BIM in Facility Management

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VŠB TECHNICKÁ UNIVERZITA OSTRAVA | FAKULTA STAVEBNÍ

Objectives of the course expressed by the achieved skills and competencies

The aim of the course is to acquire knowledge and application of theoretical background in the field of facility management using BIM. The graduate of the course is able to passport, structure data, distinguish the following data for FM and data model in relation to LOMD, knows the processes and broader relationships between BIM, FM and the life cycle of buildings, can plan and manage operational technical processes related to effective FM from an asset perspective and property management, and knows the conditions that can run the BIM model on data in CAFM.

Annotation

The digitalization of construction brings a breakthrough in the implementation and planning of construction contracts. The previous approach to building planning was disorganized, confusing and difficult to coordinate. It is therefore not surprising that the implementation phase reveals collisions of individual structural elements and technical equipment, which require immediate, rather improvised solutions, which unnecessarily prolong construction production and make its implementation more expensive, and in the subsequent phase of operation and use of buildings reduce the comfort of its use. Not only this, this will eliminate the gradual transition of the perception of the professional public of the process of preparation and implementation to the BIM method. The initial acceptance of a new idea of coordinated cooperation on one model with the involvement of all stakeholders in the process of creating project documentation and implementation is usually met with fundamental rejection and does not choose to move to something new.

The expertise of facility management in the management of property and real estate is an undeniable fact of the present. This expertise is an established practice in the commercial sphere and it is often the management of really large areas, where the individual elements may be similar to urban areas. It is no longer a question of managing individual buildings, but of entire areas, ie including adjacent areas, connecting roads, greenery and technical elements in the area. For newly emerging buildings, the information model is growing and being created in parallel with the building, but the BIM method is also applicable to existing buildings. In the context of sustainable development, current constructions should not be excluded, but rather encouraged to implement the BIM method. The reason is clear: constructions are designed and implemented for the purpose of operation and use. It is precisely the phase of operation and use that can make the most of the possibilities of the BIM model.

List of abbreviations

BA (or SZ)	Buildling Act
BIM	Building Information Modelling
CAD	Computer Aided Design
CAFM	Computer Aided Facility Management
CMMS	Computerized Maintenance Management Systems
ČSN	Czech Technical Standard
ČSÚ	Czech Statistical Authority
DSPS	As Built Documentation
EPS	Electric Fire Signalization
EZS	Electric Safety Signalization
FM	Facility Management
GIS	Geographic Information System
ICT	Information and Communication Technology
IFMA CZ	International Facility Management Association
ISO	(International Organization for Standardization
KPI	Key Performance Indicator
LC	Life Cycle
LCA	Life-Cycle-Assessment
LCC	Life Cycle Costs
LOD	Level of Development
LOI	Level of Information
LOMD	Level of Model Definition
NV	Government regulation
OHSAS	Occupational Health and Safety Assessment Specification
OZO	A qualified person
PD	Project documentation
PS	Evidence
SLA	Service Level Agreement
SVJ	Owners Associations
SW	Software

Content

1 Life cycle of buildings

Every newly built and existing building has its own life cycle, regardless of its size and purpose of use. The life cycle of buildings begins with the idea of the building, which passes into the definition of future buildings, their planning and subsequent implementation, which culminates in their operation and ends with their liquidation, see Fig. 1.1..

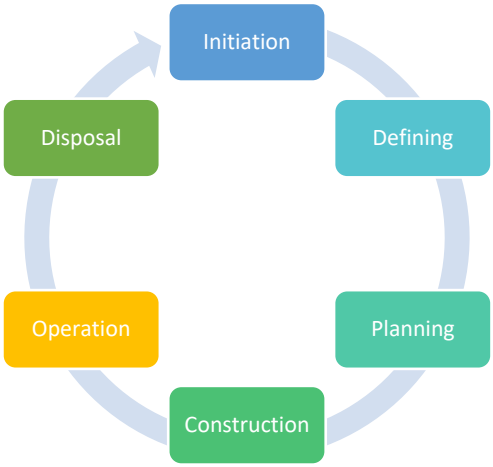


FIg. 1.1: Life cycle of buildings, Source: author

Buildings, regardless of their functional use, are designed and implemented for the purpose of operation and use. This is the main goal of all construction projects. The construction project forms a certain time stage within the life cycle of buildings, which can be precisely and unambiguously limited in time, see Fig. 1.2. It starts with the birth of an idea - initiation, and ends with the issuance of a building permit or building permit, depending on which building it is.

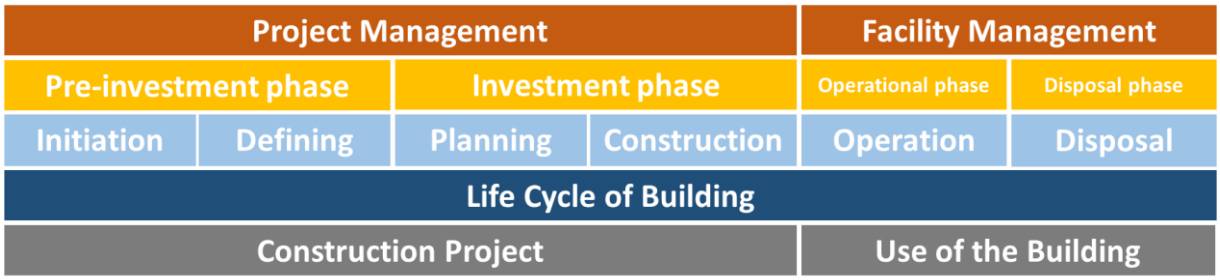


Fig. 1.2: Phases of the life cycle of buildings - construction project, Source: author

The construction project is an important stage in the life cycle of buildings, because it is in this time that decisions are made on the projected properties of future construction, in this stage strategic decisions are made that determine future operating costs and future solutions to operational situations. Within this stage, it is more than desirable for the future facility manager or facility manager to be present in the decision-making process, who could positively influence the future investment with his experience and other point of view.

When applying the BIM method to current practices of construction preparation and implementation, it should be standard for this position to figure before the construction is put into operation. The reason is simple. In the future, the BIM model will serve mainly the needs of facility management, therefore its representative should stand at its birth and cooperate on

the creation of a data model. The requirements for the data model from the point of view of administration and operation should arise from the facility management:

- economic activities - activities related to the economics of real estate operation,
- legal activities - activities that affect legislation and contracts,
- technical activities - activities related to the management of technical equipment of buildings and building structures and parts of the building,
- operational activities - activities that occur de facto in dealing with daily operations and daily routines and are activities.

1.1 Phases of the life cycle of buildings

The life cycle of buildings is divided into phases, which are characterized by certain specific activities and are limited in time by decisions and significant milestones. The phases of the life cycle are:

- Pre-investment phase,
- Investment phase,
- Operational phase,
- Liquidation phase.

Due to the focus of the publication of the subject, the phase of operation will be described in more detail.

1.1.1 Operational phase

After putting the building into operation, it is necessary to maintain and extend the designed properties of the building, ie. to take care of the construction in accordance with the Building Act, which states in §154, par. 1:

„*The owner of the building is obliged*

a) to maintain the building according to § 3 par. 4 for the entire period of its existence,

b) immediately report to the building authority defects on the construction site that endanger the lives or health of persons or animals,

c) to allow an inspection of the construction and, unless there are serious reasons to the contrary, to take part in this inspection,

d) keep the construction diary for a period of 10 years from the issuance of the building permit, or from the completion of the construction, unless the building permit is required,

e) keep for the entire duration of the construction documentation of its actual execution, decisions, certificates, approvals, verified project documentation, or other important documents related to the construction. "

The operational phase of the life cycle of buildings is the longest and most expensive stage within the life cycle, see Fig. 1.3. The costs of this phase are energy and media consumption, disposal of waste from operation, cleaning, maintenance of greenery, security and security of the building, insurance of buildings and property, administrative and service fees, costs of maintenance and renovation of construction and technical equipment of buildings, etc. costs can be influenced especially in the pre-investment phase, where the construction economic and technical properties of the proposed construction are defined and specified. In the

investment phase, as part of the implementation, any change represents not only time but mainly financial losses compared to the original solution.

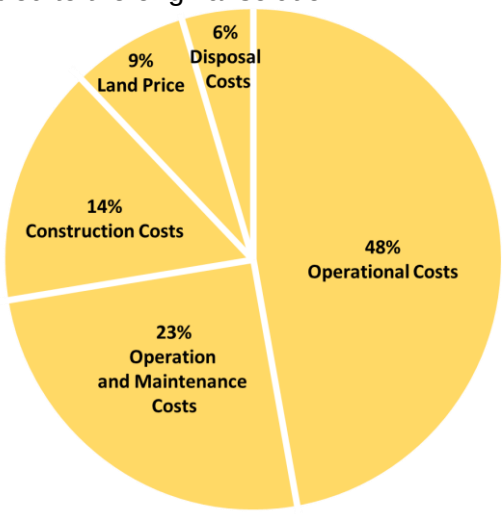


Fig. 1.3: Life cycle costs of buildings, Source: author

Although this is the longest and most costly stage in the life cycle, this stage is still greatly underestimated not only by the professional public but also by legislators. The operational phase is not sufficiently, and especially clearly legally covered, as the phase of preparation and implementation, where the basic legal regulation is Act No. 183/2006 Coll., On Spatial Planning and Building Regulations (Building Act), as amended, which together with its implementing decrees, stipulates the procedure for the approval process of capital construction. The way to operate and use buildings within the framework of determining the obligations arising from legal regulations are fragmented in the Collection of Laws. There is no uniform legal regulation that would regulate the mandatory minimum obligations of the owner of the building in the operation and use of buildings. Conceptual approach and strategic planning is the domain of large companies, usually with foreign participation, who understand that preventive and regular care of real estate brings maximization of benefits.

During the construction project, a considerable number of documents, protocols, licenses and other important outputs are created. Let us mention, for example, the documentation of the actual construction, which according to the Building Act must be kept by the owner of the building for the entire duration of the building or construction log, which is kept for 10 years from issuing the building permit, or from the completion of the building if the building permit was not required. In addition to the documentation from the construction project, there is documentation that arises during operation and use, either that which is mandatory by law or that arises at the instigation of the needs arising from the performance of property management and its scope cannot be generalized, because it is case by case different. Here, it depends on the method of process management, whether it is a spontaneous use or a well-thought-out conceptual management using modern asset management tools. After the advent of BIM, all these processes are expected to be sophisticatedly managed and the owner / facility manager / administrator will have all the above-mentioned documents in an electronic database, securely stored in cloud storage, accessible from anywhere and anywhere, and all data will be valid. If a BIM model is created, it is up to the owner to arrange, either on his own or a person (natural or legal), to take care of and update it.

The BIM model can be encountered either:

1. For newly emerging constructions, in which it is naturally created together with the project.
2. For existing constructions, where it is introduced additionally.

Both cases have a common goal - to create a BIM model that would correspond to the actual construction solution of the building and contain the true data necessary to manage the processes associated with the management of property and operation of buildings. The direction of travel to the BIM model is de facto opposite. For a newly emerging building, all data elements are defined and linked to the newly emerging elements and structures. For existing buildings, these elements are already known. It knows their number, location properties, etc. These individual attributes are connected with the graphical basis of the model. More about this implementation is given in chap. 3.

2 Facility management in the operation and use of buildings

The issues of approaches and decisions on technical and economic variants of property management and building maintenance are sensitive and in many ways a weak point of technical and economic solutions for practice, operation of companies, project offices, investor organizations, public administration. In many cases, decision-making is based only on the routine experience of key management personnel and current environmental requirements. The deficit is mainly multidisciplinary integration in the context of technical and economic decisions (strategic decisions of public investors, developers, owners, etc.).

The interconnection of FM from the point of view of technical and economic management of property and sustainability of the use of buildings and housing stock is indisputable. FM is a set of mutually integrated activities that cover all activities related to comprehensive property management. It includes all real estate management activities that lead to the provision and development of agreed services and thus support and increase the efficiency of basic real estate activities. FM incorporates the principles of many different disciplines - business administration, architecture, humanities and engineering - and thus approaches asset management as a whole. Further development of FM presupposes organized creation of conditions, especially new innovative approaches in making knowledge accessible, these include modern models of dynamics of technical and economic processes, decision-making processes and their application in technical and economic disciplines.

FM seeks to find answers to the questions of the application of new forms of solutions for building maintenance processes as a means to increase their utility in terms of use, service life, renewal dates and controlled termination of their service life. These activities are currently included under the term life cycle of the building (LC). The effort of all solutions currently used is to calculate the entire life cycle cost (LCC). Its basic attribute is the durability of the designed building. The expected result should be a more efficient use of buildings, an improvement in their condition and an increase in investor interest in entering this area. However, support for building repairs and modernization can have a significant impact on the recovery of economic activity in the regions, including the creation of a certain number of jobs.

