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METHODS FOR INCREASING STRUCTURAL STRENGTH IN REPAIR AND DESIGN**Jurayev Jamolbek Sheraliyevich**

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ABSTRACT: The topic of methods for enhancing the stability of constructions, repair, and design holds significant importance in the modern construction industry. This article explores contemporary technologies aimed at strengthening the stability of structures, methods used in repair processes, and innovative approaches applied in design. The importance of new materials, digital technologies, and automated systems in improving structural solutions is highlighted. Additionally, practical recommendations are provided for ensuring the safety and efficiency of constructions while analyzing the economic aspects of these processes. The article also addresses technical issues that arise during repair and reconstruction, offering modern solutions, as well as effective methods for ground preparation and reinforcement. The economic and technical aspects of strengthening constructions are discussed, along with the impact of these processes on labor safety and productivity. The article presents scientific approaches applicable to construction practices and develops recommendations aimed at enhancing the stability of constructions.

KEYWORDS: Structural strength, Reinforcement of construction structures, Repair methods, Innovations in design, New materials, Digital technologies, Automated systems, Ground strengthening, Safety and efficiency, Economic aspects, Occupational safety, Production efficiency, Reconstruction, Technical problems, Construction practices.

ANNATASIYA: Konstruksiyaning mustahkamligini oshirish usullari, ta'mirlash va loyihalash mavzusi zamonaviy qurilish sohasida muhim ahamiyat kasb etadi. Ushbu maqola, konstruktsiyalarning mustahkamligini oshirishga qaratilgan zamonaviy texnologiyalar, ta'mirlash jarayonlarida qo'llaniladigan usullar va loyihalashda foydalaniladigan innovatsion yondashuvlarni o'rganadi. Konstruktiv yechimlarni yaxshilashda yangi materiallar, raqamli texnologiyalar va avtomatik tizimlarning ahamiyati ko'rsatilgan. Shuningdek, konstruktsiyalarning xavfsizligini ta'minlash, samaradorlikni oshirish va iqtisodiy jihatlarini tahlil qilishda amaliy tavsiyalar taqdim etiladi. Maqolada, ta'mirlash va rekonstruksiya jarayonlarida yuzaga keladigan texnik muammolarni hal etish bo'yicha zamonaviy yondashuvlar, zaminni tayyorlash va gruntlarni kuchaytirishning samarali usullari haqida ham ma'lumot beriladi. Konstruktsiyalarning

mustahkamligini oshirishning iqtisodiy va texnik jihatlari, shuningdek, bu jarayonning mehnat xavfsizligi va samaradorlikka ta'siri ko'rib chiqiladi. Maqola, qurilish sohasidagi amaliyotga tatbiq etiladigan ilmiy yondashuvlarni taqdim etish orqali konstruksiyalarning mustahkamligini oshirishga qaratilgan tavsiyalarni ishlab chiqadi.

TAYANCH SO'ZLAR: Konstruksiyaning mustahkamligi, Qurilish konstruksiyalarini mustahkamlash, Ta'mirlash usullari, Loyihalashdagi yangiliklar, Yangi materiallar, Raqamli texnologiyalar, Avtomatlashtirilgan tizimlar, Zaminni kuchaytirish, Xavfsizlik va samaradorlik, Iqtisodiy jihatlar, Mehnat xavfsizligi, Ishlab chiqarish samaradorligi, Rekonstruksiya, Texnik muammolar, Qurilish amaliyotlari.

АННОТАЦИЯ: Тема методов повышения прочности конструкций, ремонта и проектирования имеет большое значение в современной строительной отрасли. В этой статье рассматриваются современные технологии, направленные на усиление прочности конструкций, методы, используемые в процессе ремонта, и инновационные подходы, применяемые при проектировании. Подчеркивается важность новых материалов, цифровых технологий и автоматизированных систем в улучшении конструктивных решений. Также даются практические рекомендации по обеспечению безопасности и эффективности конструкций, а также анализируются экономические аспекты этих процессов. В статье также рассматриваются технические проблемы, возникающие в процессе ремонта и реконструкции, предлагаются современные решения, а также эффективные методы подготовки грунта и усиления. Обсуждаются экономические и технические аспекты усиления конструкций, а также влияние этих процессов на безопасность труда и производительность. В статье представлены научные подходы, применимые к строительной практике, и разрабатываются рекомендации, направленные на повышение прочности конструкций.

КЛЮЧЕВЫЕ СЛОВА: « Прочность конструкций, Укрепление строительных конструкций, Методы ремонта, Инновации в проектировании, Новые материалы, Цифровые технологии, Автоматизированные системы, Укрепление грунтов, Безопасность и эффективность, Экономические аспекты, Охрана труда, Эффективность производства, Реконструкция, Технические проблемы, Строительные.»

Introduction

At present, in any country, there are numerous tasks related to the repair and reconstruction of existing industrial enterprises. The development of production largely depends on improving technological processes, optimizing production workflows, and making the most efficient use of

available space. However, any repair work usually affects the load-bearing capacity of building structures and alters their original structural scheme, which in turn requires strengthening and enhancing the structures.

