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CALCULATION OF DEFORMED STRUCTURES BY STRENGTH INDICATORS

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Abstract
The article presents the issues of calculating load-bearing structures of deformed buildings and structures in the case of technical inspection by the method of marginal cases, calculating the Real value of the impact loads, strength, biquidity and superiority, taking into account the real strength of the materials.

Keywords: deformation, real value of loads, strength, bikrlik, usefulness, defective metal structure, stretching element, weakening coefficient.

Introduction

Load-bearing structures of buildings and structures in the state of technical inspection are calculated according to the method of marginal cases; unlike newly designed structures, load-bearing structures that are in the period of Use and have certain defects are considered to be strength, biquidity and superiority, taking into account the signs of lats, damage, cracks, deformations and Breakdowns that occur in them, taking into account the current dimensions of the elements, accounting schemes, the Real value of the influencing loads, as well as the; this will also focus on a number of other additional factors, about which we will dwell in some detail below.

Results and Research Discussion

When calculating defective metal structures, their geometric characteristics are determined by their weakened cross section.

If there is a numerical resistance at the leakage $R_y \langle R_u / \gamma_u$ limit, the calculation uses the numerical resistance determined by the temporary resistance of the steel.

The calculation of the strength of stretch steel elements, whose cross-section is weakened due to holes, is performed according to the following formula:

$$\frac{N}{(\alpha A)} \leq R_y \gamma_c \qquad (1)$$

where: γ_c - working conditions coefficient; $\alpha = A_n / A$ - weakening coefficient (A_n - netto cross-sectional surface at weakened site; A - brutto cross-sectional surface); N - tension in the element.

$0,75 \leq \alpha \langle 0,85$ in the values of γ_c - the coefficient of working conditions is taken as equal to 1,18.

If $\alpha \geq 0,85$ the account is executed without considering the vulnerability, i.e. $\gamma_c = 1/\alpha$ accepted.

$R_u / R_y \langle 1,39$ for Steels with a working condition coefficient of $\gamma_c \leq 0,845 R_u / R_y$.

The effect of corrosive damage is taken into account by reducing the surface area of the cross-section of the element, taking into account the critical temperature of fragility. If the corrosion is the same on the scale of the area under investigation (tsex), the calculation is allowed to determine the cross-sectional surface according to the following formula [1,2]:

$$A_{ef} = (1 - R_s \Delta^*) A \qquad (2)$$

When checking the strength of the bending elements, it is allowed to determine the calculated resistance moment of the cross section according to the following formula:

$$W_{ef} = (1 - \Delta^* \psi_k) W \qquad (3)$$

In the case of deviations in the monolithic walled compressive elements of metal structures, they are considered as non-central compressive elements. In this case, coefficients are introduced that take into account the real state of the element [3].

If the compressible element, formed from two paired angle profiles, is also tilted over two planes, its superimposition must be checked according to the following formula:

$$\frac{N}{(\varphi_{u,v})} A \le R_y \gamma_c \qquad (4)$$

where: $\gamma_c = 0{,}95$ - working conditions coefficient; $\varphi_{u,v}$ - taking into account the decrease in carrying capacity, the coefficient, the value of which is taken from the auxiliary reference table, depending on the values of the conditional inclination and relative bending Springs. If the compressible element is weakened by local defects and the symmetricity of the netto cross section is preserved, its usefulness is checked by the following formula:

$$\frac{N}{(\varphi_e)} A_n \le R_y \gamma_c \qquad (5)$$

where: A_n - netto cross-sectional surface at weakened site; φ_e - coefficient that takes into account the decrease in computational resistance in non-central compressible elements. Sterjen's inclination netto cross-sectional radius of inertia is determined from the following expression, considering the computational length:

$$\ell_o = \mu \mu_1 \ell, \qquad (6)$$

where: ℓ - geometric length of sterjen; μ - calculation length coefficient; μ_1 - the coefficient, which takes into account the parameters of the defect, is taken according to the auxiliary reference tables. Defective lattice elements are calculated according to the following formula for priming in the plane of the unification lattice:

$$N/\varphi \varphi_b A \le R_y \gamma_c\,, \qquad (7)$$

where: φ - coefficient characterizing the general priming of the lattice sterjen; φ_b - coefficient that takes into account the nature of the work of networks on the plot between the nodes of the connecting grid.

