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Zvonov I.A.
Kashirina N.V.

Prospects of application of parametric method of standardization in conditions of the registry principle of technical requirements development

In the last few years in Russia there has been an active updating of construction legislation and regulatory and technical base. This has manifested itself in the adoption and abolition of dozens of regulatory and normative-technical documents, in the introduction of various amendments to existing acts, in the adjustment of technical regulations and sets of rules, in the revision of national and interstate standards. Primarily, these updates are aimed at reducing existing administrative barriers, reducing the time and cost of construction, and improving the quality of construction products. One of the directions of this development is the transition to the parametric method of standardization, which will be a continuation of the movement towards a more efficient and innovative technical standardization system in the industry, while guaranteeing the safety of technical solutions.
At the same time, the construction industry of our country is preparing to introduce the registry principle of maintaining technical requirements, which is also one of the tasks of improving the system of technical regulation. It is determined that the principle will be ensured through the formation of an integral system of regulatory documents establishing uniform mandatory requirements at all stages of the life cycle of the capital construction object.
Some normative acts already include mechanisms for the implementation of the registry principle and the formation of a system of management of safety and quality requirements of capital construction objects based on the creation and maintenance of digital registers of requirements in the industry.
Do these two innovations influence each other? Are they intended to achieve a single goal? The paper considers and analyzes the necessity and possibility of mutual integration and joint development of parametric method of norming and registry principle in construction.
Keywords: *Digital registers of requirements, parametric rationing method, prescriptive rationing method, organization standard, functional and technological requirements, building information models, professional competencies*

Zvonov
Ilya Alexandrovich,
Director of the scientific and educational centre "Digital construction and operation"; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; SPIN-code: 6197-7370, Scopus: 57204363101, ORCID: 0000-0002-4854-9903; ZvonovIA@mgsu.ru

Kashirina
Natalia Vladimirovna,
Joint Stock Company "Kodeks", Curator; University Information Support project; 3 X Instrumentalnaya st., Saint Petersburg, 197376; Russian Federation; SPIN-code: 2752-6270, ORCID: 0000-0003-1787-441X; kashirina@kodeks.ru

TOWARDS PARAMETRIC NORMING

Modern regulatory support in the construction industry, under the influence of socio-economic factors, needs gradual qualitative changes. It should become more flexible and oriented to changes in the conjuncture and consumer demands in relation to the formed environment and its elements. The efficiency of regulatory support determines the increasing indicators of the industry development, the level of satisfaction of consumers of construction products with the formed conditions for human life and activity. Revision of the regulatory legal framework in order to transition from the prescriptive to the parametric method of rationing, as well as the development of alternative ways and mechanisms to substantiate the compliance of design values and characteristics of a building or structure with safety requirements, is one of the main activities of the Strategy for the development of the construction industry and housing and communal services of the Russian Federation for the period up to 2030 with a forecast up to 2035 [1]. Obviously, the new concept of regulatory requirements becomes one of the most important tasks in the field of standardization for the construction industry. With this method of standardization, there are many alternative ways in the realization of the capital construction object, and the task of performers, including designers and experts, is to choose and justify the most effective way, rather than to rigidly follow all the requirements of the current regulations [2].

The existing system of regulatory documents in construction is an organized structure of interrelated documents applied at all stages of the life cycle of capital construction projects to protect the rights and interests of their consumers, society and the state. In this regard, in 2024 the Ministry of Construction and Housing and Communal Services of the Russian Federation and the Federal Autonomous Institution 'Federal Center for Norming, Standardization, and Technical Conformity Assessment in Construction' plan to develop a code of practice on parametric norming. But despite the advantages of parametric standardization — flexibility and adaptability; cost reduction; stimulation of innovations; improvement of construction quality; ensuring sustainable development, the transition to it in practice is difficult for various reasons.

The parametric method assumes that the basis for standardization is the goal that a specific normative requirement is trying to achieve. Many alternatives for achieving this goal are allowed, from which the most effective/suitable one must be chosen [3].

The prescriptive method of rationing that existed until now, based on the action of building codes, and later code of practice, neither implied the formulation of the goal nor allowed variability in its achievement, i.e. it meant the necessity of strict adherence to the normative requirements. But with the emergence of new technologies, changing conditions of activity and the environment in which it is necessary to comply with the norms, the demand for flexibility increases. The parametric method of norming is designed to provide it, because it is oriented to the result and the optimal trajectory of its achievement, and it also involves

the formation of a system of requirements, in which there are more general requirements (corresponding to laws, legal acts) and more specific (which relate to the enforcement of laws), which in turn allow to qualitatively and quantitatively determine the requirements and parameters[1].