The range of knowledge, skills and experience of employees of companies that provide FM services in the field of technical building management must be unusually wide - generally high competence of employees. At the same time, the technical and material background of such a company must go. It is not entirely professional for other professional business entities to contract for special activities that they cannot provide on their own. Although this practice is still very common. For example, arranging inspection technicians, OZO in risk prevention, OZO in risk prevention, etc. Regarding the competence of the employees of the company providing technical management services of buildings, it is necessary to take into account that technical equipment of buildings generally consists basically of dedicated equipment (electrical, gas, lifting, pressure and fire safety), machinery, fire equipment protection, etc. For workers who directly provide these activities, it is necessary to provide special qualifications, which are conditioned by sufficient education, professional training, examinations, or verification of their professional knowledge. Based on this, they obtain certificates, authorizations or certificates. For example, these are: operation of boiler rooms, operation of dedicated equipment, certificates or authorizations to perform inspection or performance of installation and service activities on dedicated equipment, etc. Here, it is an advantage if the employees of these

companies have more professional qualifications at the same time. These qualifications need to be maintained and testing of some of them is even mandatory and periodic.

Owners of buildings or organizations that manage property are obliged to provide comprehensive care for its condition in accordance with legal regulations. This activity is an important part of the administration and operation of assets. Regular maintenance of objects slows down the course of the physical wear and tear process and prevents its consequences in order to ensure their operable condition and safe operation. The primary goal of FM is not to create a perfectly accurate model of technical FM (technical building management), including maintenance and restoration of buildings and structures using mathematical modelling (model building, data collection, calibration and tuning) and application software, but to use and apply innovative, less common FM tools. sustainability of the life cycle benefits of buildings.

BIM is often called one of the dynamically developing tools for extending the usefulness of buildings. This new view of the preparation and implementation of constructions helps to transform the construction industry into digitization. With this new tool, the hitherto used and often inefficient ways of designing, implementing and subsequently managing buildings are transformed into new, simpler and more dynamic ways. BIM brings with it big changes, which may not always be accepted by the professional public, but its contribution in the phase of operation and use increases competitiveness and contributes to the rationalization of the set processes of operation and use.

It should be noted that facility management works in two levels of service provision, namely in the field of space and infrastructure and people and organizations. Due to the focus of the publication, the following text focuses on the area of space and infrastructure services.

2.1 Benefits of BIM in facility management

The BIM model provides a set of comprehensive and structured data about the building, which are ready for use in the management and operation of assets - facility management.

The handover and acceptance of the finished construction still takes place by handing over the documentation of the actual construction, where all changes and modifications compared to the documentation for the construction should be recorded, and by handing over all necessary protocols, inspection reports, certificates and other documents. On the day the finished work is handed over, it can be said that all data is valid and up-to-date, but over time the data becomes obsolete and few times are updated or lost. BIM should change all this and turn it for the better. Complete and up-to-date data will be available to administrators, which will be possible to work with, for example, when planning strategic maintenance and recovery plans. There is no need to perform additional evidence and create passports, because all relevant data from the model will be imported by a suitable and compatible SW tool environment (This applies if it is not a BIM implementation on an existing construction, evidence must be performed in the BIM implementation process on an existing construction.). Furthermore, it is easy to plan support processes and solve routine daily operations. All the work of the administrator will be promoted to the digital level of work with data, in time the paper creation of eg revision reports, contracts with service suppliers, etc. will disappear, or it will become a secondary / additional source of information. Everything will be digitized and accessible online from cloud storage via any mobile device with an Internet connection. All this is so far the music of the future, which, however, is irresistibly approaching.

2.2 Legislation

The standards of the ČSN EN 15 221 series are a professional contribution to solving the FM problem. They unify inconsistent terminology and define the scope and content of FM. An overview of FM standards is shown in tab. 2.1.

No human activity can be conducted without standardization. The standard, or standard, clarifies and sets out the basic preconditions for the correct implementation and application of procedures in order to achieve a targeted result without undesirable errors and inaccuracies.

Tab. 2.1: Overview of FM standards of the ČSN EN 15221 series, Source: author

ČSN EN 15221-1	Facility management - Part 1: Terms and definitions	Effective 1.4. 2014	Replacement of the standard from 06/2007 **Cancelled!!**
ČSN EN 15221-2	Facility management – Part 2: Guidance on how to prepare Facility Management agreements		
ČSN EN 15221-3	Facility management – Part 3: Guidance on quality in Facility Management	Effective 1.4. 2014	Replacement of the standard from 04/2012
ČSN EN 15221-4	Facility Management - Part 4: Taxonomy, Classification and Structures in Facility Management		
ČSN EN 15221-5	Facility Management - Part 5: Guidance on Facility Management processes		
ČSN EN 15221-6	Facility Management - Part 6: Area and Space Measurement in Facility Management		
ČSN EN 15221-7	Facility Management - Part 7: Guidelines for Performance Benchmarking	Effective 1.2. 2015	Replacement of the standard from 04/2013
ČSN EN ISO 41001	Facility management - Management systems - Requirements with guidance for use	Effective 1.10.2019	
ČSN EN ISO 41011	Facility management - Vocabulary	Effective 1.12.2018	It replaces the ČSN EN 15221-1 standard
ČSN EN ISO 41012	Facility management - Guidance on strategic sourcing and the development of agreements	Effective 1.3.2019	It replaces the ČSN EN 15221-2 standard
ČSN EN ISO 41014	Facility management - Development of facility management strategy	Effective 1.6.2021	

2.2.1 ČSN EN 15221–3: Guidance on quality in Facility Management

Effective FM brings value to the organization and to all related entities (stakeholders). This European Standard is primarily intended for companies that have adopted quality improvement procedures together with the definition of service level (SL) and the use of metrics The aim of this European Standard is to provide guidance on how to achieve, improve and measure quality in FM.
The standard is intended for use by management, consultants and experts both in the client's organization and in the provider's organization.

2.2.2 ČSN EN 15221–4: Taxonomy, Classification and Structures in Facility Management

Based on various definitions, the most obvious conclusion is that taxonomy is a classification system for better information management, which contributes to improving the ability of users to maintain and improve the operational operation of their business. The key concept is how to use taxonomy to improve business operations. ČSN EN 15221-4 specifies a taxonomy that includes a model of relationships, the structure of products / services and a classification system. This standard therefore represents the concept of standardized (classified) FM products.

2.2.3 ČSN EN 15221–5: Guidance on Facility Management processes

The aim of this standard is to provide a general procedure (guidelines) for the development and improvement of its processes to support the primary activity (subject of business) to all FM stakeholders, in particular providers and their clients. When implementing a standard, organizations should be able to understand the importance of FM processes for their effectiveness and should be able to assess the maturity of their existing activities.

2.2.4 ČSN EN 15221–6: Area and Space Measurement in Facility Management

The sixth part of the set is a necessary prerequisite for the seventh part (Benchmarking). In this sixth part, from the point of view of FM services, the managed areas and volumes are divided into individual categories. These categories are verbally defined, interconnected and graphically unambiguously displayed (in schematic floor plans and sections). By introducing the principles of the sixth part into common practice, the evidence and marking of areas should be unified and thus a precondition should be created for accurate measurement of costs, consumption, area, etc. and their subsequent evaluable measurement (following the seventh part of the set).

2.2.5 ČSN EN 15221–7: Guidelines for Performance Benchmarking

The last and youngest standard in the field of FM is the standard dealing with benchmarking. It provides guidelines for performance benchmarking and contains clear terms and definitions, as well as methods for benchmarking FM equipment and services and services, as well as FM organizations and operations. This European Standard provides a common basis for benchmarking FM costs, floor areas and environmental impacts, as well as service quality, satisfaction and productivity. This European Standard is applicable to FM as defined in EN 15221-1 and described in detail in EN 15221-4.

2.2.6 ISO standards for facility management

So far, no discipline has developed as dynamically as FM, so it is no wonder that its expansion is corrected by worldwide ISO standards. These are the standards:

- ISO 41001, Facility management – Facility management – Management systems – Requirements with guidance for use). **Effective 1.10.2019.**
- ISO 41011, Facility management – Vocabulary). **Effective 1.12.2018, It replaces the ČSN EN 15 221-1 standard from 2014**;
- ISO 41012, Facility management – Guidance on strategic sourcing and the development of agreements). **Effective from 1.3.2019, Replaces standard ČSN EN 15221-2 from 2014).**
- ISO/TR 41013, Facility management – Scope, key concepts and benefits., approved technical report and further developed as a standard.
- ISO/AWI 41014, Facility management – Development of Facility management Strategy, in the approval procedure,
- ISO/AWI 41015. Facility management – Influencing behaviours for improved facility outcomes and users experience, in the approval procedure.

As of the date of publication of this study material, all the mentioned standards are in English and are gradually being finalized and adopted into the environment of the Czech Republic..

2.3 Legal obligations of the owner of the construction

Obligations arising for the owner of the building are specified primarily in Act No. 183/2006 Coll., (Building Act), as amended. Implementing regulations to the Building Act and other legal regulations then describe in detail the requirements arising for the performance of administration and maintenance (maintenance work), especially for building owners but also in delegated powers for administrators and FM service providers. Legislation of the Czech Republic is preceded by regulations of the European Parliament and the Council (EU). The division of legal regulations and their significance is shown in Fig. 2.1.

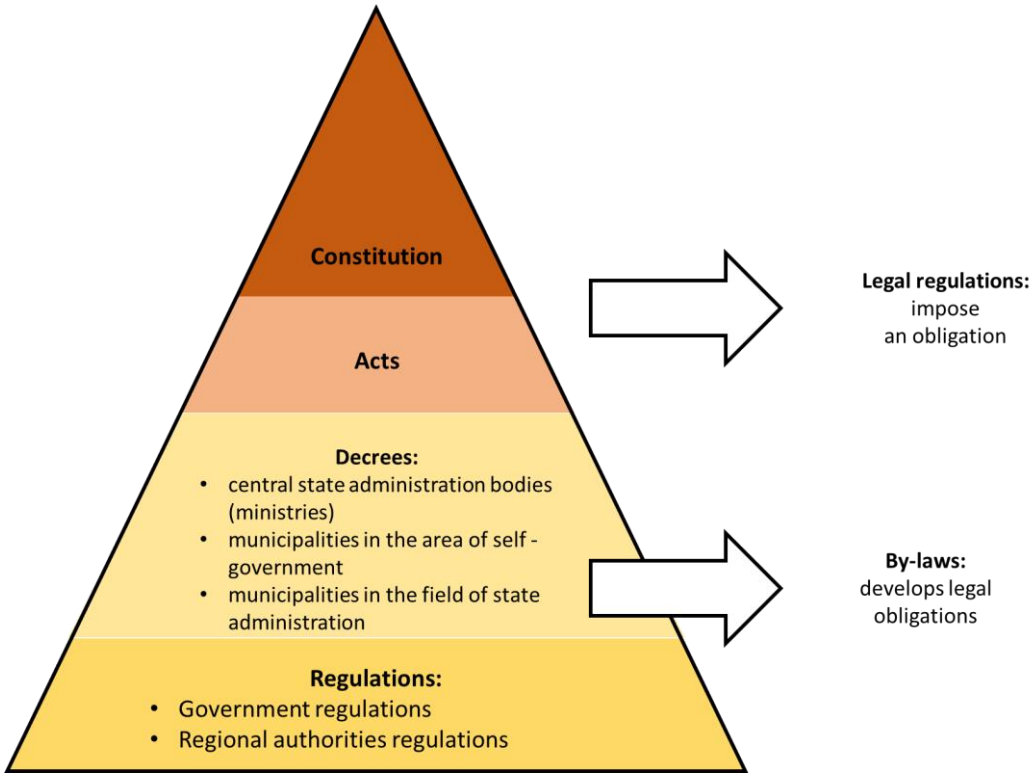


Fig. 2.1: Types of legislation, Source: author

Legal obligations are based on the basic requirements for constructions arising from Regulation (EU) 305/2011 of the European Parliament and of the Council. This regulation newly introduces seven construction requirements. The first six requirements are implemented in Czech legal regulations and indicate the direction of asset management and are a mandatory minimum, which should ensure that operation and use do not conflict with applicable legislation. As of 1 July 2013, the seventh requirement "Sustainable use of natural resources" applies to these 6 requirements for constructions. This requirement follows from Regulation (EU) 305/2011 of the European Parliament and of the Council and is not yet specified in Czech legislation.