The need to reinforce building structures arises not only during repairs but also in cases where the production technology leads to premature deterioration, damage, or other unforeseen circumstances. Among construction materials used in industrial buildings for many years, reinforced concrete structures are the most widely applied. Therefore, systematizing, analyzing, and summarizing existing methods for designing and effectively reinforcing these structures is of great economic importance. Constructing buildings on poor soils is not advisable because, during flooding, deformation increases sharply, which in reinforced concrete structures can cause significant or even catastrophic damage. This factor influences the choice of reinforcement method. Before starting reinforcement work, sources of soil moisture are eliminated, and research on effective soil strengthening at the construction site is conducted.

Below, examples are provided of structural-technological solutions for selecting, applying, and calculating the reinforcement of load-bearing reinforced concrete structures during reconstruction and major repairs, including technical solutions for strengthening slabs, beams, and columns commonly found in construction practice.

Research Methods

During the research, methods such as analysis of scientific and educational-methodical literature, pedagogical observation, comparative analysis, generalization, modeling, programming, and digitization were used.

Literature Review

The article discusses methods for increasing the strength of structures in repair and design processes. Strengthening structures, and the application of modern techniques in repair and design, is of great importance. According to Xo'jaev and Raxmatov (2020), modern construction technologies play a significant role in reinforcement, offering innovative approaches for evaluating the performance of new materials and structures. This source provides extensive information on the role of digital technologies and automated systems in the structural reinforcement process. Technological optimization and the use of new materials in strengthening and repair work increase the efficiency of structural solutions.

Mustafayev (2017) emphasizes the technological approaches and methodologies applied in the reconstruction of industrial enterprises, providing practical recommendations for the effective organization of repair and design processes, optimization of production areas, and ensuring safety.

Qodirov and Shukurov (2015) focus on studying structural-technological solutions and their role in production, noting that the use of new technologies and materials contributes to enhancing structural strength.

G'ayratov and Xodjayev (2022) analyze methods for soil preparation and strengthening, showing how modern technologies and techniques improve construction safety. Studies on increasing the load-bearing capacity of structures are also highlighted (Ismoilov, 2019). These studies are crucial for ensuring the safe operation of smart construction techniques.

Soliyev (2021) investigates the economic aspects of strengthening industrial buildings. His research analyzes the economic efficiency of reinforcement and reconstruction processes, highlighting the role of economic stability in improving structural performance. Yuriev and Mirsobirov (2016) identify technical challenges arising during reconstruction and provide necessary technical approaches to ensure safety and effective implementation.

Thus, modern technologies and scientific research applied in strengthening, repair, and design form a crucial foundation for ensuring the safe operation of smart construction techniques. Implementing the recommendations presented in the article is essential for enhancing labor safety and applying new technologies effectively.

Research Results and Discussion

As a result of inspecting the industrial building (Figure 1), it was determined that there are no defects or damages. The calculated characteristics of the concrete and reinforcement comply with the regulatory requirements.

Since a technical reassessment of the building is planned, it is necessary to check the load-bearing capacity of the building structures, and if required, perform calculations for their reinforcement.

The load-bearing capacity needs to be determined for the following structural elements:

- Floor slabs;
- Frame beams (girders);
- Columns of the first-floor frame.

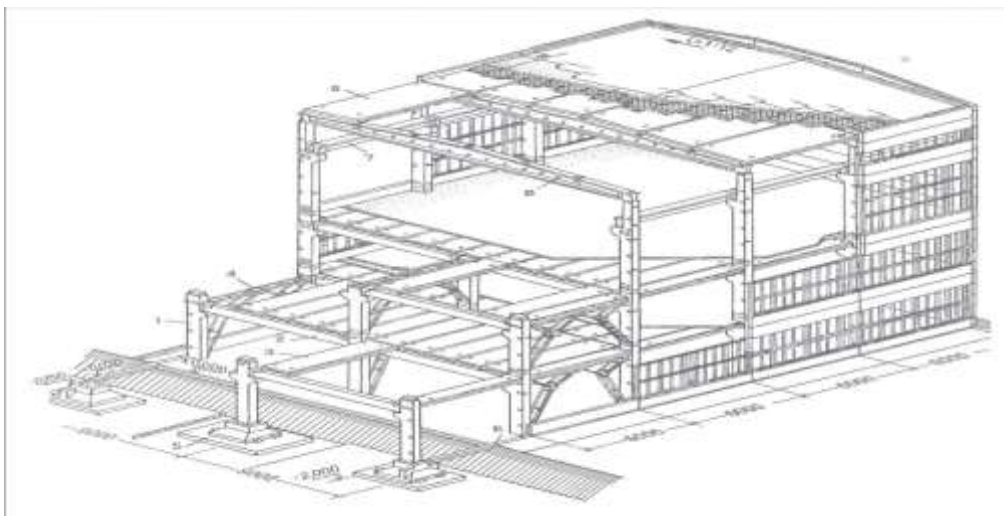


Figure 1. Complete prefabricated reinforced concrete frame of a multi-story industrial building with beam-type floor slabs.

