ISSN 1819-432X print / ISSN 1993-3495 online
СУЧАСНЕ ПРОМИСЛОВЕ ТА ЦИВІЛЬНЕ БУДІВНИЦТВО
СОВРЕМЕННОЕ ПРОМЫШЛЕННОЕ И ГРАЖДАНСКОЕ СТРОИТЕЛЬСТВО
MODERN INDUSTRIAL AND CIVIL CONSTRUCTION
2016, ТОМ 12, НОМЕР 3, 119–126
УДК 624.15, 624.153.52, 624.159.4

РЕГУЛЮВАННЯ ЗУСИЛЬ В ПЛИТНОМУ ФУНДАМЕНТІ У ПРОЦЕСІ ЗВЕДЕННЯ БУДІВЛІ

В. В. Яркін, Г. В. Кухар
Донбаська національна академія будівництва і архітектури,
2, вул. Державіна, м. Макіївка, 86123.
E-mail: yarkinvv@mail.ru

Отримана 03 червня 2016; прийнята 23 вересня 2016.

Анотація. Фундаменти у вигляді суцільної плити широко застосовуються в фундаментобудуванні, незважаючи на високу матеріалоємність. При цьому в ряді випадків несуча здатність основи залишається недовикористаною. Розглянуто метод зниження зусиль у плитному фундаменті шляхом його улаштування з окремих елементів, які включаються в спільну роботу на різних етапах зведення будівлі. Наведено результати напружено-деформованого стану основи та фундаментної плити при включенні елементів плитного фундаменту в роботу на різних етапах зведення будівлі. Аналіз отриманих результатів показав, що розглянутий метод поетапного включення плитного фундаменту в роботу дозволяє істотно знизити зусилля у фундаментній плиті, а відповідно і її матеріаломісткість. Даний метод можна також використовувати при виправленні нерівномірних осідань і кренів, що виникають уже під час зведення будівлі.

Ключові слова: регулювання зусиль, плитний фундамент, контактні напруження, нерівномірні осідання.

РЕГУЛИРОВАНИЕ УСИЛИЙ В ПЛИТНОМ ФУНДАМЕНТЕ В ПРОЦЕССЕ ВОЗВЕДЕНИЯ ЗДАНИЯ

В. В. Яркин, А. В. Кухарь
Донбасская национальная академия строительства и архитектуры,
2, ул. Державина, г. Макеевка, 86123.
E-mail: yarkinvv@mail.ru

Получена 03 июня 2016; принята 23 сентября 2016.

Аннотация. Фундаменты в виде сплошной плиты широко применяются в фундаментостроении, несмотря на высокую материалоемкость. При этом в ряде случаев несущая способность основания остается недоиспользованной. Рассмотрен метод снижения усилий в плитном фундаменте путем его устройства из раздельных элементов, которые включаются в совместную работу на различных этапах возведения здания. Приведены результаты напряженно-деформированного состояния основания и фундаментной плиты при включении элементов плитного фундамента в работу на различных этапах возведения здания. Анализ полученных результатов показал, что рассматриваемый метод поэтапного включения плитного фундамента в работу позволяет существенно снизить усилия в фундаментной плите, а соответственно и ее материалоемкость. Данный метод можно также использовать при исправлении неравномерных осадок и кренов, возникающих уже во время возведения здания.

Ключевые слова: регулирование усилий, плитный фундамент, контактные напряжения, неравномерные осадки.

REGULATION FORCES IN SLAB FOUNDATION IN THE PROCESS CONSTRUCTION OF THE BUILDING

Viktor Iarkin, Hanna Kukhar

Donbas National Academy of Civil Engineering and Architecture, 2, Derzhavina Str., Makiyivka, 86123.

E-mail: yarkinvv@mail.ru

Received 03 June 2016; accepted 23 September 2016.

Abstract. Slab foundation is widely used in foundation engineering despite the high consumption of materials. In a number of cases, the bearing capacity of soil of foundation is not enough used. A method for reducing internal forces slab foundation through creating of separate elements, which are include in the jointly work at different stages of construction of the building. It has been given the results of the stress-strain state of the base and the foundation slab when the elements slab foundation included in the work at various stages of construction of the building. Analysis of the results showed that this method phased inclusion in the work of the elements slab foundation can significantly reduce the internal forces in it and, consequently, its consumption of materials. This method can also be used for correction of non-uniform settlements and tilt arising already during the construction of the building.