Buildings as a whole and their individual parts must be suitable for the intended use, in particular with regard to the safety and health protection of persons throughout the life cycle of the works. For an economically reasonable service life, buildings must meet these basic building requirements during routine maintenance:

1. Mechanical resistance and stability,
2. Fire safety,
3. Hygiene, health and environmental protection,
4. Safety and accessibility in use,
5. Protection against noise,
6. Energy and heat savings,
7. Sustainable use of natural resources.

2.4 Levels of asset management

Asset management takes place at three levels of management (strategic, tactical, operational). In terms of time, these are long-term, medium-term and short-term levels. Each level is represented by activities that are limited by time or nature.

2.4.1 Strategic level

The strategic level represents a long-term time horizon of tasks, activities and processes. At this level, gradual steps are planned, which should be in line with long-term goals. At the strategic level, a conceptual approach to asset management is being formed. The scope and quality of the result are defined. Everything is planned in a rough, long-term, time scale without further detailed analysis.

Typical activities can be considered:

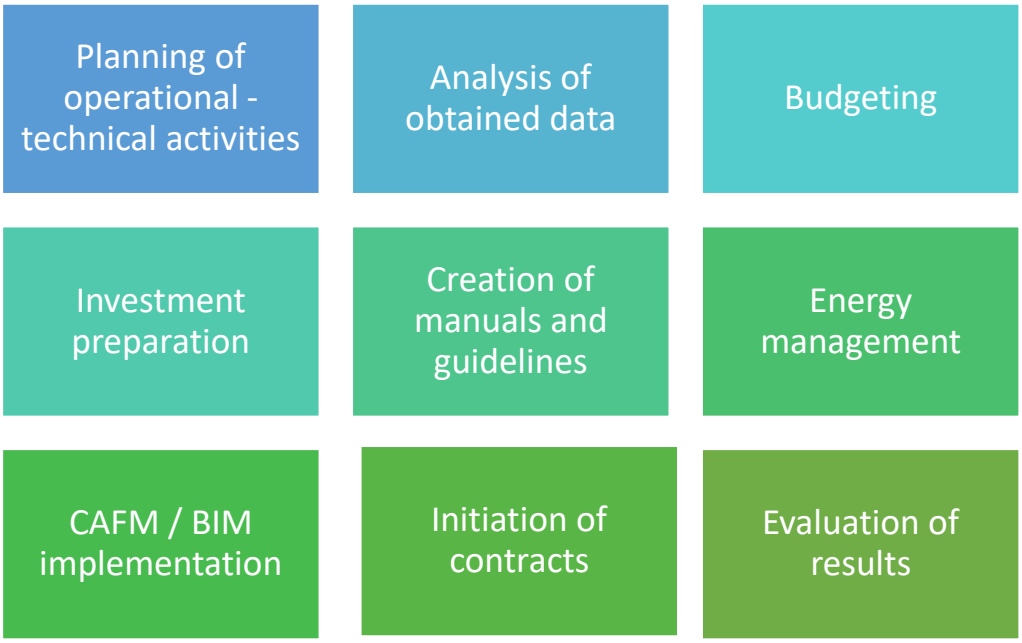


Fig. 2.2: Strategic level activities. Source: author.

Strategic management at this level has a long-term character, more than 1 year, usually 3-5 years.

2.4.2 Tactical level

The tactical level is the bridge between the strategic and operational levels. All strategic activities, see Fig. 2.3, are elaborated in greater detail and on a time scale, which can be accepted at the operational level. These are activities that ensure that everything that has been planned will also be carried out, to a specified extent and quality.
Typical activities are:

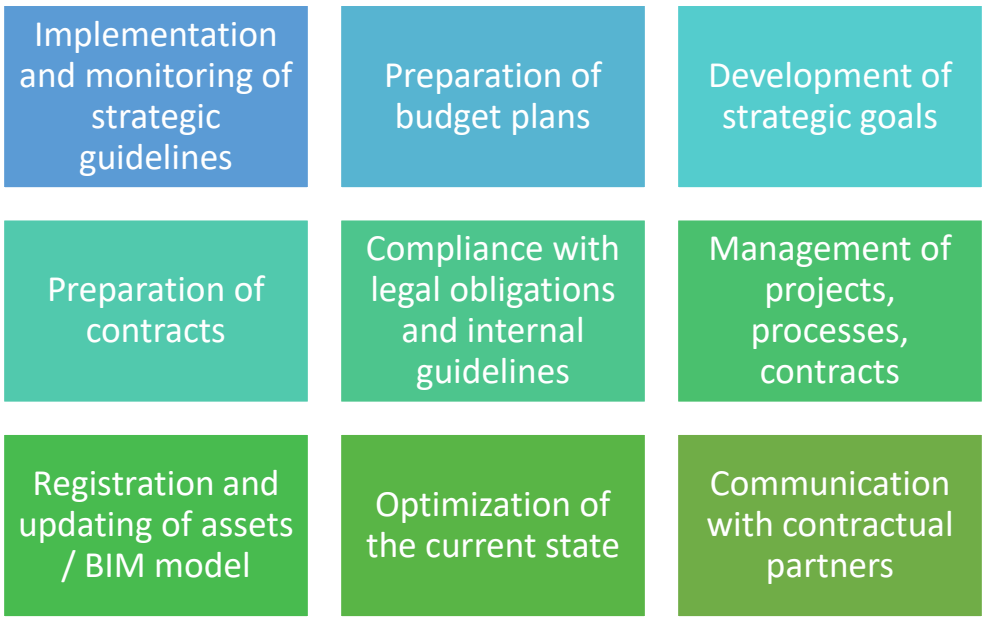


FIg. 2.3: Tactical level activities. Source: author

Tactical management operates within a time horizon of one year.

2.4.3 Operating level

This level corresponds to the performance of daily activities and routine operational routines. In the operational phase, it is expected that the sub-objectives that have been developed and contractually secured at the tactical level will be physically implemented. The goal of the operational level is to meet the expectations that were defined in the strategic level according to the assignment from the tactical level. Careful preparation in the two previous levels will be reflected in this lowest level. If all activities and tasks are planned and developed in such a way that they are carried out without any problems at this level, we can speak of effective management and operation of real estate. Fault-free and smooth operation is a reward for the time and expense of careful preparation.
These activities can be included in the operational level, see Fig. 2.4:

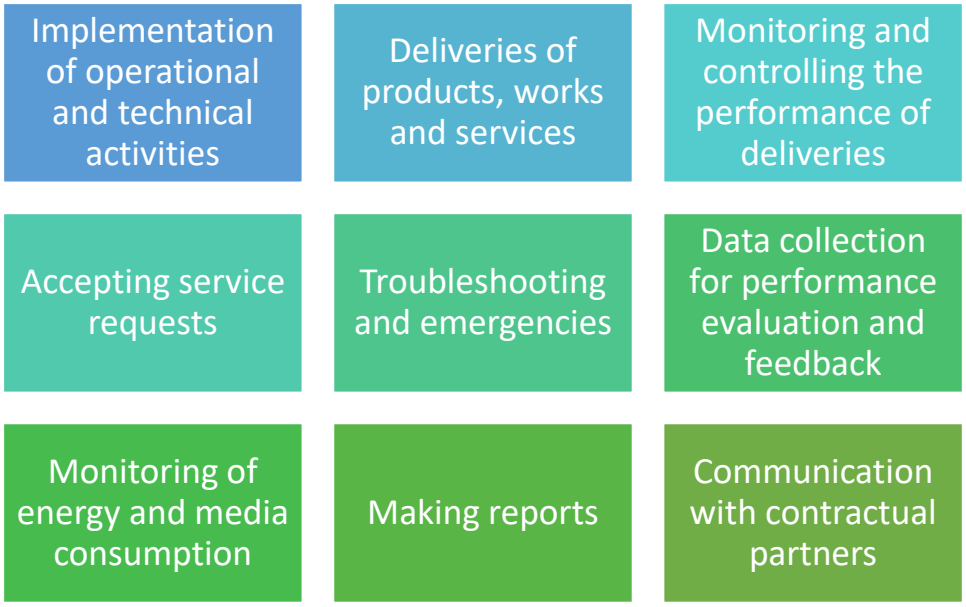


Fig. 2.4: Operational level activities. Source: author.

At this level, activities planned in the horizon of the week, month, annual quarter are performed.

2.5 Asset Management Tools

The so-called decade of asset management tools was defined as effective asset management tools:

1. documentation of the actual construction, registration and inventory of property,
2. an integrated document on the technical and economic situation for LCC (Evidence),
3. Operational and maintenance manual,
4. documentation of use and operation (operational documentation, operating rules),
5. documentation of strategic goals,
6. SW support FM (CAFM),
7. geoinformation and operational technical information systems (PTIS),
8. mathematical modelling (dynamic models and application software),

9. BIM (building information model),
10. educational programs.

2.5.1 Documentation of the actual construction

This documentation must be kept by the owner of the building for the entire life of the construction work; therefore, it is included among the documentation that must be used. This obligation is ordered by the Building Act No. 183/2006 Coll., As amended, but does not require the owners to use this documentation to perform property management. Therefore, this documentation is often neglected and underestimated.

The documentation of the actual construction (DSPS) is the last documentation in the project phase of the construction project. This documentation completes the construction work related to the implementation of the investment plan, which represents a certain and clearly defined construction work. All deviations and changes that occurred during the implementation phase are recorded in this documentation, which ensures that the owner of the construction work receives the current construction and technical documentation from the contractor. The basis for the creation of this documentation is the documentation for the construction or, if this documentation is not prepared, it may be the documentation for obtaining a building permit. When planning the future operation of individual processes and activities ensuring the operation, it contributes to the fulfilment of goals.

This documentation is usually ordered by the investor, resp. the builder at the construction contractor, unless otherwise agreed. This documentation is one of the points of the Contract for Work, which is concluded by the Client (usually the builder) and the Contractor of the work, before the actual implementation. What all the documentation of the actual construction contains is determined by Decree No. 499/2006 Coll. on construction documentation, as amended. It captures deviations that occurred during the construction. This documentation also serves for the need to innovate the current state of the operated construction and other parts of the construction documentation, serving the management of the organization or organizational unit primarily for management, such as planning, organizing, operational management or controlling.

Alternatively, a simplified DSPS, the so-called construction passport, which is not as comprehensive as the DSPS and contains information on the construction and technical condition in a simplified form. Making a building passport is a solution in cases where it is an older building without a preserved DSPS or for buildings where the building authority may order its acquisition (in cases where the owner does not fulfil the obligations under §125 paragraph 1 BA).

After the completion of construction and assembly work and the issuance of the building permit, the construction is ready for commissioning. In order to be able to compile future operational documentation as accurately as possible, it is necessary to draw information and data from the current state, which the DSPS should contain.

Thanks to the information and data obtained from this documentation, it is possible to make records, create all types of passports, plan the deployment of staff or future tenants, establish contractual relationships with suppliers of "hard" and "soft services" facility management (security, maintenance and renewal activities, cleaning services, etc.).

During the long-term operation of the building, it is the duty of the owner of the construction work to keep this documentation and also to update it throughout the entire period of operation and use in order to ensure its topicality and true informative value. Documentation that is not

continuously updated is not usable for asset management purposes. When managing assets, it is essential to rely on true information and data and compile other materials and documents, from which the need for operation is clearly defined.

Simplified documentation - construction passport contains:

a) information on the purpose and place of construction, name and surname (business name) and address of permanent residence (registered office) of the construction owner, parcel numbers of land according to the real estate cadastre with ownership or other rights and information on construction decisions; if the decisions have not been preserved, at least the probable year of completion of the construction,

b) technical description of the building and its equipment,

c) situational drawing and simplified drawings of the actual construction in the scope and details corresponding to the type and purpose of the construction with a description of how all spaces and rooms are used.

It happens, that two terms are interchanged - the evidence of the building and the passport of the building. The construction passport represents a simplified documentation of the actual construction and is defined in Decree No. 499/2006 Coll., On construction documentation, as amended. Whereas the evidence of the building is created by the evidence process and represents a comprehensive and up-to-date overview of the managed assets. It records technical and economic data and monitors both descriptive **and graphical data**.

2.5.2 Integrated document on the technical and economic situation for ŽCS

The aim of this document is to find a way to concentrate documents and factual knowledge related to the technical and economic condition of the building so that it is possible to process and archive information leading to the assessment of effective property management in the long term. It involves monitoring and designing the entire complex of economic, organizational and technological solutions that have been applied to the building.

The integrated document TE of the state of buildings can be thematically divided into three main areas, which are filled with other specifying documents:

I. Technical and economic documentation
II. Use of the building
III. Contract documentation

The builder or buyer can get a systematic overview of the object. The financing entity obtains data for the value parameters of the object.

