UDC 69:004.9

Khrabrov A.P.

Enhancing construction control possibilities with the implementation of information modelling technologies for multifunctional real estate objects

Enhancing construction control possibilities with the implementation of information modelling technologies (BIM) is a method of ensuring the organizational and technological reliability of creating multifunctional real estate objects as a tool to increase the effectiveness of this type of commercial construction. Construction control is one of the effective methods of ensuring the organizational and technological reliability of the creation of capital construction facilities, the use of modern technologies can significantly increase their efficiency.
To date, there are still a huge number of questions and difficulties that designers, builders, regulatory authorities and other participants in this area face every day. Large construction companies have already started testing and implementing new technologies.
Every year, information modelling technologies in the Russian Federation are increasingly used at all stages of the life cycle of objects.
BIM technologies are now quite common in design, a little less at the construction stage, and very slightly at the stage of operation of buildings and structures. There are Russian developers who create new software for the needs of modern realities, which helps to reduce the time for routine processes, save and verify information, and bring it to all recipients as quickly and without loss as possible[1].
This paper discusses some of the similar technologies that are already being used at the construction and construction control stage in a common data environment (CDE). This allows you to receive data at the right time, and in the right form, without spending a lot of time on all sorts of corrections, which become more costly the later they occur.
At the design stage, if the designer does not receive special requirements from the customer, he has the right to perform the task assigned to him in any way convenient to him. If, at the initial stage of planning the construction of any new or reconstruction of an existing facility, the customer will form a package of requirements not only for the interim results of the entire investment and construction project, but also requirements for further work results (construction and operation)[2], this will allow to clearly build a strategy for all processes at an early stage, select modern technologies that can reduce many costs, and especially financial and time costs.
Keywords: *construction control, BIM, information, technology, quality*

Khrabrov Anton Pavlovich,
post-graduate student of the Department of Organization of Construction and Real Estate Management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation;
5067844@gmail.com

INTRODUCTION

Organizational and technological reliability (OTR) is the ability of accepted managerial, organizational, design, and technological decisions to implement a construction project on time and with proper quality. Organizational and technological reliability consists of two components: technological reliability and organizational reliability [1].

Technological reliability of construction is a property of the accepted technology of work, selected design solutions, materials and structures used to prevent or minimize defects in construction work leading to an increase in the cost of construction and an increase in time.

Organizational reliability is the ability to organize construction production in such a way as to exclude violations of construction indicators, and in case of any deviations, their prompt elimination and functioning of the system as a whole would be ensured, which ultimately will not exceed the established estimated cost and the directive construction period. One of the tools to ensure an OTR is the use of information modelling technology (BIM).

Construction control is one of the effective methods of ensuring the organizational and technological reliability of the creation of capital construction facilities [2].

According to the regulatory documentation, construction control is carried out during the construction and reconstruction of capital construction facilities in order to verify the compliance of the work performed with design documentation, technical regulations, engineering survey results, requirements established on the date of issuance of the urban development plan of the land plot submitted for obtaining a construction permit, as well as the permitted use of the land plot and restrictions established in accordance with the land and other legislation of the Russian Federation [3].

In the Russian Federation, the rules for the formation and maintenance of an information model of a capital construction facility are regulated by Decree of the Government of the Russian Federation No. 1431, dated September 15, 2020. According to this Federal Law [4], an information model is formed at 5 stages:

1 Braila N.V., Lazarev Yu.G., Romanovich M.A., Simankina T.L., Smybin A.V. Modern problems of construction science, engineering and technology : textbook. Saint Petersburg, 2017; 141. URL: 17-50.pdf/download/s17-50.pdf (rus.)

2 On the establishment of cases in which the developer, technical customer, person providing or preparing the justification for investments, and (or) the person responsible for the operation of the capital construction facility ensures the formation and maintenance of an information model of the capital construction facility : Decree of the Government of the Russian Federation No. 331 dated March 5, 2021 (with amendments and as amended on: December 20, 2022). (rus.).