1 – Column. 2 – Beam (girder. 3 – Floor slab. 4 – Vertical steel tie (brace)
5 – Column foundation. 6 – Foundation beam. 7 – Crane runway beam. 8 – Covering beam. 9 – Roof slab

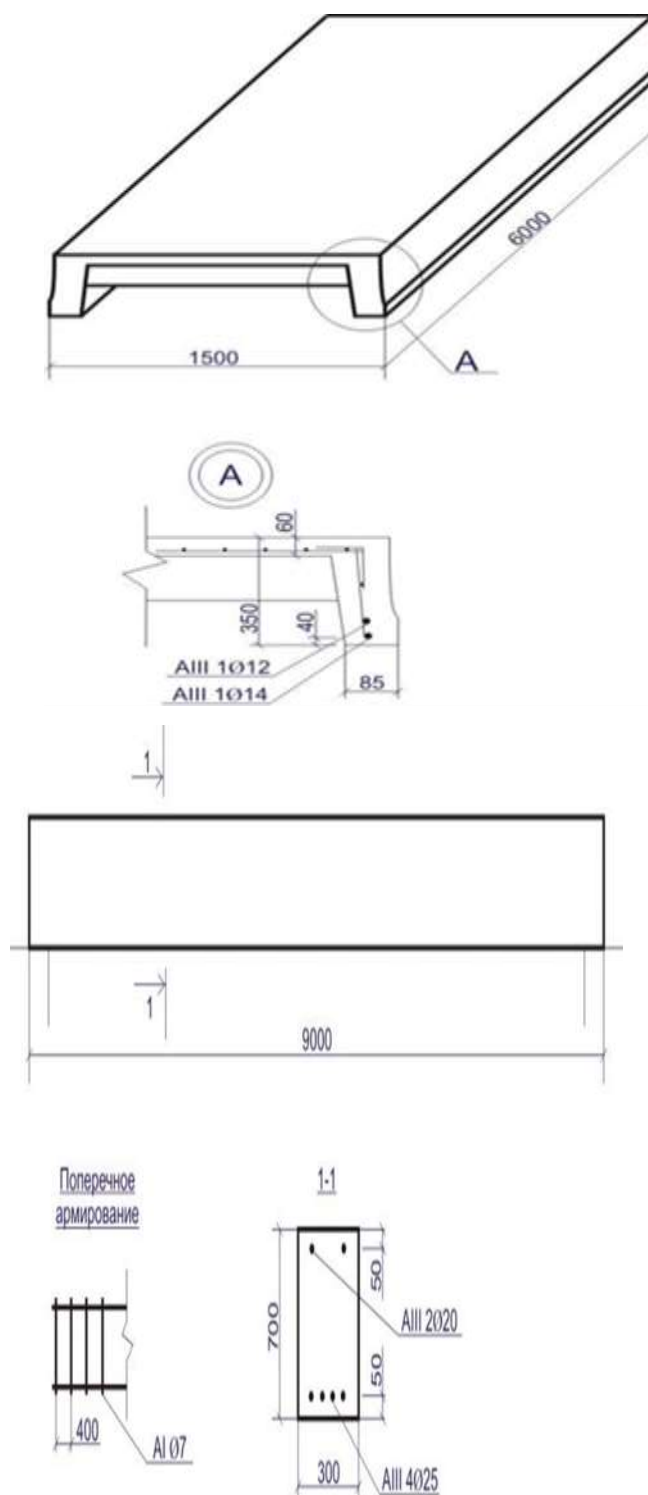


Figure 2. Parameters of the industrial building structures

Conclusion

Nowadays, the importance of repairing and reconstructing industrial enterprises is steadily increasing. Enhancing the strength of building structures and applying technological solutions play

a crucial role in ensuring production stability and improving the safety of industrial facilities. Reinforcing reinforced concrete structures, preparing and strengthening the soil, as well as applying structural-technological solutions, increase the overall durability and efficiency of construction.

Through structural reinforcement, it is primarily possible to accommodate increased loads and introduce new technologies. At the same time, higher load-bearing capacity of structures improves the efficiency of production processes and ensures long-term economic stability. In particular, technologies such as adding additional reinforcement and using special mixtures to improve concrete quality can be economically effective when strengthening reinforced concrete structures.

However, some drawbacks exist in such reinforcement processes. First, strict quality requirements for materials must be met during construction, and in some cases, insufficient resources may lead to technical problems. Second, reconstruction processes usually require high costs and may result in temporary production stoppages. Another challenge is the need to properly assess the technical condition of the building and respond appropriately to its degree of wear and external conditions during the evaluation and reinforcement process.

At the same time, to maximize the effectiveness of results achieved through structural reinforcement, it is important to apply scientifically based methods and modern technologies. This ensures the continuity of production processes and increases economic efficiency. In the future, the integration of innovative approaches into reinforcement technologies will provide even more effective solutions in the construction sector.

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