This type of documentation will soon fully replace the BIM model, which will collect all the data generated during the construction preparation and implementation process in one place, in a single repository, and will replace the complex retrieval of lost documents and information, asset management and operation. The digitization of the construction industry will bring long-awaited changes in the approach of creating, establishing and working with data for facility management.

Evidence (verb)

Evidence is required by current legislation in force in the Czech Republic, only for livestock breeding, but is not required by any law in other areas. It is only a recommended asset management tool.

Property management means for every administrator the need for continuous care for this property. Effective use of real estate (apartment buildings, office buildings, etc.) with an effort to continuously improve its technical equipment and facilities, but also its technical condition requires consistent records. Evidence is a tool that aims to ensure maximum efficiency and economy of spending on maintenance and repairs. Evidence of real estate is the basis of technically documented knowledge of their construction and technical condition. Provided it is applied correctly, the Evidence makes a significant contribution to maximum efficiency and economy in the operation and management of these assets. Each owner of a building can therefore obtain the necessary basic information from the Evidence, such as the optimal need for repairs, the amount of negligence from previous years in financial terms and units, the optimal annual need for repairs according to individual structural elements, proposal for liquidation of negligence according to order of importance, evaluation object when deciding on its sale, demolition, modernization or reconstruction, etc..

For full efficient use, the management of assets and the operation of buildings cannot be done without the existence of a complete passport in electronic form in the correct format, which is the basis for the use of CAFM software tools. By evidence it is possible to obtain a passport of buildings and land, information on the actual state of the property, graphic drawing documentation, data clearly in a spreadsheet editor. It can also include photo documentation of exteriors and interiors, digital video recording, etc. The result of the evidence is a passport - proof of equipment, providing information on technical parameters, condition, method of use, etc.

At this point it is necessary to mention the difference between inventory and evidence. The inventory is basically also a record, but only a record of equipment, ie. the number of individual elements in contrast to the evidence, which informs us on the one hand about the number (or area) of individual elements and at the same time also records their condition or location.

Evidence (noun)

One of the most basic documents for the performance of property management and maintenance is a passport. The passport is a document that increases the utility and commercial value of buildings and informs users and potential operators in the future that the building has been handled professionally in the past, that the funds invested in its restoration and maintenance can be verified on the basis of documentation. The passport is therefore a comprehensive document of verified information on the current construction and technical condition of the managed object (from individual building structures through installations to connections of individual engineering networks), in which data are recorded (collected), based on which summary information on status and operation can be obtained. object. The collection and collection of this data is carried out by the so-called detection process, which we call evidence.

The terms "building passport" and "building passport" are very often confused. The passport of the building is the result of the evidence process, ie there are descriptive and graphical data on the current construction and technical condition obtained from the evidence process. The building passport is a simplified documentation of the actual construction and its scope and content, in contrast to the building passport, is defined in the implementing decree to the Building Act No. 499/2006 Coll., On building documentation, as amended.

The content of the passport is descriptive data, both static data (data that do not change and are unchanged during the use of the building, under certain conditions, such as the number of apartments in an apartment building) and dynamic data (those data that change over time

values, eg number of tenants). The informative value of such a passport will also be supported by graphic data. By connecting the descriptive data of the passport with the graphic data, we will increase the utility value of such a document. Graphic data from passports help us to refine the idea of a given object, element of an object or establishment.

There is no normative or other regulation that prescribes the formal and content requirements of these documents, and so the final appearance and explanatory power of these documents depends on the building manager and his requirements. If the evidence is to be carried out on a larger immovable property, it is better for this matter if an organization that has experience with this process is invited and either takes care of the whole evidence process or consults the administrator's intention.

The purpose of the passport is clear. On the one hand, to record, but at the same time to capture the current physical state of the given element with all its properties and possible interventions in it.

In asset management, we distinguish 4 basic types of passports:

- Spatial
- Construction
- Technical
- Technological

In addition to these types, there are also, for example, green passports, personnel passports, etc.

When performing evidence in the MS Excel software, the most common mistake is inconsistency when entering passwords into cells, which causes duplication and poor work with data. With the advent of building information management, all these errors are broken down.

2.5.3 O&M manual

These instructions are required by the external technical and economic environment. They are an integral part of the protocol on the handover and acceptance of the completed construction work, together with certificates and instructions for the use and maintenance of the delivered materials and products. The owner, resp. the user is obliged to follow these instructions and demonstrably acquaint the employee, resp. tenants with their wording. The application of standard guidelines and implementation has brought an external socio-economic climate. The introduction of instructions brings protection to contractors against unauthorized complaints and owners of construction works a manual on how to effectively and gently handle newly acquired property.

This operating document is prepared by the construction contractor for the builder and the builder is obliged to follow this document in the operational phase. If, during the warranty period, the property owner exercises the right of defect and it is proven that the defect was caused by behaviour that is contrary to the standard instructions for use, the contractor may refuse to remedy the warranty service.

Standard instructions for use can also be found in the area of renting housing units, where these standard instructions for use are prepared by the owner of the housing unit for the tenant. The tenant must familiarize himself with the wording of these instructions and use the rented apartment unit as specified in the instructions. If the tenant damages the owner's apartment,

he may insist on a remedy at the tenant's expense on the basis of this manual. For a greater chance of law enforcement, it is desirable that compliance with the rules of use be recorded in the lease agreement and that the standard instructions for use be a mandatory annex to it.

The new Civil Code No. 89/2012 Coll., States that a construction work is a thing and the manufacturer must supply instructions for use for each thing. If we insist on compliance with and transfer of this obligation to the issue of construction, it is clear that the preparation of standard instructions is a mandatory part of the documentation of newly completed construction works.

The aim of the standard instructions is to establish rules for the use of property and protect the current property of the user with recommendations to limit possible losses (time and property), before they occur, to create and verify standard procedures and methods for monitoring the technical condition of buildings and their systematic maintenance, repairs, modernization and reconstruction. To do this, it is necessary to analyse and define the most common and most serious shortcomings and errors:

- in the method of maintenance and care of the property;
- in the technical condition of buildings;
- in the design and implementation of repairs and modernizations and reconstructions.

Based on a detailed analysis of defects of existing buildings of similar function and construction and their causes, the O&M manual lists possible approaches to their correction, rules for use, preventive inspections of individual components and functional units, effective system of documentation of inspection and test results, design of decision algorithms respecting technical as well as the economic aspects of the envisaged repairs and upgrades.

In order to avoid disputes over possible complaints and to clarify mutual communication within the contractual warranty period, the contractor submits instructions to the user for use in the form of O&M manual when handing over and taking over the construction. Sometimes a material called Object Manager's Guide, Tenant's Guide, etc. is created.

The basic contents of the manual as an instruction manual can be imagined in these components:

- Basic information about the object.
- Description of the construction - technical solution of the building (such as surface treatment, tiling, doors and windows, roof structures, etc.).
- Construction documentation and specifications.
- Instructions for its operation and maintenance (including health and safety information and the manufacturer's instructions for efficient and proper operation).
- List of machines and equipment.
- Commissioning and testing results.
- Warranties and certificates.
- Special requirements for demolition, decommissioning and disposal.

2.5.4 Documentation of use and operation (operational documentation, operating rules)

Most owners or operators of HVAC consider that if they have received operating instructions, a warranty card and, for example, instructions for repair or maintenance from the manufacturer

of the relevant equipment, they have operating documentation, but unfortunately this is not the case. Although these documents are part of the operational documentation, they are not sufficient.

There is no exact legal translation of the term operating documentation, but for each device there is a relevant standard, decree, NV or law prescribed documentation, which is considered operational and must be kept up to date throughout the life of the device.

Operational documentation can be divided into several groups, according to importance, generality or, conversely, a very clear specification. First of all, it is necessary to realize how the device that is supposed to have operating documentation actually works, whether it is, for example, a free-standing machine or a set of several devices in one place forming a whole (eg boiler room).

Operating rules

The operating rules can be understood as a document or a set of documents or an internal regulation defining the conditions, rights and obligations in the operation of a particular thing.

For better orientation, it is good to distinguish three types of operating rules:

- • Operating rules regulating the rules of operation in a certain building (eg house rules, school rules, operating rules of the playground, etc.),
- • Operating rules regulating the conditions and method of operation of certain technical equipment (eg operating rules of EPS, elevator, etc.),
- • Operating rules regulating the conditions and method of operation of a more complex technological unit.

Graphically, this distribution is shown in fig. 2.5.

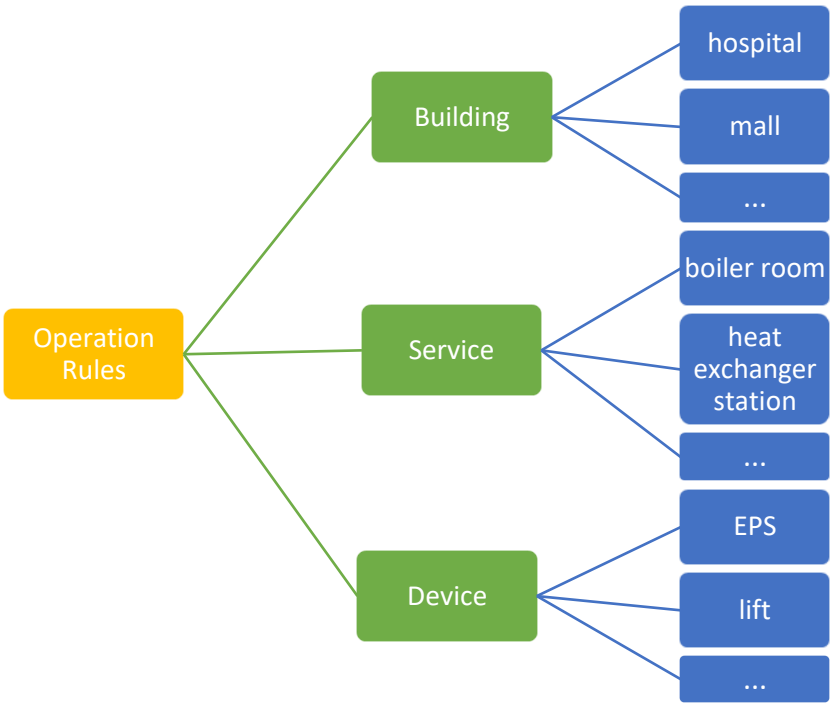


Fig. 2.1: Types of operating rules. Source: author.

2.5.5 Documentation of strategic objectives

Formulating strategic goals is the task of the owner in cooperation with the building manager. It is used to identify the quality of the building in the current external conditions in order to systematically plan such measures that will lead to a predefined goal. The resulting strategy is mainly influenced by the person of the owner, external conditions, the complex condition of the building and the profile of the building manager. The existence of strategic goals is proof of the quality of building management.

The essence of effective asset management and thus effective management of any processes, including investment processes, routine administration and maintenance, is to answer the question "where - where" the property is headed. The misconception is that we are able to conceptually manage anything only with operational instructions, actions and activities. The important thing is that the method of operational management does not allow the development and growth of assets and also the optimization of own processes. Operational management leads to stagnation and decline in any investment or conceptual processes of routine administration and maintenance. Only the process of operational management, which, if overwhelmed by operational management, leads to chaos and is financially inefficient in terms of long-term and requires a higher level of funding. Strategic asset management planning must follow the overall strategy of real estate development. If, according to the strategic intentions, it is planned to expand or change the technology, it is necessary to reflect these intentions in the strategic plan. The top management of the organization deals with it.

Planning activities must always aim at certain clear objectives. For investment activities, they should be set for routine activities resulting from the sustainability of existing investments (reproduction of assets, definition of all technologies used, revisions, legislation, etc.) as well as individually for each investment project. It is not possible to plan well without clearly defined goals.

3 Documentation of operation and use of buildings

The importance of the use of documentation necessary for the performance of property management in the operation and use in the life cycle of buildings is undeniable, especially with regard to activities dealing with manipulation or disposition of real estate, in solving and ensuring property issues related to real estate and construction activities in construction projects. (Modification of the completed building, superstructure, extensions, built - ins and building modifications).

There is a connection between technical and economic management of property and operation of buildings and a comprehensive agenda kept in the use of buildings, especially the spatial and construction passport, but especially the documentation for handing over and taking over the building for use and documentation necessary for asset management..

The management of the operation of the building is becoming a complex activity based on market relations, which is gradually being entrusted to professional companies in our country as well. The concept of operation of each individual building must be documented in some way, and therefore can and should be controlled. In our legal environment, the mandatory documentation of the condition of the building is currently ending with the documentation of the actual construction. In later time phases, only changes subject to construction or notification procedure, eg change of the completed construction, etc. There is a lack of continuous evaluation of the operation of buildings and their documentation, in a wide range of parameters not only technical, economic, but also environmental and social. Only on the

basis of such evaluations is it possible to make relevant strategic decisions. The evaluation of the quality of operation can be performed on the basis of documents that can be used by the owner / administrator of the building during its operation. They are mainly:

- documentation of the actual construction,
- information manuals for users,
- documentation of strategic goals,
- documentation of the use and operation of the building.