Keywords: regulation internal forces, slab foundation, contact pressure, non-uniform settlements.

Introduction

Slab foundation are widely used in modern construction. This is due to modern high-rise buildings, and construction on areas with difficult ground conditions. The use of slab foundation allows relatively evenly distribute the load on a large area of the base. However, despite the relatively evenly loaded may occur above permitted tilt caused by the inhomogeneity of the soil mass, eccentric vertical loads and other factors.

In addition, since the minimal sizes of the foundation slab in most cases taken constructively depending on overall dimensions of the building, often soil foundation base has a substantial margin of safety.

This work is devoted to the decreasing consumption of materials slab foundation by making fuller use of the bearing capacity of soil foundation directly in the zone of the load.

Review

Determination of stress-strain state of the slab foundation is made of the results of a complex joint calculation of «Ground – foundation – buildings» or as the structure, interacting with deformable grounds taking into account the pre-computed stiffness characteristics of the grounds and buildings [1, 2, 3, 4]. More accuracy is the calculation of the «Ground – foundation – buildings», which is recommended to perform, taking into account the sequence of the construction of buildings [2]. Increase of accuracy of calculations can better perform design the construction of the slab foundation and thereby reduce its consumption of materials. The accuracy of the calculation depends on the following factors:

- detailed calculation scheme;
- the adequacy of accepted the calculated model soil foundation [5, 6];
- physical nonlinearity of soil foundation, materials of slab foundation and overground constructions [4, 7, 8];
- loading history and change calculation scheme supporting structures in the process construction of the building [9, 10].

Also reduction consumption of materials of slab foundation can be achieved by the use of a variety of effective design solutions and technology of making slabs foundation [11, 12, 13, 14, 15, 16]. In this direction special attention should be solutions in which reduction forces in the foundation is achieved by changing the diagram of contact pressure [12, 13, 15, 16, 17, 18]. Change diagram of contact pressure can be:

- making of foundation slab of variable stiffness [12];
- making in the level of foundation base open pyramidal cavities, allowing to increase the contact area with increasing settlements [13];

- changing calculation scheme of the foundation slab by introducing hinge joints [15] or deformation seams [16];
- the use of easily deformable inserts [17] or an intermediate preparation of variable stiffness [18].

Main information

This article presents a method of reducing the internal forces in slab foundation through its making of separate elements, which are included in the joint work at different stages of construction of the building. Slab foundation is divided by temporary deformation seams on the supporting elements and the span elements. The supporting elements may be formed as a monolithic reinforced concrete strip foundations for a building wall or in the form of individual columnar foundations under columns. Between the support elements are performed the span elements in the form of monolithic reinforced concrete slabs. Between the supporting elements and the span elements of the slab foundation placed temporary deformation seams width 0.7–1.0 m. Their technology can adopt a similar temporary contraction joints p. 6.17 [2].

Inclusion the span elements in the joint work is performed by filling the monolithic concrete in temporary deformation seams.

Time of inclusion the span elements into the joint work of the slab foundation is selected from the conditions optimum use of the bearing capacity and deformability of the base under the supporting elements. As the selection criteria may be used:

- the contact pressure at the base of the supporting element reaches certain value. This may be the level of pressure that exceeds the value of the design resistance of foundation soil defined for the width of the supporting element;
- the settlement of the supporting element reaches certain value - *s'*. The thickness of the span elements of slab foundation can be reduced on the value predicted settlement of supporting elements at the time of their inclusion in the joint work.

Temporary deformation seams in the slab foundation is expedient to arrange in locales minimum bending moments. In this case, additional local upper and lower reinforcement can be terminated in the place of temporary deformation seams. Respectively the temporary deformation seams will cross only the main continuous reinforcement.

Reinforcement bars passing continuously through temporary deformation seams, can be performed with bending compensation that will allow them to include in the work only after reaching a certain difference in the settlements of the supporting elements and the span elements of slab foundation.

Initially, the load is perceived only supporting elements of the foundation slab, and at a certain stage of construction of the building is include in the work the span elements, after which the construction of the building continues. At the same time as the load increases under the base the supporting element is a transformation diagram of contact pressure (Fig. 1a) from the saddle to the parabolic type [19]. After inclusion in the work the span elements is occurs a redistribution of internal forces in elements of the slab foundation and further transformation diagrams contact pressure (Fig. 1b).