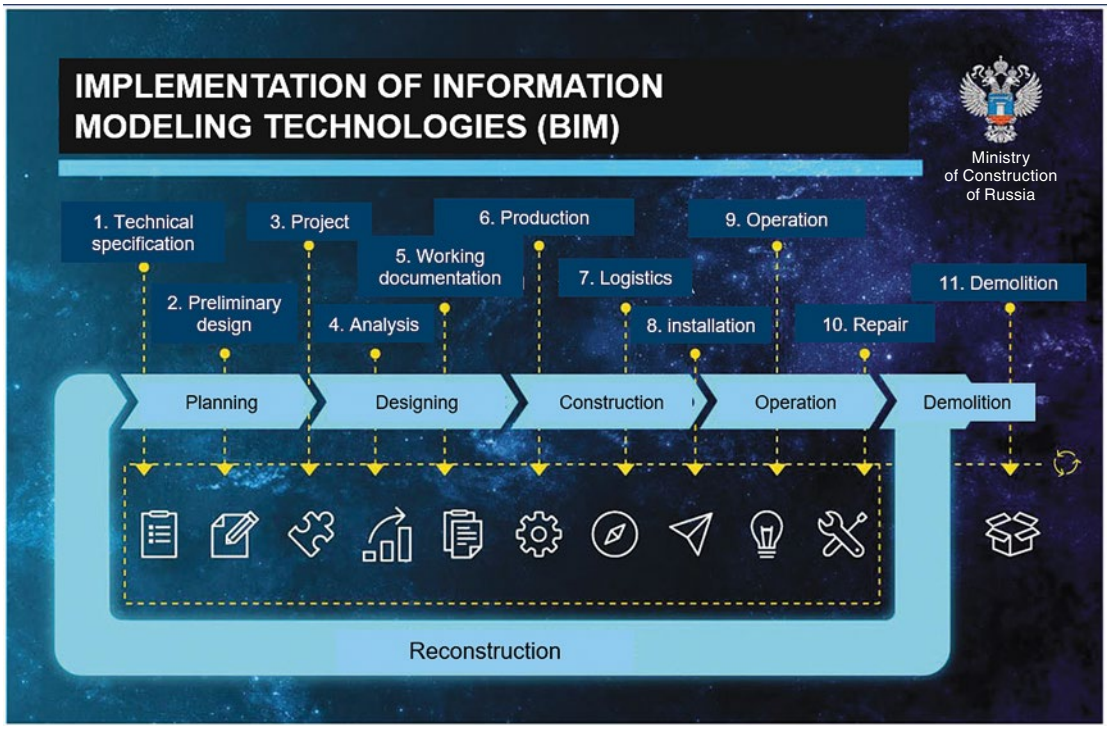

Fig. 1. The life cycle of the construction object

- engineering surveys;
- architectural and construction design;
- construction;
- operation;
- demolition.

In this paper, we will consider the way BIM technology is applied at the stage of the life cycles of a construction object [5], and the opportunities that construction quality control provides using information modelling in the BIM system (Fig. 1).

The information BIM model at the stage of issuing Working Documentation (WD), in the production of works, makes it possible to work with the project for all construction participants, such as:

- developer;
- technical customer;
- construction control of the Technical Customer;
- auditors of working documentation;
- general Contractor;
- author's supervision.

