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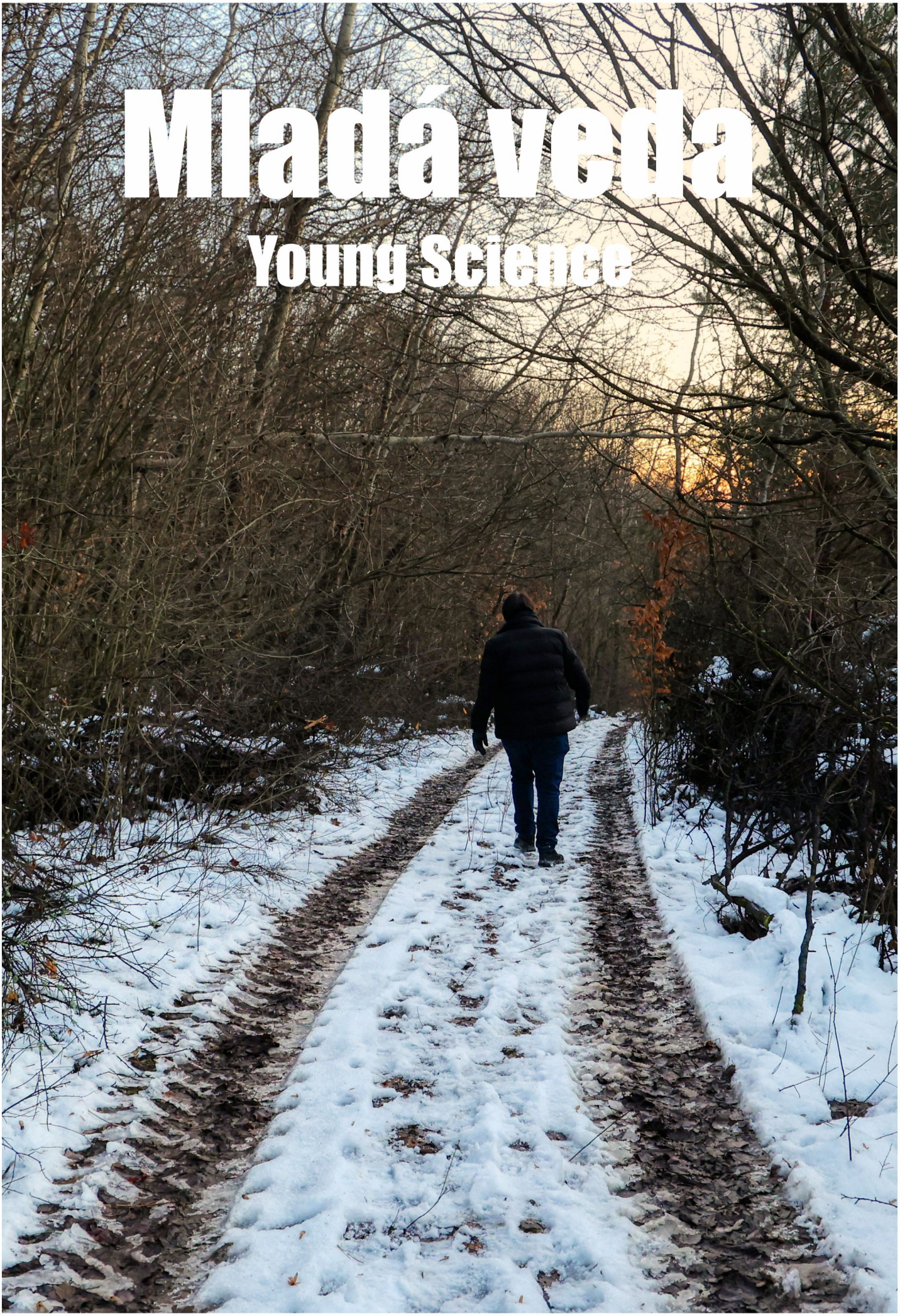

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APPLICATION OF FACILITY MANAGEMENT IN THE BUILDING STRUCTURES MAINTENANCE STREAMLINING

APLIKÁCIA FACILITY MANAGEMENTU PRI ZEFEKTÍVNENÍ ÚDRŽBY STAVEBNÝCH KONŠTRUKCIÍ

Martin Hanko, Barbara Križanová, Adam Hopocký [1]

Martin Hanko pôsobí ako výskumný pracovník na Stavebnej fakulte Slovenskej technickej univerzity v Bratislave. Vo svojom výskume sa venuje problematike údržby budov aplikáciou facility managementu a ekonomiky stavebníctva. Barbara Križanová pôsobí ako odborná asistentka na Stavebnej fakulte Slovenskej technickej univerzity v Bratislave. Vo svojom výskume sa venuje problematike časového plánovania výstavby a technológií dokončovacích procesov. Adam Hopocký pôsobí ako doktorand na Stavebnej fakulte Slovenskej technickej univerzity v Bratislave. Vo svojom výskume sa venuje problematike rozvoja moderných technológií v stavebíctve.