At its core, this method is a pre-planned strengthening strip or pier foundation by transforming them into a slab, which is sometimes used in the superstructure and reconstruction of buildings [20, 21, 22, 23].

To determine the stress-strain state of the slab foundation, created by this method, it is necessary to consider the history of the loading of the «Ground – foundation», and gradual change of design scheme of bearing structures [9, 10]. At pressures under the supporting elements of the slab foundation larger than the corresponding design resistance of foundation soil must also take into account the non-linearity of soil deformation.

For the qualitative assessment of the effect of phased inclusion the span elements on stress-strain state slab foundation performed a series of comparative calculations. Compared the results of the stress-strain state of elements included in the joint work at different stages of construction of the building, with the results obtained for a continuous slab foundation.

The calculations were performed in the software Plaxis, which allows to consider the gradual change in the design scheme at different stages of construction of the building.

The calculations regarded cross section of the foundation slab, consisting of four of supporting elements and three the span elements connecting foundation into a single monolithic block (Fig. 2).

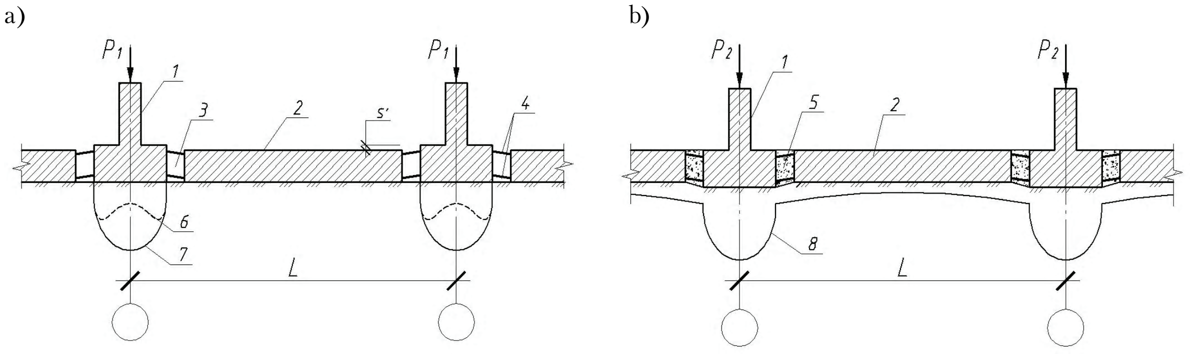


Figure 1. Distribution of contact pressure: a) separate work of supporting elements and the span elements of slab foundation; b) joint work of supporting elements and the span elements of slab foundation; 1 – the supporting elements of slab foundation; 2 – the span elements of slab foundation; 3 – temporary deformation seams; 4 – main continuous reinforcement; 5 – monolithic concrete; 6 – diagram contact pressure under the supporting element at pressures less than the initial critical pressure; 7 – diagram contact pressure under the supporting element at pressures higher than the design resistance of foundation soil; 8 – diagram contact pressure after inclusion in the work the span elements.

The calculations are performed in the conditions of plane strain that is not strict solution for slab foundation, but for qualitative assessment the accuracy of the results is sufficient. At a ratio of of length to width of the slab foundation, greater than or equal to two, is allowed perform a joint calculation slab interacting with a deformable base as a plane problem [2]. In this case when calculating the in the transverse direction base and slab foundations accept working in conditions of plane strain.

As the calculation model soil foundation used model Mohr-Coulomb.

The bases is a homogeneous mass of soil, with the following main characteristics ($\gamma = 18$ кN/м³, E = 15 MPa, $\nu = 0.3$, c = 20 kPa, $\varphi = 18°$).

The thickness of the slab foundation – 1 m. Material of foundation – heavy concrete class B20. Foundations modeled by rods finite elements with corresponding stiffness.

The loading was carried out through the supporting elements of the slab foundation. The increment of the load was performed in stages to a value of the design load. The inclusion of the span elements of slab foundation in joint work was made at various stages of loading (from 50 to 90 % value of the design load).

The calculation results

On the results calculations were obtained diagrams shadings of stresses and strain in the basis of the slab foundation.