Building Act No. 183/2006 Coll., As amended, introduces the so-called Protocol on handover and acceptance of the building for use, according to which in addition to the protocol handover of the building by the builder to the client (including documentation of the actual construction or implementation, production and operational documentation) also documents confirming the prescribed quality according to valid legal regulations.

Information user manuals are a document that is increasingly in demand by users. The basic idea is to create a reasonably simple manual for the use of each functional unit with a technical description of the individual elements and parts, instructions for operation and user-performed maintenance.

Formulating strategic goals is the task of the owner in cooperation with the building manager. It is used to identify the quality of the building in the current external conditions in order to systematically plan such measures that will lead to the set goal and a predefined goal.

Documentation of the use and operation of the building relates to activities that consist in procuring all activities related to the proper and safe use of buildings. The so-called Construction Operation Book is of fundamental importance. Its mission is to document all processes leading to the goals that are set in the strategy of use and operation and recording the current state.

3.1 Importance of documentation necessary for the performance of asset management

Technical and operational documentation remains one of the basic tools of financial planning of renovation and improvement of buildings, used mainly for:

- economic balance and profitability of the building,
- investment and repair requirements,
- planning and optimization of maintenance and renewal costs,
- processing of the energy certificate of the building,
- comprehensive evaluation of the quality of buildings within the life cycle,
- assessment of the life cycle costs of buildings.

The controlled life cycle of a building requires that the course of handling the building during its existence be monitored, and that individual interventions be documented and evaluated. The comprehensive agenda includes documents that increase the utility and commercial value of buildings and inform users and potential operators in the future that the building has been handled professionally in the past, that the funds invested in its restoration and maintenance can be verified on the basis of documentation.

The activities of large companies dealing with FM are also focused on regions and cities managing large public property, which are looking for a methodology for the introduction of a unified register of construction objects in terms of technical condition and operating costs.

The aim is to learn how to deal with the complex agenda necessary for asset management, how to use them to collect data, how to store and process them and then evaluate them by supplementing and refining the complex agenda, including passports, used for comprehensive processing of FM processes. A quality and always up-to-date comprehensive agenda is a key issue for the management of support processes. The processes of support activities are always based on data on space, property, or they can also relate to individual structural elements and parts of buildings. With the advent of BIM, many of these activities will move to the virtual environment of the model and the appropriate CAFM system. By pairing these two environments, a complex database of graphical and non-graphical data is created. All evidence, data on properties, materials, staffing, spatial arrangement, etc. will provide the facility manager / administrator with a solid basis for managing the technical and economic processes of operation and use.

All these documentations will be replaced over time by a BIM model for both the graphics and data page.

The importance of documentation for the management of property and operation of buildings is immense. At the moment, it is the honestly kept documentation of operation and use, which is the bearer of all technical, economic, legal and technical information about the construction. Primitive governance begins with a well-organized file, but the advent of digitization and the advent of Industry 4.0 requires that these approaches be elevated and adapted to the requirements and opportunities of today's society. There is a transition of the change of file solutions to digital form. The BIM model allows to store all data from paper documentation and binds them electronically with the elements of the BIM model.

3.2 Mandatory documentation

This type of documentation is prescribed by law. Its management and registration is monitored by bodies active in a specific area. In general, it is always documentation that is associated with the operation and use of certain equipment, the operation of which can endanger health, property and the environment.

3.2.1 Audit reports on dedicated technical equipment

Dedicated technical equipment (VTZ) and equipment subject to revisions belong to a set of equipment referred to as technical equipment of buildings (MEP). VTZ are defined in Act No. 174/1968 Coll., On state professional supervision over occupational safety and related regulations, and Decree No. 246/2001 Coll., On fire prevention, as amended. VTZ are a special type of technical equipment of buildings and are subject to stricter requirements during operation. These devices must be regularly monitored by a professionally qualified person, usually an inspection technician or a person specified in a specific standard, who, after carrying out an inspection or otherwise prescribed inspection, checks the operability and safety of the equipment and issues an inspection report with the result of the inspection. The inspection report may also decommission the equipment until a remedy is agreed.
The aim of the legislation is to set general requirements and procedures applicable to the operation of selected technical equipment, while the requirements for the actual operation of technical equipment for specific conditions and environments and specific purpose (for example for underground work) central administrative office. Legislation expresses the public

interest in technical equipment with a higher risk to life and health. Dedicated technical equipment includes:

- electric,
- lifting,
- gas,
- pressure,
- fire safety (regulated by Decree No. 246/2001 Coll., On fire prevention, as amended).

3.2.2 Inspection reports and documents for operability of non-reserved technical equipment and facilities

In addition to VTZ, there are also MEP, which must be revised. These are non-reserved HVACs, the operation of which does not show an increased risk of endangering the health and safety of persons and property, and which are not subject to supervision pursuant to Act No. 174/1968 Coll., As amended. Other devices apply to these devices.

This group also includes equipment for the building, specifically ladders and shelves. In addition to the above, this also includes specified meters and equipment for fire water supply.

3.2.3 Operating rules

The operating rules can be understood as an operating manual with a description of the operating procedure and defining the rights and obligations and prohibited activities, it is a comprehensive manual and tool for maintenance, repair and crisis management of a set of buildings and their technical and technological equipment.

The operating rules are therefore a guide for the operation of buildings, a manual with a concentration of activities that are necessary for the operation of the building. Operating principles are based on construction, materials, layout, purpose, technical equipment. It includes controlled processes from predictable situations that can be predicted from experience, and instructions on how to deal with these situations. The operating rules are the starting point for maintenance plans and operation of buildings, and are an essential part of asset management. In addition to the already mentioned rules of operation, the operating rules also contain information on authorized persons responsible for the operation of a specific operation or facility.

Operating rules are prepared mainly for the purpose of complying with safety rules so that in foreseeable extraordinary situations the quality of operation is observed and the effects of operational failure, resp. ways and procedures to address the emergency.

The operator of the facility also decides on the elaboration and issuance of the operating rules, if he deems it necessary, or for reasons of special consideration (for example, in the sense of § 100 of Act No. 258/2000 Coll., On the protection of public health).

3.2.4 Declaration of performance

The Declaration of Performance newly introduces into the Czech legal environment Regulation (EU) 305/2011 of the European Parliament and of the Council laying down harmonized

conditions for the marketing of construction products and repealing Council Directive 89/106 / EEC. This Regulation shall take effect on 1 July 2013.

Where a construction product is covered by a harmonized standard or is in conformity with a European Technical Assessment issued for it, the manufacturer shall draw up a declaration of performance when it is placed on the market. Where a construction product is covered by a harmonized standard or is in conformity with a European Technical Assessment issued for it, information may be given in any form on its characteristics in relation to the essential characteristics as defined in the relevant harmonized technical specifications. specifications, provided only if they are included and specified in the declaration of performance, except where a declaration of performance has not been drawn up in accordance with Article 5 of Regulation (EU) 305/2011 of the European Parliament and of the Council.

The declaration of conformity must be mentioned with the declaration of performance. Previously, one declaration of conformity was issued for all products, whether construction or non-construction. With the effect of the new above-mentioned regulation, the declaration of conformity is issued for products of a non-construction nature, eg toys, car seats, etc., and the declaration of properties for products used in construction and assembly works.

3.2.5 Occupational health and safety documentation

The basic legal framework for occupational safety and health in the EU is Council Directive 89/391 / EEC, which contains the basic principles of prevention and elimination of occupational hazards and states that improving occupational safety, hygiene and health at work is an objective that should not be subject to purely economic considerations.

3.2.6 Fire protection documentation

Act No. 133/1985 Coll. creates conditions for effective protection of life and health of the population, animals, environment and property from fires and other emergencies (natural disasters, crisis management, emergency planning, integrated rescue system). At the same time, the Act stipulates the duties of administrative authorities, legal and natural persons and the status and duties of state administration and self-government, incl. the status and responsibilities of fire protection units.

3.2.7 Energy performance certificate of the building

Energy audits have been prepared for many years to assess the overall energy performance of buildings, based on the Energy Management Act No. 406/2000 Coll. The Collection of Laws published Act No. 318/2012 Coll., Amending Act No. 406/2000 Coll., Which, among other things, stipulates the obligation to mark buildings with energy labels.

From 1 January 2013, the so-called energy performance certificate of the building is mandatory not only for all new buildings already in the project phase and more extensive reconstructions (when changing to more than 25% of the building envelope), but also for the sale of the building or its integral part (eg housing units) and when renting a building and in other cases specified by law. The obligation to ensure the processing of the card is given to the builder, the owner of the building or Owners Associations.

3.3 Recommended documentation

The previous chapter mentioned documentation, the use and management of which is required by the state in some of its legal regulations. This chapter mentions documentation that is not

conditioned by any legal regulation, but on the contrary is recommended from the point of view of long-term monitoring and analysis of the operation and use of buildings. Only what tests time can be described as quality and beneficial. The operation and use of buildings brings with it a number of situations in which readiness to search for and find solutions to problems and the ability of conceptual and strategic resource planning to maximize the benefits of operating and using buildings is verified.

3.3.1 Evidence

Evidence is required by current legislation in the Czech Republic, only for livestock breeding, but is not required by any law in other areas. It is only a recommended asset management tool.

Property management means for every administrator the need for continuous care for this property. Effective use of real estate (apartment buildings, office buildings, etc.) with an effort to continuously improve its technical equipment and facilities, but also its technical condition requires consistent records. Evidence is a tool that aims to ensure maximum efficiency and economy of spending on maintenance and repairs.

Evidence of real estate is the basis of technically documented knowledge of their construction status. Provided it is applied correctly, the evidence makes a significant contribution to maximum efficiency and economy in the operation and management of these assets. Each owner of a building can therefore obtains the necessary basic information from the evidence, such as the optimal need for repairs, the amount of negligence from previous years in financial terms and units, the optimal annual need for repairs according to individual structural elements, proposal for liquidation of neglect according to the order of importance, evaluation object when deciding on its sale, demolition, modernization or reconstruction, etc.

Very often the terms "building passport" and "building passport" are confused. The building passport is defined in ed. No. 499/2006 Coll., on the documentation of constructions, as amended, in Annex No. 14, point 2. This is a simplified documentation of the actual construction and its acquisition may be ordered in special cases by the building authority. In contrast, the passport of an object is the result of the evidence process and its scope and content vary from case to case. The object passport is processed, for example, during the BIM implementation, where it is a key basis in the BIM implementation process.

3.3.2 Operational & Maintenance manual

For more see chap. 2.5.3.

3.3.3 Meter records

In the building, the main energy consumption meters are located at the foot of the house. Secondary meters, which are also located in the building, are used to calculate the costs of consumption of individual energy, separately for family housing and separately for the operational sales part of the building.

The registration numbers of individual meters, the date of their installation and the initial states are important for the actual registration of the consumption of individual media.

Meter registration number - used to assign a specific meter to a specific measurement location so that there is no confusion.

Initial state of measured values - used for the possibility of determining the number of media taken. There is almost never a zero state on the meter at the beginning.

Date of meter installation - each meter has a prescribed expiration time, after the specified time, it is necessary to have these meters calibrated. Each meter must be sealed.

3.3.4 Construction operation book

The book of construction operation should be a matter of course at the beginning of the construction operation and an integral part of all technical documentation of the building. The obligation of the owner of the building to keep a book of operation of the building was included in the draft building law already in 2005, but was not approved. Despite the fact that keeping this book helps to have a better overview of the operation of the building, unfortunately few owners have created it. Keeping this book in your own interest is a great benefit for both the building administrator and their owners, for greater clarity about all records of the operation of the building. With the introduction of the BIM model, this intention can be realized and transferred from paper form to an electronic database system.

4 Implementation of BIM in existing buildings

The societal trend speaks of the preparation and implementation of an investment order using the information modelling tool - BIM, ie, focuses mainly on solving problems and finding answers to questions: how to create a new building in the information model? The company lives, works, relaxes and operates and uses buildings that already exist, and throughout the operational phase, savings and "smart" solutions are sought to help the owner streamline operations and use, ie, opportunities for operational and technical savings are sought and mitigating negative environmental impacts in order to increase benefits. Attention should be focused in two directions:

1. For newly emerging construction contracts, where BIM is created in parallel with the construction.
2. For existing buildings that are already in operation and used, and for which no 3D model has been processed .