The principles of parametric standardization in general terms can exist in conditions when the objectives are set by regulatory legal acts and technical regulations, and it is possible to implement them in different ways, for example, relying on code of practice or organizational standard. But even here there is a paradox: if there is only one standard, the contractor has nothing to choose from, the principle of flexibility does not work.

On the way to parametric standardization there are difficulties of different order. One of them concerns the creation of standards: there is no established system in which the standard developed by self-regulating organizations is protected by intellectual property rights and acquired by interested parties, as it happens in foreign countries. This results in low interest in the development of their own standards, the number of standards remains small, there is no variability, and there is no competition between developers, which, in turn, affects the improvement of the "quality" of the requirements set out in the standard and designed, among other things, to reduce costs and ensure sustainable development[1].

Other difficulties are related to the use of organizational standards. Foreign company standards, developed on the basis of ISO, become part of the contract, and the requirements become norms for a specific object. In these conditions there is a need to select the necessary requirements from some generalized database (register of requirements)[2]. In the Russian Federation there is no such principle, so in this context the issue of converting standards of voluntary application into machine-readable form becomes debatable. At the same time, combining parametric standardization, the conversion of norms into a machine-readable format and the establishment of SMART standards, the interconnection of norms, and their integration with pricing, procurement, etc., into a unified system will greatly enhance process optimization, elevate work quality, and boost overall efficiency.

However, there are difficulties of another order — they relate to the culture of work processes and full-fledged technological competencies. In order to determine the correct parameters and their values, highly qualified personnel and technological development of construction science, including applied science, are required[3]. Under the parametric method the developer can independently determine in accordance with which documents he will ensure the safety of the capital construction facility, but the habit of referring to the standard as the only correct option for solving certain production problems reduces the ability to make decisions, the likelihood of new and innovative technologies, etc. The situation is aggravated by the fact that due to the transfer of regulatory and technical documents to the sphere of voluntary application, "a whole generation of customers and designers has grown up, who have formed the principle of selective application of code of practice" [3].

Difficulties in the transition to parametric normalization can be solved, among other things, if the specialists of the construction industry have developed technological competences. Since technological competence includes knowledge of modern and promising technologies, experience of their use in practice on the basis of acquired technological knowledge, technological skills, taking into account the personal significance (value) of professional activity [4]. If we simplify this definition, it turns out that a full-fledged technological competence includes the ability to realize some technological process, relying on the knowledge of how this process is realized, why and how it is necessary to perform each stage of this process. Among the main tasks of the conformity assessment system development, experts cite the need to improve the level of professional competence of experts, specialists and officials involved in conformity assessment, including innovative, or alternative solutions in the parametric system of norming by developing and improving the mechanisms of accreditation of educational programs of continuous training and conducting independent qualification assessment (certification) of experts and specialists[4]. Unfortunately, full-fledged technological competencies are not often found, as their principles are partially or not always correctly executed, which eventually affects the whole process. Partly this tendency can be observed in normative documents: often there is no information about why it is necessary to do it this way and not another way, not always the steps (the more detailed and evidentiary) that need to be done in order to get the expected result by implementing this or that technology. With the emergence of new technologies, the situation becomes even more complicated — there is a technology, but no standard. There is a standard, but it does not fully describe the technology. Because the technology is not described in detail and the reasons for performing certain actions in the appropriate sequence are not described, important information is lost and incomplete. As a result, at lower levels of execution the technology cannot be realized fully and qualitatively, as well as transferred from one level of performers to another. It is impossible to work in high-tech production by trial and error.

As we mentioned above, a prescriptive method defines norms and requirements, but does not explain what the purpose of meeting the norm is or why the quantitative parameter of the norm should be the way it is. This information remains with the developer of the standard and also remains unchanged if technology changes, unless changed by the same developer [3]. But in the conditions of changing socio-economic environment, including rapid technological development, and the emergence of new requirements for designed objects due to changes in the purposes of their construction and functions, difficulties arise when there is no understanding that it would be better to move away from the prescribed norm or there is no way to justify the transition to another norm.

What is needed at this time is a school that will create technology, what is needed is an environment in which the preconditions for the creation of technology can emerge in order to meet the challenges of technological sovereignty [5, 6]. Nevertheless, a detailed description of construction processes and their requirements in standards can solve some of the problems described. This is where the advantage of parametric standardization can be seen, which is designed to help achieve the objective in the most efficient way by creating a new standard or selecting appropriate requirements.