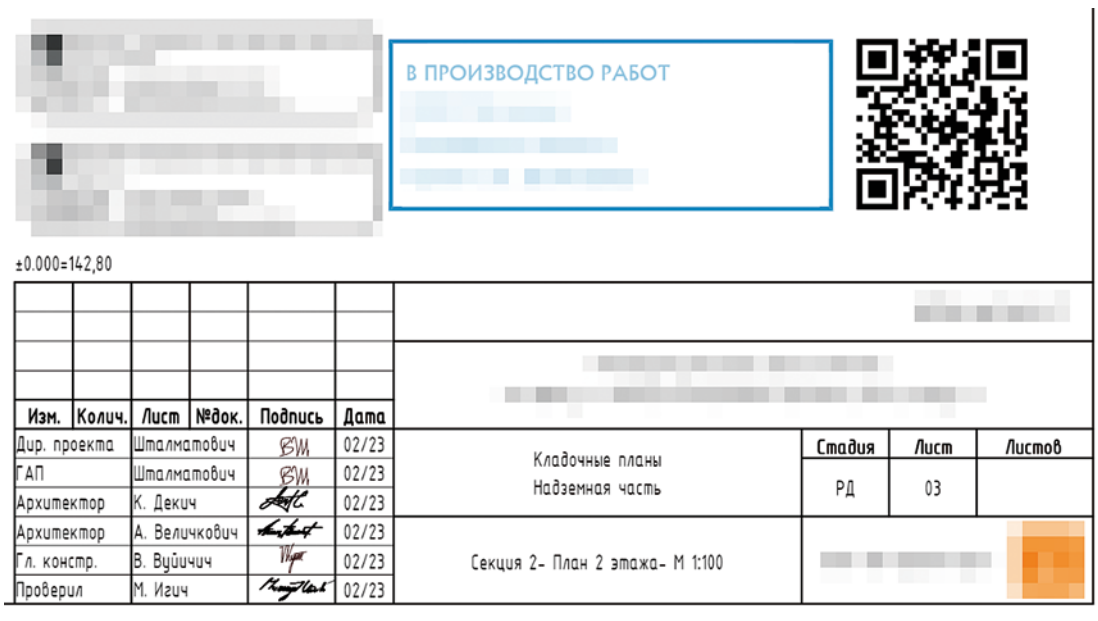

Fig. 2. An example of an issued WD section for the production of works

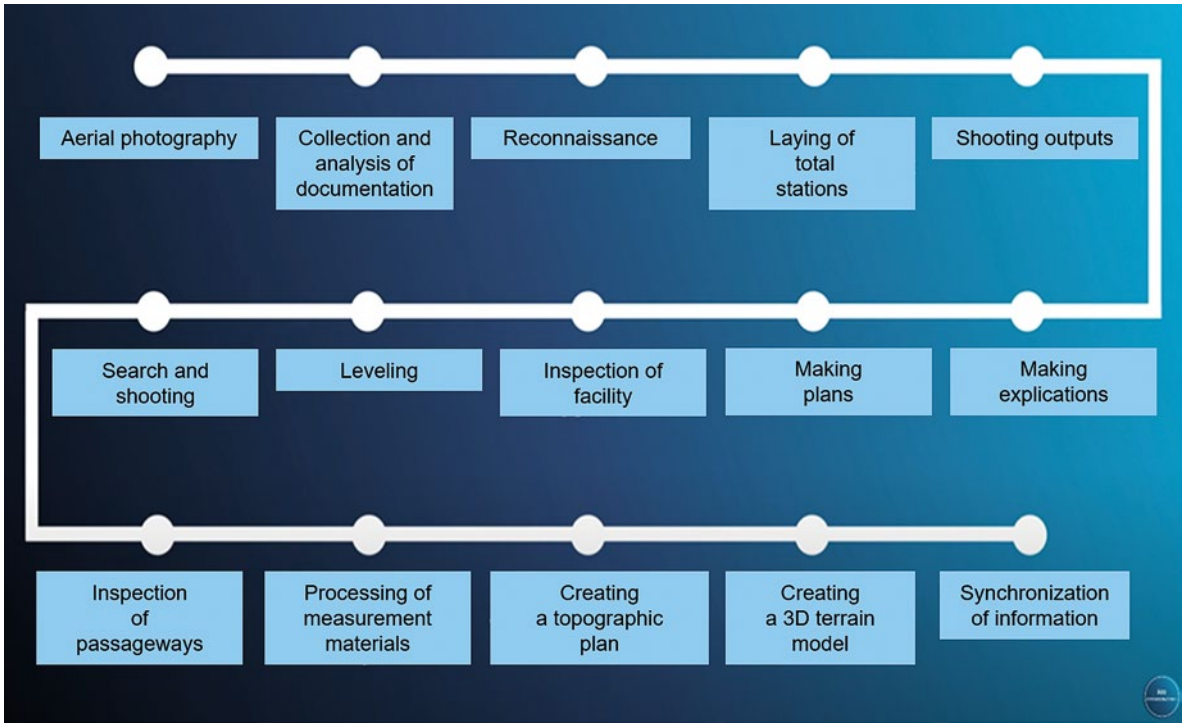

Fig. 3. Sequence of information technology implementation processes using aerial photography