There is already a whole range of Czech and foreign professional literature for the creation of BIM models for newly emerging buildings, and state institutions and municipalities also deal with it. The Ministry of Industry and Trade of the Czech Republic and the Czech Agency for Standardization and the non-profit civic association Expert Council for BIM and others. All of the above focus on the process of genesis of the construction contract using information modelling, ie, design, modelling, information exchange, stakeholder cooperation, legislation and other important activities that will help not only better grasp and understand the new direction of information modelling. buildings.

On the other hand, it was mentioned that attention should also be drawn in the area of existing buildings, where owners / facility managers / administrators are operators of operations and use, who ensure compliance with the minimum requirements of legal requirements and beyond legal standards ensure routine activities. These activities can be so burdensome that without the introduction of sophisticated CAFM systems, their management is virtually impossible. With the advent of the facility management philosophy, dated around 2000 (derived from the establishment of the Czech branch of the international professional organization IFMA CZ), owners / facility managers / administrators are still calling for it to be easier for them in terms of obtaining and archiving data on managed objects. By connecting the BIM model and the CAFM system, which can convert graphic and alphanumeric data from the BIM model, a helping hand is offered to all of the above. The introduction of the BIM method into existing buildings is a relatively time-consuming process, the complexity of which is based on the readiness and timeliness of the required data. This process cannot be determined unambiguously in time. It depends primarily on the documents, the staffing of key people and, last but not least, the ICT equipment.

4.1 BIM Deployment Procedure

As mentioned above, the process of introducing BIM into existing buildings is influenced by these factors:

- readiness and timeliness of documents,
- staffing of key people and their abilities and skills,
- ICT equipment.

On the basis of the lessons already learned, it can be concluded that, except perhaps for new-builds, when the time horizon from the commissioning and the date of the decision to implement the BIM method is not so distant, the basis for the creation of the BIM model is

insufficient, incomplete, out of date or almost undetectable. In this case, all supporting documents must be validated, updated and produced. Another factor affecting the length and smoothness of the deployment process is the human factor. It makes sense because all the process is controlled and executed by a man who uses ICT tools to do it. The requirements for BIM method implementers are clearly a skill to operate any of the CAD system that supports drawing in 3D, BIM and converting to an IFC file and then a follow-up CAFM system, which in turn is compatible with the CAD system and can be interconnected.

The framework procedure for the implementation of BIM in existing buildings is summarized in the following sub-steps:

1. Evaluation of the current state of evidence data and drawing documentation

• Based on a search of the current state of the drawing documentation, a further procedure is determined. If a 3D model is created, it can become a passport of some data (dimensions, materials, etc.). It would therefore be useless to do such a passport once again separately.

2. Completion / acquisition of drawing documentation

• Fulfilment of this point depends on the current actual state of the drawing documentation.

3. Digitization of 2D drawing documentation on a 3D model

4. Defining relevant evidence data for FM / BIM-LOI

• It is necessary to set goals to be met by FM / BIM. The exact structure and detail of the passporting data will be determined accordingly.

5. Evidence of the object, personnel passport and more

• Evidence of all real estate, ie all buildings, outdoor areas, etc. in a predetermined range of data and structures.

6. Filling the CAFM system with evidence data, connection of documentation

• CAFM (Computer Aided Facility Management) system needs to be filled not only with evidence data, but also manuals, guarantees for built-in products, technical specifications, personnel agenda, overview of workplaces, etc.

7. Connection with drawing documentation

8. Setting up facility management processes in the CAFM system

• FM processes can include: cleaning, maintenance, inspections, staffing and more, duplication, property management and more.

9. Own administration and operation

• Process control using BIM model + CAFM.

10. Creating a BIM Model Manager position

• The BIM model must be updated and maintained on an ongoing basis to keep it up-to-date and to keep all labor-intensive data true and usable. The optimal solution is to create a new job position.

11. Continuous updating of data and processes

• Data and processes set in the BIM model and in CAFM must remain current.

12. Analysis and simulation, evaluation

• For deciding on further procedures, investments

4.1.1 Phase of preparation of documents

The answer to the question of the fluidity of the BIM implementation process is the readiness of the input documents. The following documents are required for the implementation of BIM:

- Documentation of the actual construction in the current digital form, where it is possible to display 2D and 3D model of the building.
- Evidence of the object in the details of the needs specified in the LOI (level of detail information).
- Documentation for the equipment of the facility, which is not part of the DSPS, but is necessary to set up the facility management process.

The preparation phase is a relatively lengthy and demanding phase. During it, the documentation of the actual execution of the condition is searched and it is determined whether it is complete, digital and whether it contains all the necessary data for the creation of a 3D model. If the DSPS is in paper form, all that remains is to digitize it using a suitable CAD system that can also work with 3D. If the documentation is out of date or incomplete, it must be supplemented and updated to the required detail. This finding prolongs the entire phase of document preparation. It is no exception that the DSPS does not correspond to the current state, even though nothing has changed on the construction part of the building during operation and use. During the implementation phase, there are deviations from the implementation documentation, which, depending on the size of the building, when added together, can form hundreds of m2. Therefore, it is very important that the data from the DSPS is validated. If the model is to be real, it must contain real data.

When introducing the BIM method into existing buildings, it is a common fact that the DSPS is in such a state that it cannot be used for further work and thus the collection of graphic data about the building is approached. Documentation is often lost, incomplete, or outdated. Documentation of the actual construction is still one of the underestimated documentations created during the construction project. Its importance for property management and building operation is immense. It contains all the object data that the owner / manager needs to know in order to be able to strategically plan future managed maintenance and restoration interventions on the physical condition, as well as to actively manage the owned / entrusted property. For this reason, the introduction of the BIM method into existing buildings is a long-awaited activity, which is expected to achieve all the predicted benefits.

Currently, there are a number of ways, methods and techniques that can be used to obtain data on the actual construction and technical condition of the property. It is worth noting laser scanning, which uses a point cloud to automatically convert the actual state into digital form and is already used in connection with the acquisition of data on existing buildings. The phase of preparation of documents can be considered the most time-consuming and at the same time the most important. Further accuracy and fluency in creating a BIM model derives from the quality of input data preparation. The level of complexity depends on the current work and the method of archiving the operational and technical documentation. It is also to some extent influenced by the age of the building. Data on the spatial structure of a building is only one of

two areas of data contained in the BIM model, the graphical ones. Non-graphic data can be, for example, data on physical and technical properties of built-in products, service life of elements and used materials, etc..

At this stage, it is desirable that there is an active cooperation of the facility management represented by the administrator or, in the case of self-service, the owner of the construction. His experience and needs result in requirements for the degree and detail of evidence data, incl. their structures so that it is possible to maintain a uniform structure of attributes during evidence. The LOI, an indicator for the amount of information the model should have, is determined. More in the next chapter.

The resulting passports in electronic form, processed eg in the ordinary tool MS Office Excel, can be imported into CAFM systems and create a database for a graphical model. After connecting the graphic and data model, it is possible to set the necessary FM processes via BIMng.

4.1.2 BIM Information Level (LOI) refinement phase

BIM models contain both graphical and non-graphical information about buildings. The complexity in the whole process of creating a BIM model for new or existing buildings is to determine the amount and structure of information that the model should provide. In general, as much information as possible does not lead to better results, but on the contrary, an adequate and really necessary amount of information leads to success. Various types of abbreviations appear around information modelling of buildings, which specify the level of detail and the information contained in the BIM model. It can simply be said that it is true:

$$LOMD = LOD + LOI \quad (1)$$

LOMD … Level of Model Definition
LOD … Level of Detail
LOI … Level of Information
In addition to the above, there are other abbreviations regarding the amount of information contained. For the needs of implementing the BIM method in existing constructions, it is possible to limit oneself to these three mentioned.

This division of the model is based on the BIM protocol AEC (UK), which distinguishes between graphical and non-graphical parameters of the model. In addition to the designation used, the designation can also be found:

$$LOD = LoD + LOI \quad (2)$$

LOD … Level of Development
LoD … Level of Detail
LOI … Level of Information

It follows from the above that various sources of information are not uniform in the use of terms, as well as in the Czech environment there is no clear and uniform language of translation and interpretation of English acronyms.
These abbreviations represent the definition of the range of graphical (LOD / LoD) and non-graphical information (LOI). By defining these parameters, it is said in what details the individual structures and elements are to be drawn, whether only schematically or, conversely, drawn in all details and details. LOI defines the amount of information that an element should contain.

An unanswered question remains how to define the model level (LOMD) for facility management needs. The LOMD rate is set to 100 (least detailed), 200, 300, 400, 500 (most detailed). It is assumed that the LOMD 500 is a highly detailed model suitable for existing buildings, but in reality there are not many projects that achieve these qualities. An unavoidable disadvantage of such a demanding data BIM model is also its management and updating over time and the fact that facility management does not need such a large amount of data for its operation and the management of such a full BIM model requires increased demands on ICT equipment. As a result, facility management, which has an overview of managed processes and information needs, should best decide how the model should be developed from the LOD's point of view and how much information (LOI) should be fulfilled. Filling the model with unnecessary information only at the cost of capacity increase is inefficient in the overall context.

4.1.3 Phases of evidence of input data

The evidence process takes place for objects that have not processed passports or have them, but not in the required quality. The process of evidence and passports are not supported by any legal regulation, and therefore they do not have any fixed structure defined and their content and scope is derived from the needs of the object and its operation. Again, it is not an exception that there are cases where the evidence is not processed in a spreadsheet editor, but on the contrary in a text editor. In this case, it is good that there is at least some data, but it is necessary to convert it into a format and structure, from which it will then be possible to import it into the CAFM system. Due to the need to import data into the CAFM system, it is optimal to keep passports in a uniform attribute format that corresponds to the attributes of the CAFM system, or at best to already have a CAFM system and passports directly in it. Due to the relatively high acquisition costs for CAFM systems, the need to process the evidence of the object is thus more represented, in the detail determined by the LOI.

In facility management, you can also find the approach of keeping non-graphical data on assets, such as SAP software, which is isolated from the SW tools of facility management. Due to a different approach and data management, duplications and inaccuracies in data management can very often occur, so it is more than desirable for non-graphical data to correspond and be linked to graphical data using the BIM model.

evidence is performed on parts of building structures and elements, as well as on parts of interior equipment and HVAC to the extent specified in the LOI.

It depends on the initial state of data registration, whether it is necessary to perform a general evidence, or it is just a matter of supplementing it with a possible extension with missing data. The same goes for the graphics part. If the drawing documentation is complete, it is not necessary to process additional documentation of the actual construction, but it is sufficient to check its timeliness or complete the missing ones. Based on the electronic 2D drawing documentation, a 3D model can be created, which is then connected in the next step with the database created from the evidence process.

When passporting data, it is very important that the data is entered by all persons in the same format in a single form. For this purpose, it is recommended to develop a methodology of the data entry procedure, an excerpt of which is given in Annex 1. The purpose of this methodology is to provide passporting persons with a method of accurate and uniform formulation of recorded data for individual attributes. The evidence process is again one of the more time-

consuming phases of introducing BIM into existing buildings and is based on documents collected in the phase of preparation of documents.

4.1.4 Phases of preparation of input data for import into CAFM

All necessary data for facility management were obtained from the evidence process. After checking the completeness, uniformity and complexity, you can continue by importing data into CAFM. This process is used when there is no BIM model, but only a 3D model.

There is a possibility to export or import data in CAD / BIM software. However, this feature is not included in the basic software installation, so it is necessary to install it as a plugin. The function itself allows you to export / import individual elements and their properties directly to / from the MS Excel spreadsheet editor.

The plugin is available, for example, from BIMOne Inc. and is provided free of charge. It can also be found in the Autodesk app store. Working environment see Fig. 4.1.

The plugin works on a similar principle as export / import for CAFM systems. First, you need to generate your own Excel by exporting from Revit. It creates its own structure in which we can edit data or insert new ones. This file with its own structure and modified or supplemented data can then be imported back into Revit.