1 Why doesn't parametric normalization work? URL: https://www.all-smety.ru/company/news/pochemu-parametricheskoe-normirovanie-ne-rabotaet/?ysclid=luzr3n1kew921267842 (rus.).

2 Parametric norming in construction. URL: https://exinco.ru/news/parametricheskoe-normirovanie-v-stroitelstve/?ysclid=luzqzsas54538324753 (rus.).

3 Pustovgar A.P. Prospects of transition of the construction industry to the norms based on the parametric method of rationing. URL: https://smeta-na.ru/tehnologii/perspektivy-perehoda-stroitelnoj-otrasli-na-normy-osnovannye-na-parametricheskom-metode-normirovaniya/?ysclid=luzr8cngf3408612912 (rus.).

4 Barinova L.S. On the directions of reforming the system of technical standardization and regulation in the construction industry. URL: https://profi.erzrf.ru/upload/iblock/cd6/L.S.-Barinova_-O-napravleniyakh-reformirovaniya-sistemy-tekh-normirovaniya.pdf?ysclid=lv2pqugo1 m604218151 (rus.).

The key principle in this case will be to match the requirements to a specific object or type of work.

PARAMETRIC METHOD OF STANDARDIZATION AND THE REGISTRY PRINCIPLE IN CONSTRUCTION

A detailed consideration of the features and advantages of the registry principle in construction was carried out by the authors in previous publications. In the following we will establish the relationship between the parametric method of standardization and the registry principle. The transition to working with requirements in digital form is one of the key tasks in the digitalization of the construction industry. The transition to the registry principle is planned to start from April 2024 [7]. This is due not only to the need to link specific requirements to the information model, but also to provide conditions for the automation of this process, as well as the process of control over the requirements (search, relevance check, conformity assessment, etc.) [8]. But the transition to working with requirements involves certain difficulties, in particular:

1. Misunderstanding among implementers (industry) of what constitutes a digital registry, what is meant by a requirements registry, what is a requirement.

2. Uncertainty associated with the use of neural networks (artificial intelligence) in the process of extracting requirements from regulatory documents and forming registers.

3. Lack of ready-to-use registers of requirements.

4. Lack of methods and opportunities for linking the register of requirements to design solutions.

5. Lack of algorithms, methods and capabilities to integrate registers of requirements into digital information models.

In accordance with the Provisions of the Decree of the government of the Russian Federation from 06.02.2021 No. 128 and from 26.08.2023 No. 1389 it is supposed to create registers of mandatory requirements on the resource “Stroycomplex.RF”, also the developers of Information reference systems are engaged in the creation of registers of requirements of technical regulations, which would be convenient to work with in a single information space (system “Tehexpert: SMART-designing”). But these registers are created, first of all, for normative requirements that are mandatory for fulfillment, which is logical. However, functional and process requirements remain uncovered. It is also important for the industry to have access to registers of those requirements that are used in the work and prescribed in the company's internal documentation. In practice, it turns out that realizing the benefits of the registry principle is delayed over time.

Meanwhile, the application of the registry principle may significantly affect the possibility of implementing the parametric rationing method. Before defining the mechanism of such interaction it is necessary to define the terms.

Requirement is a provision of a normative document containing criteria that must be met. Traditionally, in normative and technical documentation used in the construction industry, there is no clear structure of the text of the standard, where each paragraph corresponds to one requirement; there are complex requirements; a requirement can be an illustration, a table; there are collisions of requirements (regulatory guillotine). Also the requirement may be unmeasurable quantitatively, and the degree of compliance with the requirement is not specified (i.e. variability of its achievement is assumed, as we mentioned when describing the method of parametric standardization).

A parameter is a feature, usually quantitative, but on the basis of which something is evaluated, defined or classified, a measure of evaluation. A parameter can also be some significant measurable characteristic of a system.

Based on these definitions, the parameter is a component of the requirement and serves to define the characteristics that must be achieved to fulfill the stated requirements. The concept of a parameter is important in the creation of requirement registries for several reasons:

1. A parameter, especially a quantitative one, is easy to formalize (make understandable to the information system) and hence to integrate into an information model.