Shadings of settlements of the bases for the design load for a continuous slab foundation, as well as for phased inclusion of the elements is shown in Fig. 3.

The relative change of the bending moments and the settlements in the support section and the span section of slab foundation, depending on the stage inclusion of the span elements in the work are shown in Fig. 4. The bending moment M_{sf} and settlement S_{sf} in relevant sections of the continuous slab foundation taken as 100 %.

Conclusion

1. Phased inclusion in the work the span elements of the slab foundations can significantly reduce the internal forces in the slab foundations. In this case, the later is included in the work elements span the less they are bending moments. Bending moments in the span section of the slab foundation thus can be reduced several times and thus significantly reduced consumption of materials.
2. Reducing the bending moments takes place not only in the span elements of the slab foundations, but in the supporting elements. This phenomenon is explained by the transformation diagram of contact pressure under the base foundations after the formation of zones of limit equilibrium under the edges of the supporting elements.

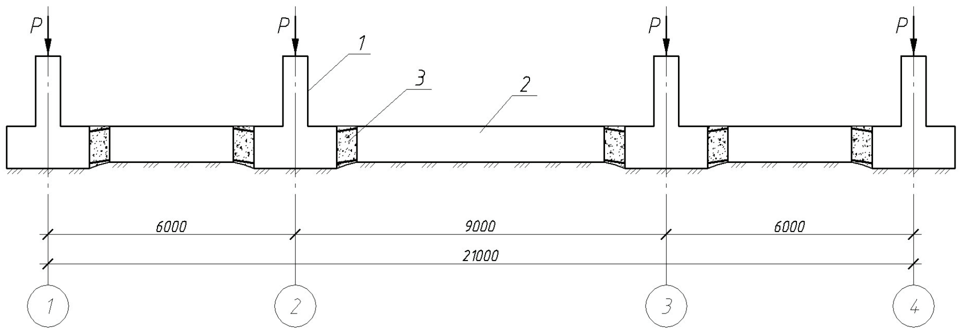


Figure 2. Cross section of the slab foundation: 1 – the support element; 2 – the span element; 3 – temporary deformation seams filled a monolithic concrete.

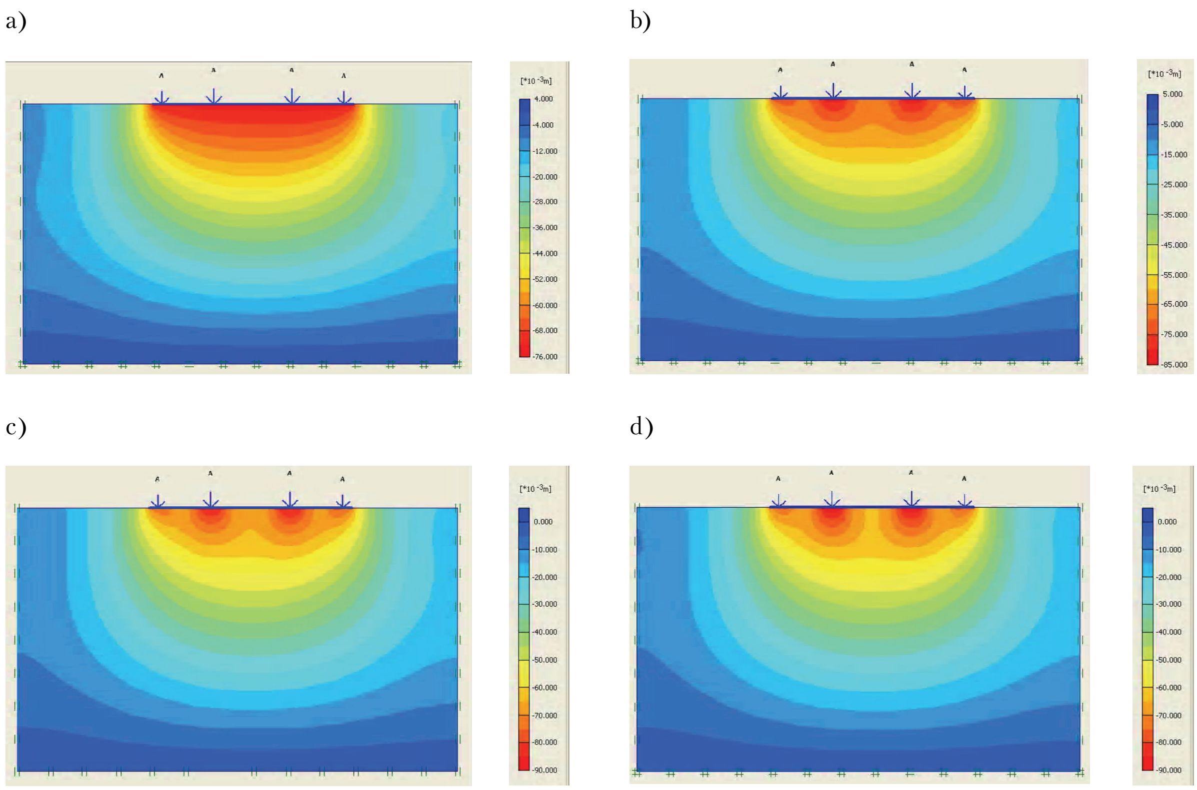
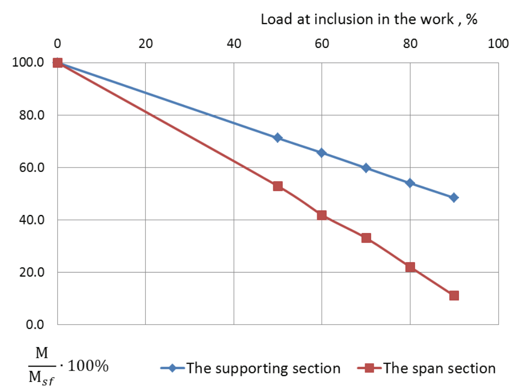