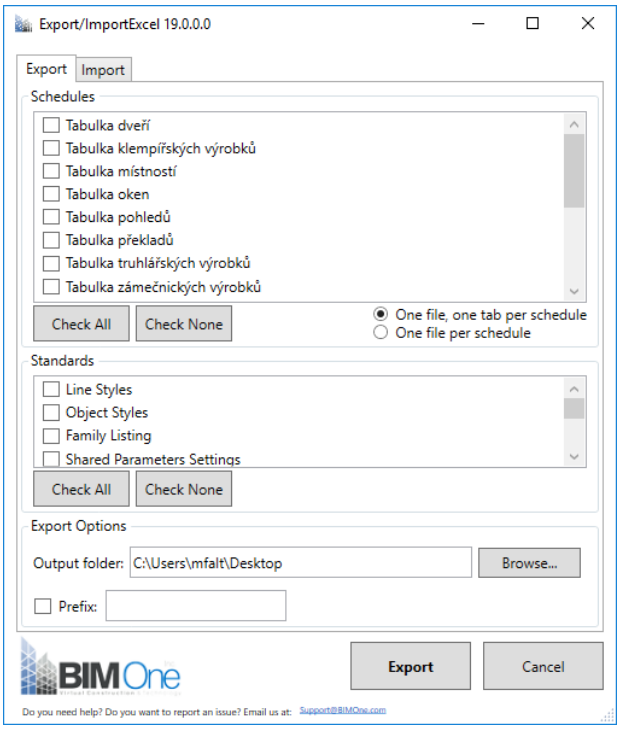


FIg. 4.1: Export / Import Function Plugin Window in Autodesk Revit Software, Source: [15]

4.1.5 Equipment requirements

The process of implementing BIM is a matter of digitizing pre-structured data into a CAFM system with connection to a graphical 3D model of a building.

Requirements for SW equipment are:

1. CAD software that supports 3D drawing and supports the creation of BIM models. Currently, most developers indicate whether their product enables BIM design.
2. CAFM system that is compatible with a plugin or other connection solution with CAD software. This functionality is important from the point of view of communication between the graphic and data base of the BIM model.
3. Visualization software with support for IFC files, which allows viewing the 3D model and other PC stations that do not have access to CAD software.

4.1.6 Phases of interconnection of graphic part and database

The preparation for the introduction of BIM is already complete, all documents are prepared, the passportization is performed, the passports contain real data in a uniform format and structure and a 3D model is made. At this stage, non-graphic and graphic information is connected. Requirements of the BIM implementation process for the current conditions of operation and use.

The process of introducing BIM into existing buildings entails requirements for equipment (hardware, software) as well as for staffing the entire process and subsequent use in the operational phase.

4.1.7 Staffing requirements

Although these are purely virtual activities that take place outside the real space, one is still the end user and operator who assigns tasks for processing and who is responsible for their accuracy and fulfilment. Therefore, it is necessary to take into account the greater demands on employees operating the BIM model in the area of administration and operation.

When implementing the BIM model, it is necessary to provide a working group, the content of which will be:

- Validation of current data - graphic and non-graphic.
- Evidence of the current state of the object.
- Preparation of the database in the required structure and scope.
- Redraw 2D documentation.
- 3D model creation.
- Import of data into the CAFM system or filling the CAFM system with passported data.
- Linking a 3D model with data.
- Entering and controlling processes in CAFM systems.
- Analyses, simulations.
- BIM model update over time (graphic part and data part).

The scope of the above activities varies according to the readiness of the building for the implementation of BIM. There may be cases where some steps and activities will not need to be implemented because they are already of the required quality. On the other hand, there may also be situations where, in full operation, it will be necessary to carry out all these activities and it is unthinkable for them to be implemented with the current capacities. In such a case, all that remains is to expand the working group with additional staff to ensure the performance of these activities.

With the introduction of the BIM method into the entire life cycle of buildings, the requirements for competencies and qualifications of current or emerging job positions are also increasing. If the BIM method is to be introduced and grasped uniformly by all employees, they should be allowed further training, for example through training courses or in some other way with an effort to expand their existing competencies. The response to this fact is the emergence of, for example, a lifelong training course accredited under ČKAIT, where the aim of the training course is to educate investors, building contractors, designers and, last but not least, facility managers / building operators in the BIM method. This course consists of two blocks - a general introduction to the BIM method and a follow-up block thematically adapted for either investors or designers or contractors or facility managers / building operators. It is of course possible to complete all thematic blocks and create a comprehensive idea of what the BIM method is and what its implementation in a wide range of construction and facility management means.

5 Continuity of BIM and CAFM systems in the phase of operation and use of the building

The digitalisation of the construction industry will affect not only the phases of preparation and implementation of construction life cycle, but also the subsequent phase of operation and use, where facility management plays a significant role - proactive approach to real estate care and management of operational and technical services using CAFM software tools.

Before applying BIM, all data had to be imported into the CAFM system manually or, in better cases, from existing Excel files that were modified for import into the SW. With the introduction of BIM, the situation of filling the CAFM system with data is simpler - data can be imported directly from the BIM model. Facility management and management of support activities is an activity of the operation and use phase, therefore it is necessary to mention that the BIM model with connection to the CAFM system can be provided for constructions:

- **Newly** approved and put into operation, where it is more than desirable that the person of the future facility manager be present at all significant meetings in the preparation of the investment contract. With its view of the future administrator, it can positively influence the future costs associated with the operation and use of the building and ensure the structure and format of data entering the BIM model for FM needs.
- **Existing** where the facility manager is facing a very difficult initial situation. It depends on the age of the building and the previous method of management and operation, but in the vast majority of cases the common state is the absence, duplication, ambiguity, outdated and paper form of all documentation describing not only the physical condition of the managed property, but also the processes taking place in it.

Regardless of the above, it is always desirable to implement a system for the management and operation of CAFM adapted to the specific construction.

5.1 CAFM systems

CAFM systems (Computer Aided Facility Management) are software tools designed to support facility management. It has become an integral part of the BIM concept, and rightly so. The operation and use of buildings is the longest part of the life cycle of buildings and the specialization / expertise of this industry is facility management.

There are a number of CAFM systems on the market. In essence, these are table-structured software that can effectively link and combine individual tables using complex functions. This creates an effective tool that provides not only a real overview of technical and economic information about the construction (passports), but which can also plan and evaluate individual processes associated with asset management, ie. link individual activities to the passport itself and calculate costs. The very interconnection of data in the CAFM system guarantees fast searching and the possibility to work efficiently with available data. A characteristic feature of these SW tools is that they are modular, which means that the end user defines the developer of this system exactly what functionalities he is interested in. Modules that are commonly offered:

- maintenance
- records
- cleaning work
- documents

- helpdesk
- lease management
- real estate
- and more.

In order for a CAFM system to work, it needs to be filled with data. Data is key to the proper management of operational and technical processes. If the data is duplicate, inaccurate, inconsistent, then the more honest facility manager "plays an accurate game with inaccurate numbers", which ultimately represents financial losses.

Requirements for maintenance and technological repairs can be imposed on CAFM systems. Regular maintenance is partly prescribed by the manufacturer or directly by legislative regulations (for example revisions) or it is performed by technicians on the basis of many years of experience and knowledge of operation. CAFM systems therefore record a summary of regular maintenance and repairs, which generate one-time requests at specified intervals. These are displayed on the screen together with one-off requests due to findings during inspections or in the event of specific failures or accidents. Regular requirements can also be introduced into these registers based on the requirement of environmental aspects (ISO 14000), security controls (OHSAS 18000), etc. Individual service requirements for employees (building users) are introduced into the system either directly by employees or dispatchers or written by individual facilities. managers or other authorized employees of the FM department, to which individual employees (building users) turn with their needs. However, the range of types of requests can still be expanded (primarily these are activities that the FM supplier provides directly, but it is also possible to record requests that the FM supplier only mediates, but recording or later evaluation is a great benefit for registration). Help Desks and a uniform form of registration and handling of requests (requests for services) also increase the corporate culture. The integrated control room is another stage of integration, where the demand systems are connected to the technological control room, both control rooms (both technological and demand control room) can be integrated into one room. All requirements are then uniformly recorded and reported. This leads to higher operability, substitutability and, last but not least, to the unification of unit cost monitoring. By interconnecting the BIM model and CAFM systems, processes and requirements will be handled efficiently.

5.2 BIM data and their migration

The life cycle of buildings is a basic measure of the BIM concept, which works throughout this cycle. However, BIM is primarily about information (or data) that has its own life cycle. A 3D model without descriptive information (attributes) is a mere visualization and we can hardly call it a BIM model - ie an information model of a building. This data can have a different form and structure, and there can be problems with existing buildings, how to work with this data, how to unify them and get them into the model so that the whole BIM concept works effectively.

5.2.1 Types of data

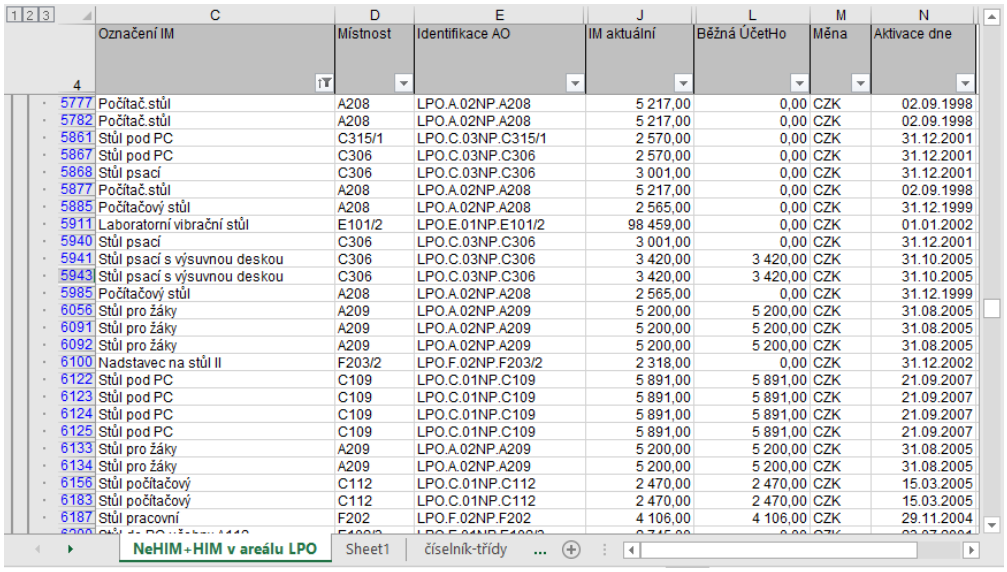
Data is an expression of the description of a selected attribute of the information model. For the needs of information management, let's distinguish between data:

- • electronic and digital - electronic data is unstructured, digitized data that was created in a text editor or by scanning. Digital data is structured, can be sorted and filtered.
- • graphic and non-graphic. Administration should be ingested geometric and non-geometric, but the practice uses the terms graphical and non-graphical - Graphic data is expressed by an image or a substitute symbol. Non-graphical data are descriptive data, eg textual, numerical.

- • static and dynamic - static data are data that do not change over time only under the expression of some special conditions, they are, for example, data expressing areas, volumes, number of pieces of elements, etc. Dynamic data are data related to eg water meter reading, number of employees and other values that change in the short term.

5.2.2 Formats and structure of available data

A large number of data formats are available for existing buildings. These are, for example: paper documents (drawing documentation, technical reports, attached documents, statements, etc.), simple electronic data in XML format (see Fig. 5.1), DOC or PDF or more complex outputs from various software.



	C	D	E	J	L	M	N
4	Označení IM	Místnost	Identifikace AO	IM aktuální	Běžná ÚčetHo	Měna	Aktivace dne
5777	Počítač.stůl	A208	LPO.A.02NP.A208	5 217,00	0,00	CZK	02.09.1998
5782	Počítač.stůl	A208	LPO.A.02NP.A208	5 217,00	0,00	CZK	02.09.1998
5861	Stůl pod PC	C315/1	LPO.C.03NP.C315/1	2 570,00	0,00	CZK	31.12.2001
5867	Stůl pod PC	C306	LPO.C.03NP.C306	2 570,00	0,00	CZK	31.12.2001
5868	Stůl psací	C306	LPO.C.03NP.C306	3 001,00	0,00	CZK	31.12.2001
5877	Počítač.stůl	A208	LPO.A.02NP.A208	5 217,00	0,00	CZK	02.09.1998
5885	Počítačový stůl	A208	LPO.A.02NP.A208	2 565,00	0,00	CZK	31.12.1999
5911	Laboratorní vibrační stůl	E101/2	LPO.E.01NP.E101/2	98 459,00	0,00	CZK	01.01.2002
5940	Stůl psací	C306	LPO.C.03NP.C306	3 001,00	0,00	CZK	31.12.2001
5941	Stůl psací s výsuvnou deskou	C306	LPO.C.03NP.C306	3 420,00	3 420,00	CZK	31.10.2005
5943	Stůl psací s výsuvnou deskou	C306	LPO.C.03NP.C306	3 420,00	3 420,00	CZK	31.10.2005
5985	Počítačový stůl	A208	LPO.A.02NP.A208	2 565,00	0,00	CZK	31.12.1999
6056	Stůl pro žáky	A209	LPO.A.02NP.A209	5 200,00	5 200,00	CZK	31.08.2005
6091	Stůl pro žáky	A209	LPO.A.02NP.A209	5 200,00	5 200,00	CZK	31.08.2005
6092	Stůl pro žáky	A209	LPO.A.02NP.A209	5 200,00	5 200,00	CZK	31.08.2005
6100	Nadstavec na stůl II	F203/2	LPO.F.02NP.F203/2	2 318,00	0,00	CZK	31.12.2002
6122	Stůl pod PC	C109	LPO.C.01NP.C109	5 891,00	5 891,00	CZK	21.09.2007
6123	Stůl pod PC	C109	LPO.C.01NP.C109	5 891,00	5 891,00	CZK	21.09.2007
6124	Stůl pod PC	C109	LPO.C.01NP.C109	5 891,00	5 891,00	CZK	21.09.2007
6125	Stůl pod PC	C109	LPO.C.01NP.C109	5 891,00	5 891,00	CZK	21.09.2007
6133	Stůl pro žáky	A209	LPO.A.02NP.A209	5 200,00	5 200,00	CZK	31.08.2005
6134	Stůl pro žáky	A209	LPO.A.02NP.A209	5 200,00	5 200,00	CZK	31.08.2005
6156	Stůl počítačový	C112	LPO.C.01NP.C112	2 470,00	2 470,00	CZK	15.03.2005
6183	Stůl počítačový	C112	LPO.C.01NP.C112	2 470,00	2 470,00	CZK	15.03.2005
6187	Stůl pracovní	F202	LPO.F.02NP.F202	4 106,00	4 106,00	CZK	29.11.2004

NeHIM+HIM v areálu LPO | Sheet1 | číselník-třídy | ...