The load-bearing capacity of lattice-shaped sterjens with defects in their hollows is determined by assessing its overall superiority and, in addition, directly checking the load-bearing capacity of the defective hover [4,5,6,7]. Failure to comply with the condition of superiority means that the

defective Hawon has failed and the transverse force is accepted by the working networks to bend; in this case, the value of the coefficient φ_b is determined as in the compressible elements.
φ_b it is allowed to determine the quoted relative eccentricity, which is used when finding the coefficient, according to the value of the maximum bending moment in the network:

$$M_b = Q\ell_b/4 \,, \qquad (8)$$

Checking the technical condition of reinforced concrete structures is also performed just like that of metal structures. Preliminary examinations are usually carried out in the form of an examination. In this case, safety measures are taken, noting the presence of defects in the structure and elements, the presence of cracks, large deformations, signs of deterioration, structures in the event of an accident.
If in structures there are no defects, damage, as well as impenetrable cracks and deformations that reduce their load-bearing capacity, the tension in the elements from real loads does not exceed project values, then the condition of the structures is considered to satisfy the conditions of reconstruction. The non-fulfillment of any of these conditions indicates the need for the implementation of control (inspection) calculations on the loads imposed after the reconstruction of the structures [8,9].
Inspection calculations can be performed on the basis of project data if there are no defects in reinforced concrete structures, their deformations do not exceed the limit values, cracks are absent, or their opening width is smaller than the permissible amounts. The result of these calculations is that the load-bearing capacity of the structures is determined to be unsatisfactory, or project data is not available, and in cases where it is known that there are serious defects in the elements, the condition of the structures is subject to detailed examination, the strength of concrete and reinforcement, cross-section dimensions are determined, the calculation schemes and The strength of concrete and reinforcement is determined by the methods of inspection without breaking [10,11,12,13,14].
Structures designed according to Old regulatory documents are also calculated on the basis of the requirements of building standards and rules that are currently in force. Sections with defects and lats are examined in the calculations; sections in areas where concrete strength is 20% or more below average strength are also recalculated and examined.
Accounting strength of concrete in inspection accounts BNR 2.03.01-96 depending on the conditional class of structural concrete according to its strength to compression is defined under.
In project data-based control calculations of designed structures according to previous regulatory documents, classes of heavy and light concrete are determined by the following formula:

$$B = 0{,}8R\delta, \qquad (9)$$

When determining the strength of concrete by methods of testing without breaking its strength, its class on the strength to compression is determined by the average strength of the structure being tested, a separate structure or its area. Where δ =1,05, δ = 1,00 is acceptable if the test results measure is quoted to a cube of 20x20x20sm. In addition, in some cases it is also allowed to determine the strength of concrete by statistical methods [15].
Normative strength of the reinforcement in the inspection accounts of existing structures performed on the basis of Project data R_{sh} depending on its class BNR 2.03.01-96 is determined by.

In these cases, the strength of a B-I class wire armature is perceived as that of a Bp-I class armature. The computational resistance of the armature in stretching is found by the following formula:

$$R_s = R_{sh} / \gamma_s , \qquad (10)$$

where: γ_s - the coefficient of confidence in the fittings, its values are taken as follows:
- for sterjensimon fittings: A-I, A-II, A-III are classed, γ_s = 1,15, A-IV, A-V, A-VI are classed, γ_s=1,25; B-I, Bp-I, B-II, Bp-II, K-7, K-19 for class wire fittings and ducts γ_s = 1,25.