Figure 3. Shadings settlements after applying the design load: a) continuous slab foundation; b) inclusion the span elements in the joint work at a load 50 % of design load; c) at a load 70 % of design load; d) at a load 90 % of design load.

3. Pressure on the foundation base is distributed less evenly, increased under the supporting elements, and decreased under the span elements. It makes better use of the bearing capacity of the base directly under the supporting elements.
4. Settlements the supporting elements of the slab foundation is higher than the span elements in this regard is recommended to provide them preliminary rise.
5. When building in difficult ground conditions there is the probability of non-uniform settlements and tilt are already in the process of construction of the building. In this case, possible a partial or complete correction of non-uniform settlements encountered during construction, by including in work the span elements of slab foundation in areas with less settlements at later stage the construction of the building.

a)



b)

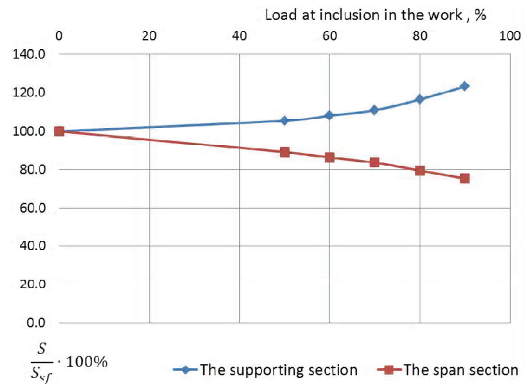


Figure 4. Changing the bending moments and the settlements in the supporting section and the span section of slab foundation, depending on the stage of the span elements inclusion of in the work: a) bending moment expressed as a percentage of the bending moment in the respective section continuous slab foundation; b) settlements expressed as a percentage of the settlements continuous slab foundation.