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Abstract

In the use phase of construction objects, the possibility to influence their maintenance is already minimal. The aim of the article is to draw attention to the high-quality maintenance of buildings by its planning already during the design of building structures. One of the tools that helps us in this planning is the process sheet of the building structure and the building maintenance manual. The task of the article is to clarify the essence of the process sheet and

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the manual, what it should contain, when it is used and what are its possibilities of use. Appropriate selection of materials in the design phase can significantly affect the life cycle costs of the building, especially future operating costs. Investors currently decide on the material solution of building structures mainly according to the amount of investment costs. The paper points out the need to create a suitable methodology that would create the basis for modern technologies and facilitate the process of selection of building materials for investors and designers.
Key words: facility management, cost, manual

Abstrakt
Vo fáze užívania stavebných objektov je už možnosť ovplyvniť ich údržbu minimálna. Cieľom článku je upozorniť na kvalitnú údržbu budov jej plánovaním už pri projektovaní stavebných konštrukcií. Jedným z nástrojov, ktorý nám pri tomto plánovaní pomáha, je procesný list konštrukcie budovy a manuál údržby. Úlohou článku je objasniť podstatu procesného listu a manuálu, čo by mali obsahovať, kedy sa používajú a aké sú jeho možnosti využitia. Vhodný výber materiálov vo fáze projektovania môže výrazne ovplyvniť náklady životného cyklu budovy, najmä budúce prevádzkové náklady. Investori sa v súčasnosti rozhodujú o materiálovom riešení stavebných konštrukcií najmä podľa výšky investičných nákladov. Príspevok poukazuje na potrebu vytvorenia vhodnej metodiky, ktorá by vytvorila základ pre moderné technológie a uľahčila proces výberu stavebných materiálov investorom a projektantom.
Kľúčové slová: facility management, náklady, manuál

Introduction

Currently, sustainability in the construction industry should be a priority. Facility managers have valuable tracked information from the use phase of various types of buildings, according to which they are able to define the conditions for future maintenance of building structures.
The building maintenance manual is the main basis for building managers and facility managers, but they should ensure its creation. It is necessary to ensure trouble-free and low-cost operation of buildings, which can be contributed to by the high-quality development of the manual.

The energy and operational intensity of the building is maximally determined by the material, spatial solution and its technical equipment. (Somorová, 2010) These factors have a direct impact on most of the future operating costs of a building. The efficiency of the investment process is determined by the optimal life cycle costs (LCC) of the building, namely investment costs and operating costs.

The material solution of the building structures of the building has a priority position in relation to the future maintenance costs during the use phase of the building. As a percentage, the highest component of the total future operating costs of the building is the heating costs. They are decisively influenced by the material and structural design of the building. (Somorová, 2010) By including the facility manager in the design phase of the building, future operating costs can be minimized, and thus also the costs of maintaining the building structure.

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The proposed procedure for solving the methodology

Evaluation of the structure, where the designer during the design phase will design a material solution for building structures. For individual constructions, individual life cycle costs will be processed according to the methodology. Based on the minimum life cycle costs of the building, the investor will choose a suitable solution. The determined costs, after reference to the unit area lcci [€/m2], can serve as a starting point for the design. The proposed methodology for determining costs for the maintenance of building structures is shown in figure 1.

The methodology was incorporated for three variants of external wall on the administrative building. V1 was considered as a masonry wall made of ceramic blocks, V2 was considered as a reinforced concrete wall with insulation, V3 was considered as an all-glass facade. The highest operating costs were achieved during the specified period by V3, which was caused mainly by high maintenance costs of the structure. The V2 material solution has the lowest investment and future selected operating costs during the life cycle. (Hanko, 2017)

For each building structure, the manual shall specify the specific maintenance activities and their periodicity. The periodicity of some maintenance activities is determined by legislative requirements that must be complied with. The frequency of activities not specified by legislation can be adapted to the requirements of the facility manager, designer and investor and distribute the activities evenly over time. These not specified periodicities are processed precisely in process sheets, which thus become part of the manual for the maintenance of building structures. By including the facility manager in the design phase of the building, future operating costs can be minimized, and thus also the costs of maintaining the building structures.