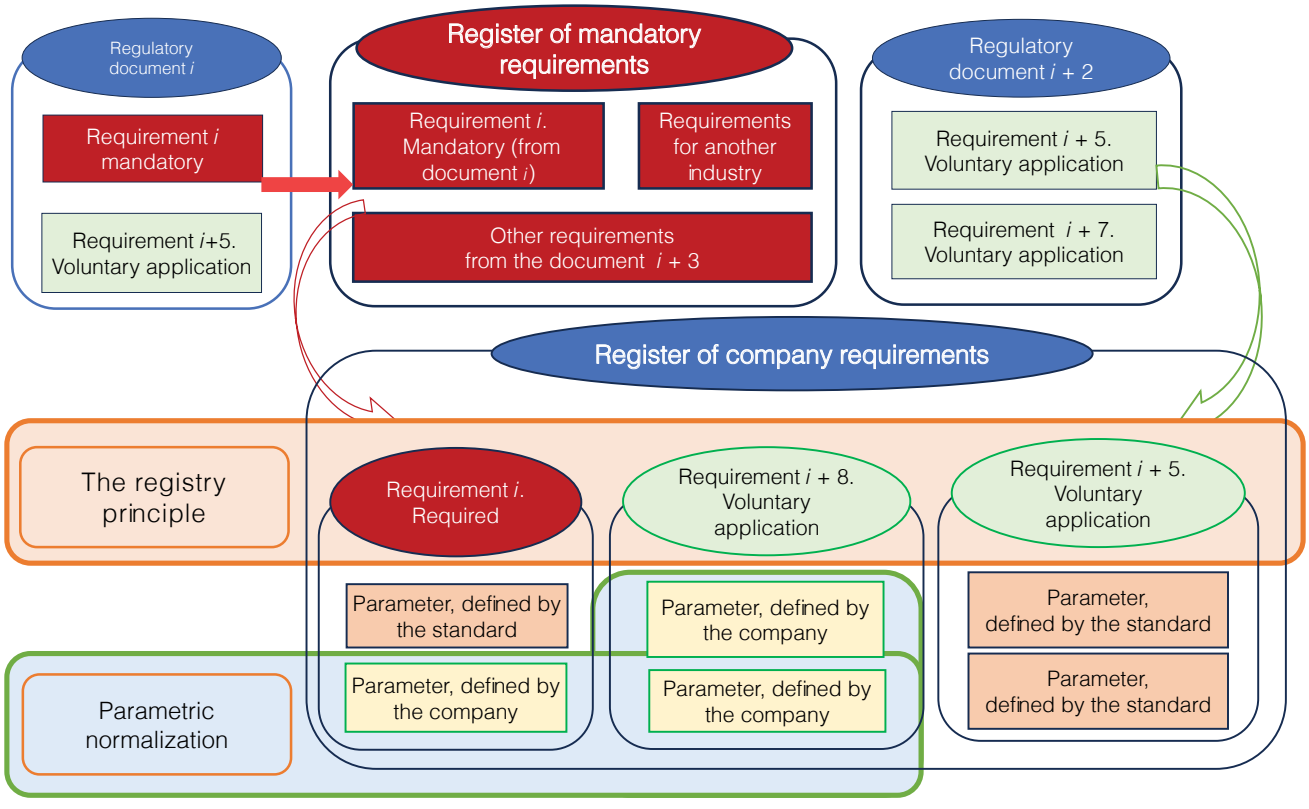
2. Formalized parameters can be collected in a database (for example, in *xml format), set up between them logical relationships and provide automation of various practical tasks. Based on such a principle, the authors have developed an algorithm for assessing the compliance of performed works with the norms [9].

3. If the parameter is not specified in the requirement specifically, the performer can determine the appropriate parameter by himself, adapting it to his capabilities and applied technologies.

4. Functional and technological parameters can be flexibly customized (if the normative requirement does not specify certain characteristics) depending on the needs and requests of the functional customer. Functional parameters are given not by chance, because according to the Strategy for the Development of the Construction Industry and Housing and Utilities Sector: “parametric method of normalization” — a method of establishing regulatory requirements, in which the establishment of mandatory requirements applies only to the operational (functional) characteristics of the object of technical regulation, including quantitative parameters, regardless of its design and performance.

As a result, in the array of parameters extracted from the normative requirements, respectively, there may be mandatory parameters, parameters of voluntary execution, as well as parameters defined by technical or functional customers “for themselves”. At this stage parametric normalization appears. As we have already mentioned above, in the conditions of technology development and appearance of new requirements to designed objects, there is often a need to justify the transition from the prescribed norm or realization of this norm using more technological solutions. It is possible to justify such a transition, among other things, by defining new parameters to achieve the required result.

