of the group in each round the average value and medium square deviation and asks them to briefly justify all assessments that differ from the mean by more than the standard deviation (in either direction). Of course, we assume that opinions will have a normal distribution about the mean value, and this assumption is not necessarily fair. Surveys can be repeated until then, until the standard deviation decreases to a predetermined value or until it becomes clear that a further reduction in the variance of the estimates will be.

The method of direct estimation, involving the anonymity of the views the processing of results, controlled feedback, numerical evaluation and statistical definition of group assessment, promises to be a valuable research tool for developing simulation models.

Experiments based on this method showed the following:

1) Personal discussions do not give as effective a resultant, as a method of direct grading.
2) The accuracy of the estimate improves with the increase in the number of group members and the number of iterations.
3) The accuracy of the estimate decreases with increasing time interval between the responses of group members.
4) Using this method achieved the highest agreement between the group opinion and the opinion of individual members of the group than with methods that require personal contacts.

3. A Generalized Method for Estimation of Technical Condition of Buildings

Objective assessment of technical condition of buildings is one of the main tasks of the system of technical supervision. Its implementation is based on periodic and, if necessary, extraordinary inspections of structures, identifying and fixing their defects and damages, the determination of the degree of damage (wear) designs and further calculation that summarizes the state of the structures with regard to their importance in the composition of the object on the technical condition of the latter [2].

In comparison with traditional evaluation procedure which is based on the use of qualitative criteria, the task assumes a quantitative assessment of technical condition of building structures and facilities, which increases the accuracy of the calculations, the specificity of the findings and allows to determine analytically their predictable characteristics. As a performance indicator of the technical condition of the *r-th* design *i-th* species take the value of the degree of damage E_{ir} that is expressed in fractions of a unit, and it is absolutely intact without defective design is attributed $E_{ir}=0$. For structures having defects and damage, as well as deviations from the design decisions made when assembling, the definition $E_{ir} > 0$ must be performed in the system of rules, based on the nature of the violations, the quality of the material structures and their individual characteristics. Given the practical experience of assessment of technical condition of structures in the examinations and surveys, it can be argued that the transition structures in an alarm condition occurs if the damage is close to 0.25. On this basis, the saving of the operational characteristics of the building structure is in the interval $0< E_{ir} < 0,25$. Since the operation there is a continuous change in the quality of construction, then the generalized characteristics of its actual technical state at the moment, it is advisable to use the notion of the category of the technical condition of structures [3]. The category of the technical condition of the object represented by the table. 1.

When predicting the dynamics of technical condition of buildings, it is assumed that in the interval 0<E<=0,18 (first, second and third categories) trends and rates of wear, including the development of defect structures and the likelihood of damage remain for this object constant and independent of the actual lifetime. On this basis, can be calculated the probable duration of use of buildings from the time of inspection before the onset of a technical condition that is characterized by any value of the specified interval.

Overall assessment of damage to the object *E* is calculated from the following relationship and serves as the basis for the classification of the object to one of the categories of technical condition:

$$\boldsymbol{E} = \frac{\sum_i \frac{\sum_r E_{ir} * A_{ir}}{\sum_r A_{ir}}}{n_i} \qquad (3.1),$$

where E_{ir} –the degree of damage to the *r-th* design *i-th* type of the object;
A_{ir} – the significance of the structure, which is determined by an expert on a scale depending on type of construction, its place and role in the design scheme of the object and its degree of damage.

Table 1: Description of categories of technical condition of buildings

Category of the technical condition of the object	Quantitative characterization of the category through the assessment of damage to the property, *E*	Characteristics the performance characteristics of the object
1	*0 < E <= 0,06*	Safety of operation is certainly met, structural repair is not necessary. It contains no structures with *Eir > 0,12*
2	*0,06 < E <= =0,12*	Operating safety are met; not bypass the repair and prevention; the potential need for a custom recovery repair. It contains no structures with *Eir > 0,18*
3	*0,12 < E <= =0,18*	Safety of operation is conventionally observed and is dependent on the implementation of recommendations following the review. Necessary repairs and restoration; separate designs for possible needed repairs. It contains no structures with $E_{ir} > 0,18$
4	*0,18 < E <= =0,24*	Safety of operation is provided; in the composition of the object visually determined by design that are threatened. Continued operation is allowed as an exception in compliance with the set of special conditions.
5	*E > 0,24*	Emergency condition; operation must be stopped immediately.