The interaction of all participants in the construction is carried out: by working with the model and issuing WD from it to the production of works (by means of an electronic signature, with the assignment of a unique QR code to each document); using CDE [6]; with the help of which the audit procedure of Working documentation is optimized (it becomes possible to perform work simultaneously for a whole group of audit and reconciliation specialists "P" and "WD" in one section) (Fig. 2).

The introduction of CDE technology in construction made it possible to access up-to-date Working Documentation using a mobile device during construction and installation works (CIW) and Construction control. Using a QR code allows you to quickly determine the status of the documentation.

With the introduction of information technology into the work of Construction control, it became possible to track CIW processes for the entire construction period by using high-resolution photographs with 360° viewing and subsequent preservation (Fig. 3).

It became possible for the Construction Control to issue digital comments indicating the exact location of the identified defect (section, floor, room and structure), a description of the violation, photo fixation and indication of persons responsible for eliminating defects (Fig. 4), this allows you to promptly inform all participants about the violations identified by sending comments from the place of the detected violation, thereby significantly reducing the response time to Contractors' comments [7]. These comments can be exported according to previously set parameters (object, construction stage, section, floor, date of issue of the credit, date of elimination of the comment) to a single register.

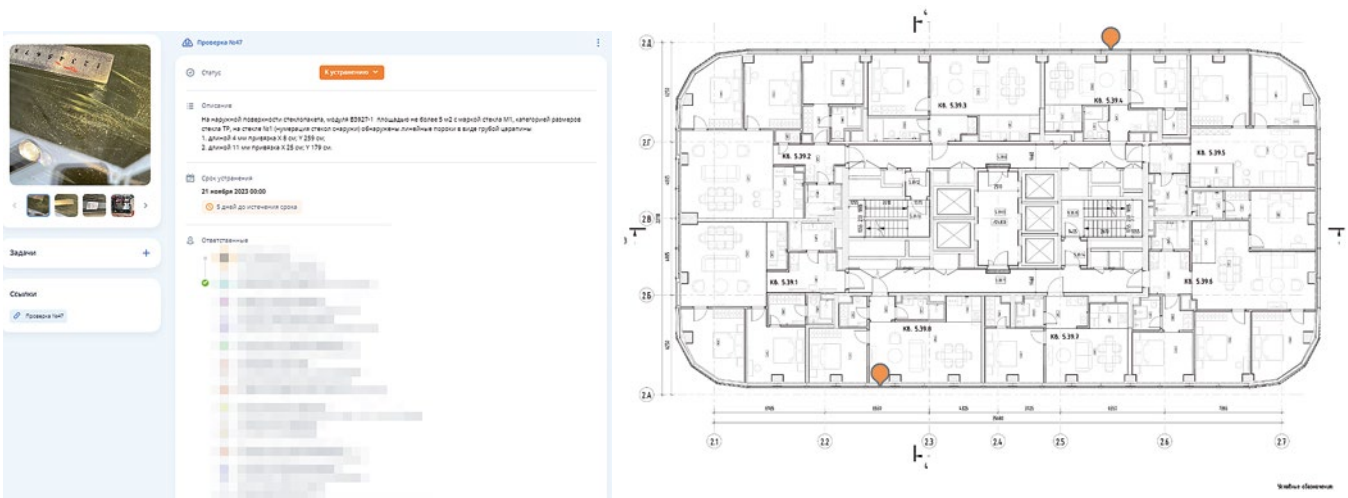

Fig. 4. Example of issuing comments by the Construction Control

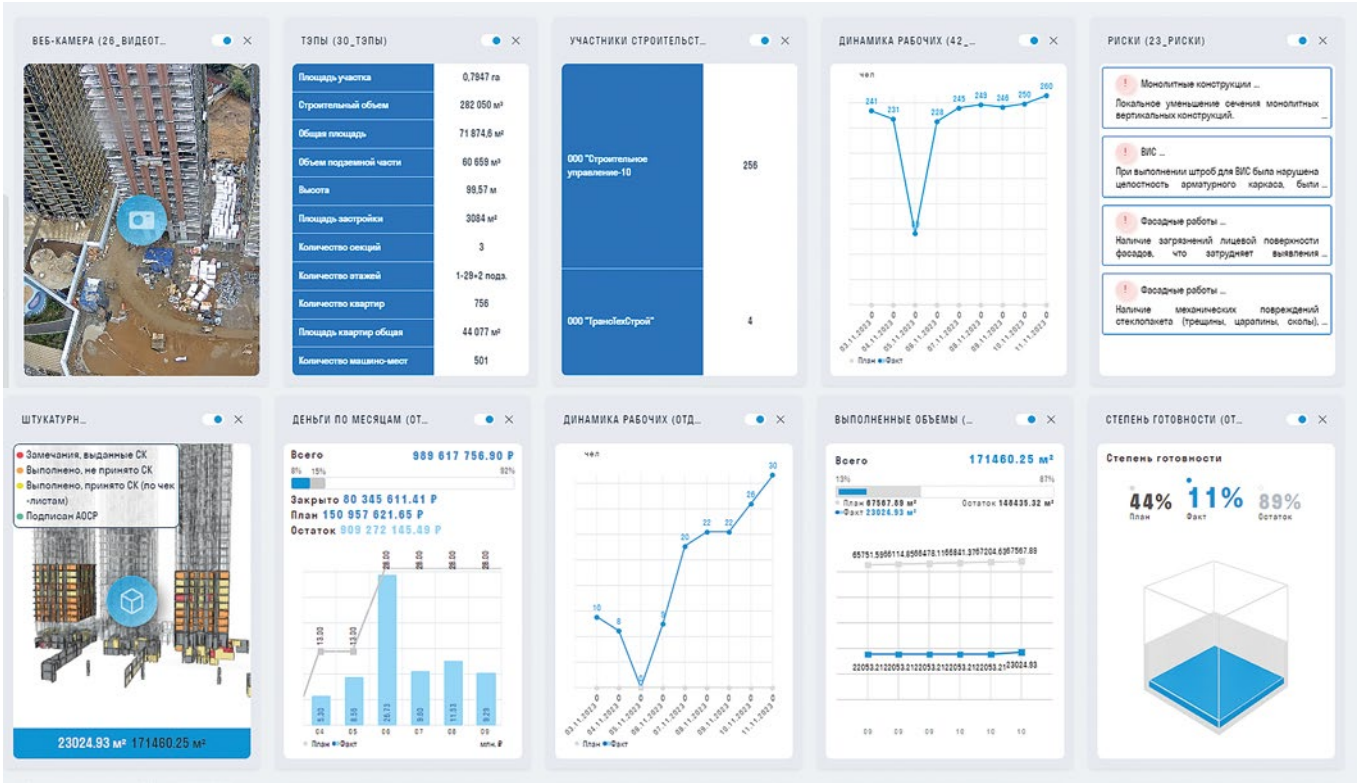

Fig. 5. Example of a card for an object under construction

In order to carry out timely construction work and carry out further construction control, it is necessary to update the current state of the facility and track the progress of construction at each stage and intermediate stages. This gives in terms of the effectiveness of construction control:

- Understanding the actual position of building elements and communications, and deviations from their design position;
- Understanding the amount of work performed.

The technology of an unmanned aerial vehicle (UAV) using 3D scanners is actively used in the work of Construction control, which makes it possible to quickly, accurately and fully confirm the completed volumes at various stages of construction[3]. This 3D scan is subsequently used to automatically build an executive digital information model (DIM).