If we summarize the above, we can outline the following hierarchy of rationing levels (Fig.). The upper level is the objectives of rationing, they are defined by the laws and should realize the relevant socially important objectives. In our case, this level will include registers of mandatory requirements defined by the regulator. The next level is the parameters of mandatory requirements or requirements of voluntary application. The next level is the parameters that allow to achieve regulatory requirements, but defined taking into account the capabilities and needs of the performer. These can be parameters of architectural and construction, engineering and technical, functional and technological and operational requirements. It follows that parametric standards are of great importance in all phases of the building life cycle. In this connection The Ministry of Construction and Housing and Communal Services has included in the list of the main directions of work on the transition to the parametric method further digitalization of urban planning processes, reformatting of the evidence base of the Technical Regulations on the Safety of Buildings Technical Regulations on the Safety of Buildings and Structures,



Schematic diagram of the formation of parameters

strengthening the role and responsibility of project engineer and chief project architect and much more[5].

Requirements and parameters can also be formalized in registers or databases, added to organizational standards, technical specifications, process maps or other company documentation. Thanks to this approach, users of register of regulatory requirements get all the advantages of both the registry principle and parametric standardization: optimization and automation of work processes, increased efficiency, cost reduction, improved product quality and labour productivity[6]. Including, due to more active work with requirement registers, there are prospects for the transition to "smart" SMART-standards.

CONCLUSIONS

In conclusion, it can be stated preliminarily that parametric normalization has great prospects for implementation and effects of use. But it is necessary to develop a concept that will describe this method and its applications, including a clear definition of concepts. In order to ensure the relationship between the parameters in the information model, it is necessary to understand what exactly will be the parameters, what will be the characteristics, how to build the architecture of connections between the parameters so that the resulting virtual model is flexible and changes after adjusting the selected parameters. Therefore, a reformatted norming system could more successfully address the challenges confronting the construction industry and ensure the improvement of safety of construction products, their reliability and quality, increase the energy efficiency of buildings, labor conditions and living conditions of citizens. It can be considered that the development of parametric standardization and the registry principle are the most important tasks in the field of standardization in the construction industry.

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Перспективы применения параметрического метода нормирования в условиях реестрового принципа разработки технических требований

В последние несколько лет в России происходит активное обновление строительного законодательства и нормативно-технической базы. Это выразилось в принятии и отмене десятков нормативно-правовых и нормативно-технических документов, во внесении различных изменений в действующие акты, в проведении корректировок технических регламентов и сводов правил, пересмотре национальных и межгосударственных стандартов. Преимущественно эти обновления нацелены на сокращение существующих административных барьеров, уменьшение сроков и стоимости строительства, повышение качества строительной продукции. Одним из направлений данного развития является переход на параметрический метод нормирования. Ожидается, что это станет продолжением движения в сторону более эффективной и открытой к инновациям системы технического нормирования в отрасли, гарантирующей при этом соблюдение безопасности технических решений.

Одновременно с этим в строительной отрасли нашей страны готовится внедрение реестрового принципа ведения технических требований, что тоже является одной из задач совершенствования системы технического регулирования. Определено, что принцип будет обеспечиваться посредством формирования целостной системы нормативных документов, устанавливающей единые обязательные требования на всех этапах жизненного цикла объекта капитального строительства.

В отдельные нормативные акты уже включены механизмы реализации реестрового принципа и формирования системы управления требованиями безопасности и качества объектов капитального строительства на основе создания и ведения цифровых реестров требований в отрасли.

Влияют ли эти два нововведения друг на друга? Призваны ли они достичь единой цели? В статье рассмотрены и проанализированы необходимость и возможность взаимной интеграции и совместного развития параметрического метода нормирования и реестрового принципа в строительстве.

Ключевые слова: *цифровые реестры требований, параметрический метод нормирования, предписывающий метод нормирования, стандарт организации, функциональные и технологические требования, информационные модели зданий, профессиональные компетенции*

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Об авторах: **Звонов Илья Александрович** — директор научно-образовательного центра «Цифровое строительство и эксплуатация»; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; SPIN-код: 6197-7370, Scopus: 57204363101, ORCID: 0000-0002-4854-9903; ZvonovIA@mgsu.ru;

Каширина Наталия Владимировна — куратор проекта информационной поддержки ВУЗов; **АО «Кодекс»**; 197376, г. Санкт-Петербург, ул. Инструментальная, д. 3, лит. Х; SPIN-код: 2752-6270, ORCID: 0000-0003-1787-441X; kashirina@kodeks.ru.

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