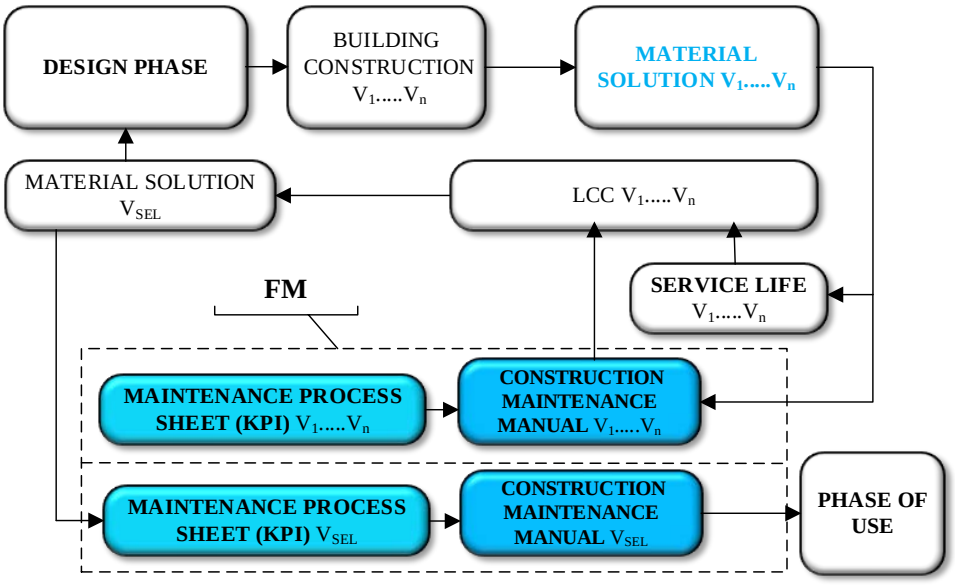

Figure 1 - The Use of Construction Maintenance Manual and Process Sheets in the Methodology for Streamlining Maintenance
Source: Authors

For individual variants, the selected part of the maintenance manual of construction structures has been processed in the application part: Rules for the maintenance of structures (table 1-3) and the process sheets (table 4-6). Content of these rules have a direct impact on the determination of future operating costs.

V1: Masonry Facade Construction	
Maintenance	Structure Maintenance Rules:
Very Good	Immediate troubleshooting. Cleaning. Renewal of protective coating (Thermoshield exterieur).
Normal	Troubleshooting. Renewal of protective coating (Thermoshield exterieur).
Neglected	The construction is subject to external influence: atmospheric, vandalism. Repair on emergency.

Table 1 - Rules for the Maintenance of Structures V1
Source: Authors

V2: Reinforced Concrete Facade Construction + Contact Thermal Insulation System	
Maintenance	Structure Maintenance Rules:
Very Good	Immediate troubleshooting. Cleaning. Renewal of protective coating (Weber.ton Acrylate-Silicone).
Normal	Troubleshooting. Renewal of protective coating (Weber.ton Acrylate-Silicone).
Neglected	The construction is subject to external influence: atmospheric, vandalism. Repair on emergency.

Table 2 - Rules for the Maintenance of Structures V2
Source: Authors

V3: ALL-GLASS FACADE CONSTRUCTION	
Maintenance	Structure Maintenance Rules:
Very Good	Immediate troubleshooting. Washing. Replacing damaged glass.
Normal	Troubleshooting. Washing. Replacing damaged glass.
Neglected	The construction is subject to external influence: atmospheric, vandalism. Repair on emergency.

Table 3 - Rules for the Maintenance of Structures V3
Source: Authors

Subject of the maintenance process:	Restoration of protective coating ThermoShield Exterieur
Maintenance frequency:	1 time in 7 years
Maintenance time duration:	-
The responsible person:	Construction Supervisor/Facility Manager
Professional competence required:	-
Legislative and normative requirements:	Act No. 124/2006 Z. z. Decree No. 24/2003 Z.z.
Technical equipment:	Airless spraying equipment, roller, paint brush
Description of maintenance activities: ThermoShield Exterieur is applied to all supporting, clean, dry substrates that are free of corrosion and grease. Cleaned surfaces. Which are formed by coarse plaster, it is necessary to clean. The coating is applied with the help of a brush, roller or airless spraying (Airless). The first application of paint must be applied in two layers. The paint should be thoroughly mechanically mixed before application. For Airless applications, it is necessary to follow the instructions from the device manufacturer. Do not work below +5°C. During the total drying time, the temperature must not fall below +5°C. Work must be carried out during sufficient daylight hours. The material must be mixed after work has been interrupted. If there are substrates that absorb water and where there may be increased remaining moisture, water may rise to the surface of the structure after application of the first layer of paint. Then the next layer is applied only after the previous layer has completely dried. ThermoShield Exterieur will not become fully functioning until after 36 days. **(**Thermoshield.sk**,** 2022)	
KPI: 3: Very good maintenance of building structures: -maintenance has been carried out: on time, according to the activity description -payment to the supplier 110% of the agreed price 2: Normal maintenance of building structures: maintenance has been carried out: on time or with a month's delay, as described in the -payment to supplier 100% of the agreed price 1: Neglected maintenance of building structures: maintenance not performed -withdrawal from contract with supplier	