References

1. Горбунов-Посадов, М. И. Расчет конструкций на упругом основании [Текст] / М. И. Горбунов-Посадов, Т. А. Маликова, В. И. Соломин. – М. : Стройиздат, 1984. – 679 с.
2. Руководство по проектированию плитных фундаментов каркасных зданий и сооружений башенного типа [Текст] / НИИОСП им. Н. М. Герсеванова. – М. : Стройиздат, 1984. – 263 с.
3. ДБН В.2.1-10-2009. Основи та фундаменти споруд. Основні положення проектування [Текст]. – Введено вперше зі скасуванням на території України СНиП 2.02.01-83 ; чинні від 2009–07–01. – Київ : Мінрегіонбуд України, 2009. – 107 с.
4. Клепиков, С. Н. Расчет сооружений на деформируемом основании [Текст] / С. Н. Клепиков. – К. : НИИСК, 1996. – 204 с.
5. Улицкий, В. М. Геотехническое сопровождение развития городов [Текст] / В. М. Улицкий, А. Г. Шашкин, К. Г. Шашкин. – СПб. : Стройиздат Северо-Запад, 2010. – 554 с.
6. Петраков, А. А. Влияние расчетных моделей грунтового основания на напряженное состояние несущих конструкций каркасных зданий на плитных фундаментах [Текст] / А. А. Петраков, В. В. Яркин, Е. О. Брыжатая // Галузеве машинобудування, будівництво : Збірник наукових праць. Полтава, 2013. Вип. 3(38), т. 2. С. 274–278.
7. Соломин, В. И. Методы расчета и оптимальное проектирование железобетонных фундаментных конструкций [Текст] / В. И. Соломин, С. Б. Шматков. – М. : Стройиздат, 1986. – 208 с.
8. Ильев, И. М. Сравнительный анализ результатов расчетных усилий в плитних фундаментах [Текст] / И. М. Ильев, В. Г. Шаповал // Вісник Придніпровської державної академії будівництва та архітектури. Дніпропетровськ, 2000. № 7. С. 18–26.

References

1. Gorbunov-Posadov, M. I.; Malikova, T. A.; Solomin, V. I. Calculation of structures on elastic foundation. Moscow: Stroiizdat, 1984. 679 p. (in Russian)
2. N. M. Gersevanov Scientific and research institute of foundations and buried structures. Design guide slab foundations framed buildings and structures towers-type. Moscow: Stroiizdat, 1984. 263 p. (in Russian)
3. DBN V.2.1-10-2009. Basis and foundations of constructions. General principles of designing. Kyiv: Ministry of Regional Development of Ukraine, 2009. 107 p. (in Ukrainian)
4. Klepikov, S. N. Calculation of structures on the deformed basis. Kyiv: NIISK, 1996. 204 p. (in Russian)
5. Ulitskiy, V. M.; Shashkin, A. G.; Shashkin, K. G. Geotechnical support for the development of cities. Saint-Petersburg: Stroiizdat North-West, 2010. 554 p. (in Russian)
6. Petrakov, A. A.; Iarkin, V. V.; Bryzhata, K. O. The Influence of ground design models on stain-stress distribution of bearing structures of frame buildings with slab foundations. In: *Sector engineering, construction*, 2013, Issue 3(38), Volume 2, pp. 274–278. (in Russian)
7. Solomin, V. I.; Shmatkov, S. B. Methods of calculation and optimal design of reinforced concrete Foundation structures. Moscow: Stroiizdat, 1986. 208 p. (in Russian)
8. Iliev, I. M.; Shapoval, V. G. Comparative analysis of the results of the calculation effort in plate foundations. In: *Vestnyk of the Prydniprovska State Academy of Civil Engineering and Architecture*, 2000, No. 7, pp. 18–26. (in Russian)
9. Perelmuter, A. V.; Kabantsev, O. V. Accounting for the elements stiffness change in the course of erection and operation. In: *Magazine of Civil Engineering*, 2015, No. 1(53), pp. 6–14. (in Russian)