Fig. 5.1: Example of evidence data in Excel spreadsheet editor, source: [15]

This data on the managed construction is of considerable importance, especially for facility management, and if BIM is implemented on an existing building, the information model itself should contain this data. If the model is empty and the data is externally in various formats, it is necessary to import it into the model. This can be accomplished in several ways, which are described in the following sections of this chapter.

An important point before importing this data into the CAFM system or CAD / BIM software is their restructuring. This part is very demanding, but necessary. The data, which is available in various formats, must be carefully taken over and evaluated, which are really important for the needs of operation and use. It is also necessary to put them in a structured way so that they can be imported. This way we get a real and clear passport about the construction in a uniform format - for example: in the Excel spreadsheet editor. By structuring the data, we ensure their readiness for subsequent migration to the CAFM system / BIM model.

Individual formats have their pitfalls and combining them into a unified, comprehensive and structured overview can be very difficult.

- The most difficult thing is to work with paper documents. These need to be either transcribed into electronic form if the data is necessary for import and subsequent work with them, or scanned into PDF format and used as attachments, see the following section.

- PDF documents are usually uneditable and it is also very difficult, but not entirely impossible, to filter information from them. Usually, PDF documents are only attached to individual structures and building equipment (hereinafter "building elements") in the CAFM system and are therefore easily traceable and directly linked to building elements (drawings of individual floors, energy performance certificate of the building, manuals and other documentation, e.g. to operate the equipment, warranty cards, etc.).
- • Text formats of the DOC type can again be attached as an attachment to individual elements, or it is better to convert them to PDF again. If it is specific data (attributes) about elements, which is suitable to apply directly to the tables of the CAFM system or BIM model, it is appropriate to turn them into the structure of an Excel table.
- • The last step before importing data and the easiest way to import construction data into the CAFM system is to own the data in XML (CSV) format. It is necessary to modify / edit this data into a correctly structured form so that the import into the CAFM system can be performed. By proper structuring, we ensure a real overview of the construction and minimize the risk of errors or duplications.

5.2.3 Data interconnection and migration

The BIM model created in CAD / BIM software should cooperate with CAFM systems and mutual data migration should be ensured. This guarantees the possibility of constant updating of data in the model and the CAFM system (see Fig. 5.2), which is necessary for the proper functioning of the BIM concept.

We can come across two different cases. For existing buildings, we usually have external data available in one of the formats mentioned in the first part of this chapter. When implementing BIM in such buildings, we usually digitize the building into a 3D realistic model, and this model must then be filled with data.

The second case is the creation of a 3D information model of the building, ie a model that already contains important information (attributes) and this model is then connected to the CAFM system..

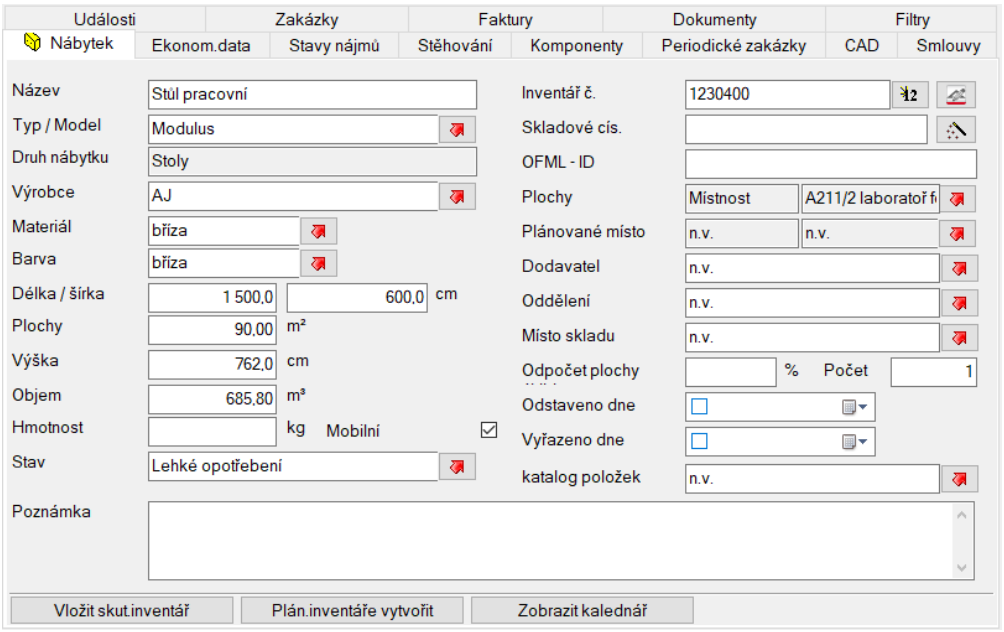


Fig. 5.2: Example of an evidence card in the CAFM pit-FM system, source: [15]

5.2.4 BIM model filled with information

For new buildings designed by BIM method (ie a model containing a graphic part, but especially an informative database (attributes) to the elements of the building, the connection with CAFM systems is simple (regardless of the requirements of the BIM concept, which is broader and more comprehensive than the information model itself). As a rule, the CAFM system is connected to CAD / BIM software and the individual elements from the model are imported into the CAFM system, thus creating the database of the building itself, individual floors, rooms and equipment, as well as importing data (attributes) about building elements. connection / localization between CAFM and CAD / BIM software, ie localization of individual floors, rooms or equipment and easy display from CAFM to the model and vice versa, but also visualization of digital drawing in the CAFM system itself (in the visualization window) without having to own CAD / BIM software.

5.2.5 BIM model that needs to be filled with information

Another method is to use the CAFM system as a bridge between external data and the 3D model. The 3D model (which does not yet contain information / attributes for individual building elements) is connected to the CAFM system and imports data, thus creating a database. Subsequently, external data (eg from the MS Excel spreadsheet editor) for individual elements, which are obtained from the 3D model, are imported into the CAFM system. The last step is data migration between the CAFM system and the 3D model. The connection of individual elements has already been created in the first step, so the migration of descriptive information (attributes) from the CAFM system to the model is very easy. This fills the model with information and becomes an information model of the building.

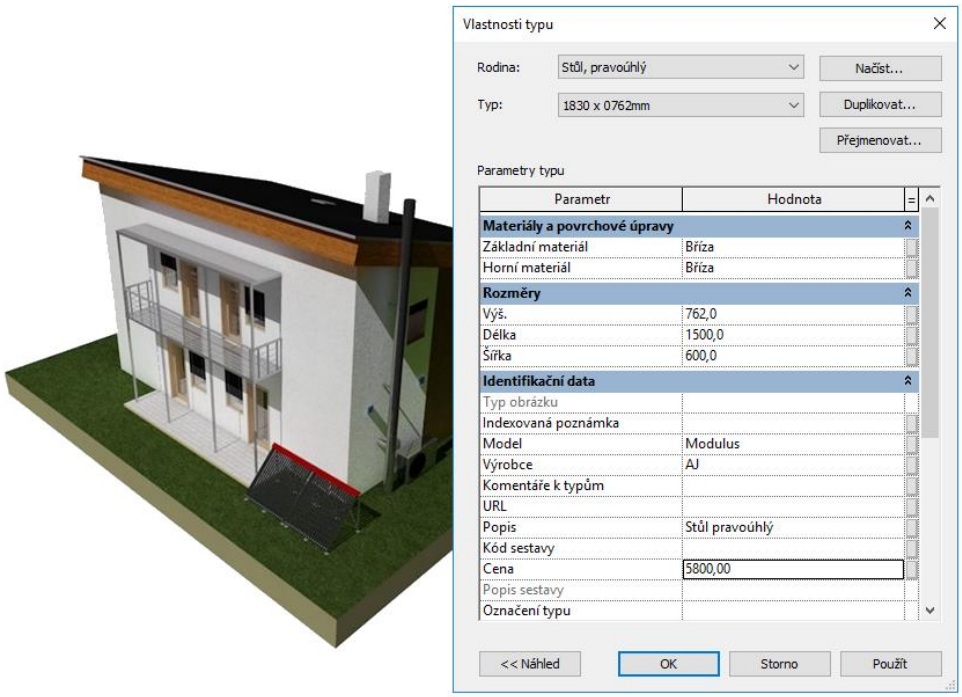


Fig. 5.3: BIM model and element attributes that can be migrated, source: [15]

Data update

Data updating is an essential part of the BIM concept, without which its efficient operation is not possible. The concept of working with old and invalid data makes no sense. It is therefore very important that the data migration, between the model and the CAFM system, works quickly, easily and efficiently.

Most CAFM systems allow this migration, and if there is a change in information / element movement / design change, etc. in one software, it can be updated by then importing the changes into another software.

This process should work in both directions: from the BIM model to the CAFM system and from the CAFM system to the model. The principle is the same as during the initial data import. The only difference is that only the changes made are imported and the migration is essentially faster because it does not contain such a large amount of data..

5.3 Synergy BIM, CAFM and a human

BIM specialists can define the requirements for hardware and software needed for BIM, facility manager can define the requirements for the implementation of CAFM system, but very often forget the requirements of a key element of the entire digital community - man. It is an unforgettable link in the whole chain. Without it and its abilities and skills, the potential of BIM models connected to the CAFM system cannot be flourished. Therefore, it is very desirable for this person to combine more than just a technical focus. Just as facility management is multidisciplinary, so the facility manager must be familiar with construction issues, issues related to the operation of HVAC and economic activities. As in any industry, the facility manager pays particular attention to the economy of all processes and must be able to plan costs and provide resources to cover them, communicate with people, whether on the client's side or its own employees, must be able to plan and manage their own agenda and last but

not least. be able to comprehensively operate ICT, analyse and sort data and formulate information about operations and processes from them. The minimum knowledge he should have is also related to the legal obligations related to the operation of dedicated technical equipment and equipment subject to revisions and to know the legal obligations of the owner, ie the operator, imposed by relevant legislation according to the nature of construction and functional use.

This difficult task requires one to have an overview of all the mentioned duties and activities and to be able to define exactly what is necessary for the BIM model to be connected to the CAFM system. Those requirements for the BIM model are mainly the data with which the BIM model is to be filled. This is very key for the subsequent interconnection and control of FM processes. Defining a LOIN (Level of Information Need) is really very laborious. The determination of the structure and format of data depends on the employees of operational and technical processes.

It is therefore clear that this is indeed a very wide range of activities that must be kept to a minimum to ensure that the operation and use of the building is considered safe. To this must be added other unplanned (extraordinary) activities related to operation and use. If the facility manager is to handle all the tasks entrusted to him, it is necessary to implement the system. According to the size and amount of managed assets, incl. constructions, there is a possibility to use the CAFM system. There are a large number of developers on the market offering de facto optimal solutions for everyone. When choosing a CAFM system, it is important to get acquainted with the offered modules and verify whether it allows live connection with BIM models (two-way communication between tools). It is not true that all CAFM systems can do this. There are still tools that are filled with data obtained from evidence rather than connection to the BIM model. If it is possible to select a suitable CAFM system and go through it with the BIM model, the processes of operation and use can be managed sophisticatedly from one place over real and unambiguous data. Any change compared to the BIM model (reconstruction, modernization, extension, installation, change of structures and elements, etc.) must be updated.

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