To structure the information received about the progress of construction processes, services are actively used that allow structuring the information received into short and accessible information cards of the object, to which all project participants have access (Fig. 5) [8]. This information allows to fully reflect the current state of the object, according to such parameters as:

- technical and economic indicators;
- the number of specialists involved;
- project risks;
- the project implementation period in visual diagrams;
- an executive BIM model [9];
- control of made payments (to the General Contractor/to contractors);
- the volume of planned / actually completed work (divided by type);
- control of the deadlines for the implementation of works.

CONCLUSIONS

For further development, the global identifier (GUID) can also be used in addition to the name [10]. This is necessary so that the exchange of information, which today depends on the names specified by the user, becomes interoperable and does not depend on the systems used. Such a mechanism is the Library of International Data Dictionaries [11].

REFERENCES

1. CP 48.13330.2019. Organization of construction (updated version of SNiP 12-01–2004). (rus.).
2. Article 53. Construction control // Urban Planning Code of the Russian Federation : dated 12.29.2004 No. 190-FZ (as amended on 08.04.2023) (with amendments and additions, intro. effective from 09.01.2023). (rus.).
3. On the procedure for conducting construction control during the construction, reconstruction and overhaul of capital construction facilities : Decree of the Government of the Russian Federation No. 468 dated June 21, 2010. (rus.).
4. Urban Planning Code of the Russian Federation : dated 12.29.2004 No. 190-FZ (as amended on 08.04.2023) (with amendments and additions, intro. effective from 09.01.2023). (rus.).
5. SP 333.1325800.2020. Information modelling in construction. Rules for the formation of an information model of objects at various stages of the life cycle. (rus.).
6. ISO 19650-4:2022. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Part 1: Concepts and principles. (rus.).
7. ISO 19650-4:2022. Organization and digitization of information about buildings and civil engineering works, including building

3 Channel "PRO Construction +", video "Drones on the construction site. Pilot application for construction control and BIM (TIM)". URL: https://www.youtube.com/watch?v=K2LBfIGmM7M (rus.).

information modelling (BIM). Information management using building information modelling. Part 4: Information exchange. (rus.).
8. ISO 19650-4:2022. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Part 2: Delivery phase of the assets. (rus.).
9. SP 471.1325800.2019. Information modelling in construction. Quality control of construction works. (rus.).
10. SP 328.1325800.2020. Information modelling in construction. Rules for describing information model components. (rus.).
11. GOST R (draft, first edition).Unified information modelling system. Basic provisions. (rus.).

Расширение возможностей строительного контроля с внедрением технологий информационного моделирования для объектов многофункциональной недвижимости

Расширение возможностей строительного контроля с внедрением технологий информационного моделирования (ТИМ) — метод обеспечения организационно-технологической надежности создания объектов многофункциональной недвижимости, как инструмент наращивания результативности данного типа коммерческого строительства. Строительный контроль является одним из эффективных методов обеспечения организационно-технологической надежности создания объектов капитального строительства, использование современных технологий позволяет существенно увеличить их эффективность.

На сегодняшний день остается еще огромное количество вопросов и трудностей, с которыми каждый день сталкиваются проектировщики, строители, контрольные органы и другие участники данного направления. Крупные строительные компании уже приступили к тестированию и внедрению новых технологий.

С каждым годом технологии информационного моделирования в Российской Федерации все активнее применяются на всех этапах жизненного цикла объектов.

Сейчас довольно распространены технологии информационного моделирования в проектировании, несколько меньше на этапе строительства, и совсем незначительно на этапе эксплуатации зданий и сооружений. Существуют российские разработчики, которые создают под нужды современных реалий новое программное обеспечение, помогающее сократить время на выполнение рутинных процессов, сохранить и верифицировать информацию, донести ее до всех адресатов максимально быстро и без потерь[1].

В данной статье рассматриваются некоторые из подобных технологий, которые уже используются на этапе строительства и строительного контроля в единой среде общих данных. Это позволяет получать данные в нужный момент и в подходящем виде, без траты большого количества времени на всевозможные исправления, которые чем позже происходят, тем становятся более дорогостоящими.