9. Перельмутер, А. В. Учет изменения жесткостей элементов в процессе монтажа и эксплуатации [Текст] / А. В. Перельмутер, О. В. Кабанцев // Инженерно-строительный журнал. 2015. № 1(53). С. 6–14.
10. Кабанцев, О. В. Учет изменений расчетной схемы при анализе работы конструкции [Текст] / О. В. Кабанцев, А. Г. Тамразян // Инженерно-строительный журнал. 2014. № 5(49). С. 15–26.
11. Тетиор, А. Н. Проектирование и сооружение экономичных конструкций фундаментов [Текст] / А. Н. Тетиор. – Киев : Будівельник, 1975. – 204 с.
12. Пат. 1216288 СССР, МПК Е 02 D 27/01. Фундамент зданий и сооружений [Текст] / А. К. Беляничев, И. А. Бердичевский, С. Н. Клепиков, М. Л. Клоницкий, Д. Б. Цекерман, А. С. Шенкар ; заявитель и патентообладатель Киевское отделение Всесоюзного Ордена Ленина и Ордена Октябрьской Революции научно-исследовательского и проектно-изыскательного института «Атомтеплоэлектропроект». – № 3778436/29-33 ; заявл. 06.08.84 ; опубл. 07.03.86, Бюл. № 9. – 2 с.
13. Тимченко, Р. А. Работа плитных фундаментов-саморегуляторов на неравномерно-деформируемом основании [Текст] / Р. А. Тимченко, Д. А. Кришко // Современные проблемы строительства. 2010. № 13. С. 83–91.
14. Пат. 1814677 СССР, МПК Е 02 D 27/00. Сборно-монолитная фундаментная плита [Текст] / Р. Л. Айвазов. – № 5019792/33 ; заявл. 29.12.91 ; опубл. 07.05.93, Бюл. № 17. – 2 с.
15. Иконин, С. В. Конструкция фундаментной плиты с регулируемыми усилиями [Текст] / С. В. Иконин, А. В. Сухотерин // Инженерно-строительный журнал. 2015. № 3(55). С. 10–20.
16. Пат. 53905 України, МПК E02D 27/34. Спосіб зведення фундаменту будівлі (споруди) [Текст] / Петраков О. О., Віноградов В. М., Рашевський М. В. ; власник Донбаська державна академія будівництва і архітектури. – № 2002021396 ; заявл. 19.02.2002, опубл. 17.02.2003, Бюл. № 2. – 4 с.
17. Заболотный, П. П. Фундаменты с легкодеформируемыми вставками [Текст] / П. П. Заболотный, В. Л. Яструбецкий // Промышленное строительство и инженерные сооружения. 1990. № 2. С. 32–33.
18. Основания, фундаменты и подземные сооружения [Текст]. Справочник проектировщика / М. И. Горбунов-Посадов, В. А. Ильичев, В. И. Крутов [и др.] ; Под общ. ред. Е. А. Сорочана и Ю. Г. Трофименкова. – М. : Стройиздат, 1985. – 480 с.
19. Далматов, Б. И. Механика грунтов, основания и фундаменты [Текст] / Б. И. Далматов. – Л. : Стройиздат, 1988. – 415 с.
20. Яркин, В. В. Конструкция усиления фундаментов, совмещенная с отмосткой и ее модификации [Текст] / В. В. Яркин // Современные проблемы строительства / Украинская государственная строительная корпорация «Укрстрой», Государственный проектный и научно-исследовательский

10. Kabantsev, O. V.; Tamrazian, A. G. Allowing for changes in the calculated scheme during analysis of structural behaviour. In: *Magazine of Civil Engineering*, 2014, No. 5(49), pp. 15–26. (in Russian)
11. Tetior, A. N. Design and economical construction of foundations. Kyiv: Budivelnik, 1975. 204 p. (in Russian)
12. Patent 1216288 USSR, MPK E 02 D 27/01. The foundation of buildings and structures / Belyanichev, A. K.; Berdichevsky, I. A.; Klepikov, S. N.; Klonitsky, M. L.; Tsekerman, D. B.; Shenkar, A. S.; applicant and patentee Kiev branch of the All-Union Order of Lenin and the Order of the October Revolution the Research and Design Institute «Atomteploelektroproekt». No. 3778436/29-33; declaration 08.06.84; published 07.03.86, Bull. No. 9. 2 p. (in Russian)
13. Timchenko, R. A.; Krisko, D. A. Work block foundations-selfadjustable on unevenly-deformable foundation. In: *Modern problems of construction*, 2010, No. 13, pp. 83–91. (in Russian)
14. Patent 1814677 USSR, MPK E 02 D 27/00. Precast-monolithic Foundation slab / Aivazov, R. L. No. 5019792/33; declaration 29.12.91; published 07.05.93, Bull. No. 17. 2 p. (in Russian)
15. Ikonin, S. V.; Sukhoterin, A. V. Design of the foundation slab with controlled forces. In: *Magazine of Civil Engineering*, 2015, No. 3(55), pp. 10–20. (in Russian)
16. Patent 53905 Ukraine, MPK E02D 27/34. Method for mounting the basement of a building (construction) / Petrakov, O. O.; Vinogradov, V. M.; Rashevskiy, M. V.; proprietor Donbas National Academy of Civil Engineering and Architecture. No. 2002021396; declaration 19.02.2002, published 17.02.2003, Bull. No. 2. 4 p. (in Ukrainian)
17. Zabolotnyi, P. P.; Yastrubetskiy, V. L. Foundations with deformable inserts. In: *Industrial construction and engineering structures*, 1990, No. 2, pp. 32–33. (in Russian)
18. Gorbunov-Posadov, M. I.; Ilichev, V. A.; Krutov, V. I. et al.; Edited by Sorochan, E. A.; Trofimenkov, Y. G. The bases, foundations and underground structures. Guide designer. Moscow: Stroiizdat, 1985. 480 p. (in Russian)
19. Dalmatov, B. I. Soil Mechanics, bases and foundations. Leningrad: Stroiizdat, 1988. 415 p. (in Russian)
20. Iarkin, V. V. Structure strengthening foundations combined with the paving and its modification. In: *Modern problems of construction*. Donetsk: Donetsk Promstroy of Research and Development Establishment project, LLC «Lebed», 1999, pp. 69–71. (in Russian)
21. Egorov, A. I. Reinforcement of the Foundation in the process of reconstruction of buildings and structures. Moscow: VNIINTPI, 1991. 64 p. (in Russian)
22. Konovalov, P. A. Bases and foundations of reconstructed buildings. Fourth edition revised and enlarged. Moscow: Paper gallery, 2000. 320 p. (in Russian)