In the second group of boundary case accounts, γ_s=1,00 is acceptable.

In cases where there are no project documentation, as well as there is no possibility of testing samples from the structure, it is allowed to specify the accounting resistances of the fixture according to its profile: for smooth fittings with a surface R_s=155 MPa, for screw profile fittings R_s=245 MPa, for arch-shaped profile fittings R_s=295 MPa. In this case, the computational resistance of the compressible armature is R_{sc}=R_s, the transverse armaturan is $R_{s\omega}$ =0,8R_s accepted. The cross-sectional surface is reduced, the impact of defects on the strength and deformation indicators of concrete and reinforcement, the eccentricity of longitudinal strength, the adhesion of concrete and reinforcement is taken into account if there are recesses, displaced broken rags and other mechanical and chemical damage on the concrete surface in the structure where the inspection calculations are performed.

As a result of corrosion, under the influence of temperature and other factors, a decrease in the adhesion of concrete and reinforcement to each other negatively affects the load-bearing capacity of the structure [16,17]. The corrosion layer thickness is up to 0.5 mm, and in the absence of cracks, the load - bearing capacity of the element is up to 5%, the corrosion thickness is up to 3mm, and the opening width of longitudinal cracks is up to 2mm-up to 15%, and the thickness of the corrosion layer is reduced by 30% in cases.

Of structures with much larger scale damage (50% and more of the concrete cross section is broken or 50% and more of the working armature cross section is disabled), the work of the reinforcing structure in check - control accounts is considered to take full loads acting on the reinforcing structural elements themselves, not taking into account at all.

Assessment of the technical condition of brick - stone, large-block and large-panel structures by strength is the main type of assessment. The load - bearing capacity of reinforced and non - reinforced brick-stone and large-block structures is determined using the following information obtained in the technical inspection: stone-brick, masonry, real strength of concrete, resistance of the reinforcement to the leakage limit, the current (residual) strength of steel elements (beams, drawers, anchor devices, mounting details) and so on.k. It is necessary to take into account factors that lead to a decrease in the load-bearing capacity of structures: the presence of cracks and defects; mechanical damage, aggressive environment and dynamic effects, the impact of moisture and freezing-melting, the impact of corrosion and erosion the laying of various holes, grooves, vertical and horizontal channels; the formation and increase of eccentricities as a result of deviations of walls, displacement of the girder, plate and sarbastas at the supports [18].

Taking into account the above factors, the actual load-bearing capacity of the investigated structure φ is determined by the following formula:

$$\varphi = Nk_{mc}, \qquad (11)$$

where: *N* - the ability of the element cross-section dimensions according to the instructions BNR 2.03.07-98 of the structure, the calculation of the load-bearing capacity of the materials, which is found without taking into account the reducing factors on the values of the actual strength indicators.

The need for reinforcement of reinforced concrete and brick-stone structures is determined by checking the following condition:

$$F \geq \varphi n_{nг} , \qquad (12)$$

where: F - the value of the load provided for in the actual or reconstruction project; φ -(11) actual load-bearing capacity of the structure found by the formula; $n_{пг}$ - permissible overload coefficient: $n_{пг}$ =1,15 for brick-stone and concrete structures; for reinforced concrete structures; for structures with cracks, the use of the $n_{пг}$ =1,1; for structures with cracks, the use of the $n_{пг}$ coefficient is not allowed.

Conclusions

Stone-brick with cracks, large-block and large-panel structures with reduced load-bearing capacity by 15% or more are a prerequisite for strengthening. It is allowed to strengthen lost structures by accident, more than 50% of the load-bearing capacity, only in cases where a feasibility study is developed. Stone-brick structures with no defects and damage will have to be reinforced as a result of a decrease (or low) in the strength of the materials, with the determination that the actual load-bearing capacity is less than the stresses acting [19,20].

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