Calculation of the volume of time from the time of inspection before moving object in the category of the technical condition of t_1 in the state, requiring major repairs, t_2 is based

on the analytical expression of the extent of the damage, with exponential law of decrease of reliability of building structures under conditions of constant wear *k:*

$$E = 1 - e^{-kt} \quad (3.2),$$

where *t* –the duration of operation to achieve the degree of damage *E*.

$$k = \frac{-\ln(1-E_\delta)}{t_\delta} \quad (3.3),$$

where E_ϕ – the actual (survey) value of damage;
t_ϕ – the actual duration of operation of the facility until the time of inspection from the entered or last overhaul.
Denote by critical $t_{кр}$ duration of operation of the facility, after which achieved critical the damage level of the $E_{кр}$.
Then:

$$t_1 = t_{кр1} - t_\phi \quad (3.4),$$
$$t_2 = t_{кр2} - t_\phi \quad (3.5).$$

The corresponding critical damage $E_{кр1}=E$ (lower bound the following categories of technical condition); $E_{кр2}=0,18$ (the lower border of the fourth category of technical condition). For given values $E_{кр1}$ and $E_{кр2}$ the following relations are true:

$$E_{кр1} = 1 - e^{-kt_{кр1}} \quad (3.6),$$
$$E_{кр2} = 1 - e^{-kt_{кр2}} \quad (3.7),$$
$$t_{кр1} = \frac{-\ln(1-E_{\text{ед}})}{k} \quad (3.8),$$
$$t_{кр2} = \frac{-\ln(1-E_{\text{ед}2})}{k} \quad (3.9).$$

Substituting the values of *k* and replacing $t_{кр}$ amount $(t_\phi+t)$, we obtain:

$$t_1 + t_\phi = \frac{-\ln(1-E_{\text{ед}})}{-\ln(1-E_\delta)} - 1 \quad (3.10),$$
$$t_1 = t_\phi \left[\frac{\ln(1-E_{\text{ед}})}{\ln(1-E_\delta)} - 1 \right] \quad (3.11).$$

Similarly:

$$t_2 = t_\phi \left[\frac{\ln(1-E_{\text{ед}2})}{\ln(1-E_\delta)} - 1 \right] = t_\phi \left[\frac{\ln 0{,}82}{\ln(1-E_\delta)} - 1 \right] \quad (3.12).$$

In determining the category of technical condition of buildings is necessary to calculate the estimate of damage, while taking into account their life and degree of wear of the main structural elements. , Here is a chart showing the trend of achieving different buildings categories depending on the period of operation (Fig. 2.). Therefore, we can conclude that the technical condition of buildings depends on the negative impacts and their lifetime.

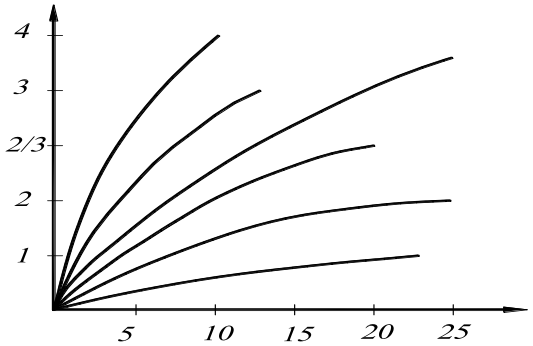

Figure 2: The trend according to the category of the technical condition of life of the buildings

4. Conclusion

The result is the construction of the problem of assessment of technical condition of buildings, which is one of the main tasks of the system of technical supervision. Its implementation is based on periodic and, if necessary, extraordinary inspections of structures, identifying and fixing their defects and damages, the determination of the degree of damage (wear) designs and further calculation that summarizes the state of the structures with regard to their importance in the composition of the object on the technical condition of the latter.

References

[1] A.Y. Barashkov, Technical operation of buildings and urban areas: the Textbook /A.J. Barashkov, V.A. Gomilko, A.M. Malyshev. - K.: High school, 2000.
[2] V.M. Mikhailenko, Organization and technology survey of technical condition of buildings on the basis of information technology /P.M. Yatsyk, O.O. Terentyev, O.B. Poltorak.// - K.: Construction production, interdepartmental scientific-technical journal, issue 50/2009, NIISP, 2009.
[3] G.A.Hayna, Information technology management lifecycle //P.M. Yatsyk, O.O. Terentyev, O.B. Poltorak.// - K.: New technologies in construction, interdepartmental scientific-technical journal, issue 1-2 (17-18)/2009, NIISP, 2009.

Author Profile

Mr. Olexander Terentyev received B.Sc. and M.Sc. degree in information and computer science and the PhD. degree in information technologies" Kyiv national University of Construction and Architecture, Ukraine, in 2001, 2002 and 2009, respectively. Since 2006 associate professor, and since 2009 associate professor at the Department of information technology, Kyiv national University of construction and architecture, Ukraine. From 2002 – junior research fellow, and from 2008 to the present time – senior researcher, head of sector studies of buildings and structures of the State enterprise "State research Institute of building production, the Ministry of regional development of Ukraine". The author of numerous research, design and many other scientific works.

Mr. Mykola Tsiutsiura since 2012 is master in "Information control systems and technologies." Since 2013 is master in "Project Management". Since November 2012 is a graduate student of the Kiev National University of Construction and Architecture in the direction of information technology and project management. Since 2013 is assistant professor Information Technologies department in Kyiv National University of Construction and Architecture, Ukraine.