институт Донецкий ПромсройНИИ проект. – Донецк : Донецкий ПромсройНИИ проект, ООО «Лебедь», 1999. – С. 69–71.
21. Егоров, А. И. Усиление фундаментов в процессе реконструкции зданий и сооружений [Текст] / А. И. Егоров. – М. : ВНИИНТПИ, 1991. – 64 с.
22. Коновалов, П. А. Основания и фундаменты реконструируемых зданий [Текст] / П. А. Коновалов. – 4-е изд. перераб. и доп. – М. : Бумажная галерея, 2000. – 320 с.
23. Полищук, А. И. Основы проектирования и устройства фундаментов реконструируемых зданий [Текст] / А. И. Полищук. – Northampton : STT ; Томск : STT, 2004. – 476 с.
23. Polishchuk, A. I. Design principles and Foundation of reconstructed buildings. Northampton: STT; Tomsk: STT, 2004. 476 p. (in Russian)

Яркін Віктор Володимирович – кандидат технічних наук, доцент кафедри основ, фундаментів та підземних споруд Донбаської національної академії будівництва і архітектури. Наукові інтереси: взаємодія будівель і споруд з нерівномірно деформуючою основою. Будівництво та проектування будівель і споруд в складних інженерно- та горно-геологічних умовах.

Кухар Ганна Володимирівна – кандидат технічних наук, доцент кафедри основ, фундаментів та підземних споруд Донбаської національної академії будівництва і архітектури. Наукові інтереси: будівництво та проектування будівель і споруд в складних інженерно-геологічних умовах, конструктивні методи захисту будівель і споруд на карстонебезпечних територіях, системи автоматичної компенсації деформацій основи.

Яркин Виктор Владимирович – кандидат технических наук, доцент кафедры оснований, фундаментов и подземных сооружений Донбасской национальной академии строительства и архитектуры. Научные интересы: взаимодействие зданий и сооружений с неравномерно деформируемым основанием. Строительство и проектирование зданий и сооружений в сложных инженерно- и горно-геологических условиях.

Кухарь Анна Владимировна – кандидат технических наук, доцент кафедры оснований, фундаментов и подземных сооружений Донбасской национальной академии строительства и архитектуры. Научные интересы: строительство и проектирование зданий и сооружений в сложных инженерно-геологических условиях, конструктивные методы защиты зданий и сооружений на карстоопаных территориях, системы для автоматической компенсации деформаций основания.

Iarkin Viktor – Ph.D. (Engineering), Associate Professor; Basements, Foundations and Underground Structures Department, Donbas National Academy of Civil Engineering and Architecture. Scientific interests: interaction of buildings and structures with unevenly deformable grounds, construction and design of buildings and structures in hard engineer- and mini-geological conditions.

Kukhar Hanna – Ph.D. (Engineering), Associate Professor; Basements, Foundations and Underground Structures Department, Donbas National Academy of Civil Engineering and Architecture. Scientific interests: construction and design of buildings and structures in complicated engineer-geological conditions, constructive methods of protection of buildings and structures on karst territories, systems for automatic compensation of deformation of the base.