Table 4 - Process Sheet V1
Source: Authors

Subject of the maintenance process:	Restoration of protective coating ThermoShield Exterieur
Maintenance frequency:	1 time in 7 years
Maintenance time duration:	-
Responsible person:	Building supervision

Professional competence required:	-
Legislative and normative requirements:	Act No. 124/2006 Z. z. Decree No. 24/2003 Z.z.
Technical equipment:	Suitable spraying equipment, roller, paint brush
Description of maintenance activities: The base layer must be: supporting, solid, dry, free of dust and grease. If uneven, the substrate is straightened with a fine plaster R 605 with the addition of weber.betonkontakt. Old coatings and coatings with different sucking, or plaster, which are dusty, need to be inseed once with weber 707. The new plaster must already be ripe and dry. Non-standard substrates, such as: volume-volatile, it is necessary to evaluate the suitability of using weber.ton acrylic-silicone. Air and substrate temperature and must not fall below + 5 °C. The coating does not apply during direct sunlight, strong wind and rain. When application during temperatures above 25 °C, strong wind, heated substrate, it is necessary to consider all conditions that affect the correct implementation. When applied during low temperatures, high relative humidity of the air will be an extended drying time, which can cause unequal surface color, and even after more than 12 hours, the coating may be sucked away by rain. Penetrate the substrate with a weber 553 coating, which is diluted with clean water in a ratio of 1:3. Apply the paint with a façade roller or paint brush in two layers. Apply the first layer with a coating that is diluted with 10% water. Apply the second layer with a coating that is not diluted or diluted up to 5% water. Between the different layers, it is necessary to think about a day with a technological break. **(**Baumit.sk, 2022)	
KPI: 3: Very good maintenance of building structures: -maintenance has been carried out: on time, according to the activity description -payment to the supplier 110% of the agreed price 2: Normal maintenance of building structures: maintenance has been carried out: on time or with a month's delay, as described in the -payment to supplier 100% of the agreed price 1: Neglected maintenance of building structures: maintenance not performed -withdrawal from contract with supplier	

Table 5 - Process Sheet V2
Source: Authors

Subject of the maintenance process:	Window washing
Maintenance frequency:	2 times in 1 year
Maintenance time duration:	-
The responsible person:	Building manager/ facility manager
Required professional competence:	-
Legislative and normative requirements:	Act No. 124/2006 Z. z. Decree No. 24/2003 Z.z.
Technical equipment:	

Description of maintenance activities: Glass that is dirty is washed with more clean summer water. A little suitable detergent or ordinary detergent is added to the water. Glass is cleaned with the use of paper towels, felt rags that do not leave fibres. After cleaning, the glass is rinsed with clean water, which is wiped off with a spatula. With the help of a clean and delicate fabric, greasy stains and impurities are removed with the help of diluent or acetone. The windows are then cleaned according to the previous procedure. Glass shall be polished using means intended for windows and window cleaners containing alcohol. For polishing use rags that are sucking or cloths made of paper that do not leave fibers. The glasses are cleaned by circular movements to ensure that the smudging and traces of the glass surfaces dry out. Glass is not cleaned with: textiles and paper containing fine abrasive elements, the rough side of sponges and wireworm. During handling and installation, the use of soft protective gloves should be**.** (Lmmont.sk, 2022)
KPI: 3: Very good maintenance of building structures: -maintenance has been carried out: on time, according to the activity description -payment to the supplier 110% of the agreed price 2: Normal maintenance of building structures: maintenance has been carried out: on time or with a month's delay, as described in the -payment to supplier 100% of the agreed price 1: Neglected maintenance of building structures: maintenance not performed -withdrawal from contract with supplier

Table 6 - Process Sheet V3
Source: Authors

Conclusion

An effective tool for deciding on building materials can be the proposed methodology, which would be used in a simple and quick way to determine the selected life cycle costs, ie investment costs and other operating costs, even during the design of buildings. Quality-processed maintenance process sheets are the basis for the development of a building construction manual. The development of the maintenance manual for several variants of the material solution of building structures will help to determine the cost indicators, the essential part of which are the maintenance costs. By determining the cost indicators, it is possible to support the decision-making of investors about the choice of material solution already during the design of new buildings or renovation.

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