На стадии проектирования, если проектировщику не приходят особые требования от заказчика, он вправе выполнять порученное ему задание любым удобным ему способом. Если же на начальном этапе планирования строительства какого-либо нового, либо реконструкции уже существующего объекта, со стороны заказчика будет формироваться пакет требований не только к промежуточным результатам всего инвестиционно-строительного проекта, но и требования к дальнейшим результатам работ (строительство и эксплуатация)[2]. Это позволит на ранних этапах четко выстраивать стратегию всех процессов, подобрать современные технологии, которые могут сократить множество издержек, и в особенности финансовые и временные затраты.

Ключевые слова: *стройконтроль, контроль, ТИМ, информация, технология, качество*

СПИСОК ИСТОЧНИКОВ

1. СП 48.13330.2019. Организация строительства (актуализированная редакция СНиП 12-01–2004).
2. Статья 53. Строительный контроль // Градостроительный кодекс Российской Федерации от 29.12.2004 № 190-ФЗ (ред. от 04.08.2023) (с изм. и доп., вступ. в силу с 01.09.2023).
3. О порядке проведения строительного контроля при осуществлении строительства, реконструкции и капитального ремонта объектов капитального строительства : Постановление Правительства РФ от 21 июня 2010 г. № 468.
4. Градостроительный кодекс Российской Федерации от 29.12.2004 № 190-ФЗ (ред. от 04.08.2023) (с изм. и доп., вступ. в силу с 01.09.2023).
5. СП 333.1325800.2020. Информационное моделирование в строительстве. Правила формирования информационной модели объектов на различных стадиях жизненного цикла.
6. ISO 19650-1:2018. Организация и оцифровка информации о зданиях и строительных работах, включая информационное моделирование зданий (BIM). Информационный менеджмент с использованием технологии информационного моделирования зданий. Часть 1. Понятия и принципы.
7. ISO 19650-4:2023. Организация и оцифровка информации о зданиях и строительных работах, включая информационное моделирование зданий (BIM). Информационный менеджмент с использованием технологии информационного моделирования зданий. Часть 4: Обмен информацией.
8. ISO 19650-2:2018. Организация и оцифровка информации о зданиях и строительных работах, включая информационное моделирование зданий (BIM). Информационный менеджмент с использованием технологии информационного моделирования зданий. Часть 2. Стадия создания активов.
9. СП 471.1325800.2019. Информационное моделирование в строительстве. Контроль качества производства строительных работ.
10. СП 328.1325800.2020. Информационное моделирование в строительстве. Правила описания компонентов информационной модели.
11. ГОСТ Р (проект, первая редакция). Единая система информационного моделирования. Основные положения.

Об авторе: **Храбров Антон Павлович** — аспирант кафедры организации строительства и управления недвижимостью; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; 5067844@gmail.com.

For citation: Khrabrov A.P. Enhancing construction control possibilities with the implementation of information modelling technologies for multifunctional real estate objects. *Real Estate: Economics, Management*. 2023; 4:43-47.

Для цитирования: *Храбров А.П.* Enhancing construction control possibilities with the implementation of information modelling technologies for multifunctional real estate objects // Недвижимость: экономика, управление. 2023. № 4. С. 43–47.

1 Брайла Н.В., Лазарев Ю.Г., Романович М.А., Симанкина Т.Л., Улыбин А.В. Современные проблемы строительной науки, техники и технологии : учебное пособие. СПб., 2017. 141 с. URL: 17-50.pdf/download/s17-50.pdf

2 Об установлении случаев, при которых застройщиком, техническим заказчиком, лицом, обеспечивающим или осуществляющим подготовку обоснования инвестиций, и (или) лицом, ответственным за эксплуатацию объекта капитального строительства, обеспечиваются формирование и ведение информационной модели объекта капитального строительства : Постановление Правительства РФ от 5 марта 2021 г. № 331 (с изм. и доп. от: 20 декабря 2022 г.).