www.briainvenia.sk

Buildustry

Číslo: 2/2022 Ročník: VI ISSN: 2454-0382 Vyšlo: 09.12.2022 Vydáva: Bria Invenia, s.r.o.

Zmeny katastrálneho zákona

Nárast cien v stavebníctve a obstarávanie prác a

Vplyv zelených striech na prevádzkové náklady

Prevetrávané podlahy

Inteligentné mestá

Povrchové teploty jednoplášťových a vegetačných striech

Facility management

- Procesné listy
- Manuál údržby

Návrh komunálneho vozidla

9 772454 038007

OBSAH:

Buildustry

Vedecko-odborný recenzovaný časopis publikujúci články v jazykoch:
- Slovenčina
- Čeština
- English
- Français

Ročník: VI
Číslo: 2
Vychádza: 2 x ročne
Vyšlo: 09.12.2022

Vydáva:
Bria Invenia, s.r.o.
Poštová 11
972 26 Nitrianske Rudno
Slovenská republika
www.briainvenia.sk

Redakcia:
Bria Invenia, s.r.o.
Poštová 11
972 26 Nitrianske Rudno
Slovenská republika
Tel: +421 948 429 981
E-mail: buildustry@briainvenia.sk

Inzercia:
Ing. Jana Briatková Olšová
Tel: +421 904 591 511
E-mail: olsova@briainvenia.sk

Grafika:
Ing. Roman Briatka
Tel: +421 948 429 981
E-mail: buildustry@briainvenia.sk

Náklad: Online
ISSN: 2454-0382
EAN: 9772454038007

Upozornenia:
Odborné a vedecké články prešli recenziami nezávislých recenzentov.

Uverejnené články neprešli jazykovou úpravou. Za ich znenie a správnosť zodpovedajú autori.

Názory a stanoviská uverejnené v článkoch nereprezentujú názory a stanoviská redakcie.

Vydavateľstvo nemá právnu zodpovednosť za obsah inzercie.

Fotografia na titulke:
https://www.unsplash.com

Zmeny katastrálneho zákona a jeho vplyv na znaleckú a stavebnú činnosť

The impact of the amendent to the Cadastral Law on expert activity

Ján Amos Florián Gajniak[1]
Zaradenie článku: Odborný

Abstrakt

Platný a účinný katastrálny zákon bol novelizovaný v roku 2018, 2019 a 2022, pričom pre znaleckú a stavebnú činnosť z toho vyplývajú niektoré praktické účinky. V príspevku je niekoľko bodov ku katastrálnemu zákonu platnému a účinnému v Českej republike, aby sme mali informácie o legislatívnom stave k problematike, ktorej sa venujeme v príspevku. V závere tohto príspevku sú stanoviská k problematike noviel tohto zákona a odporúčania pre legislatívny proces, aby znalci boli rovnocennými subjektmi pri získavaní informácii z katastrálneho operátu a zbierky, ako iné subjekty uvedené v zákone.

Abstract

The valid and effective Cadastral Act was amended in 2018, 2019 and 2022, while some practical effects result from this for expert and construction activities. There are several points in the article on the Cadastral Act valid and effective in the Czech Republic, so that we have information on the legislative status of the issue, which we address in the article. At the end of this paper, there are opinions on the issue of amendments to this Act on recommendations for the legislative process so that experts are equal subjects in obtaining information from the Cadastral register and Collection than other entities listed in the Act.

Kľúčové slová: Kataster, Znalec, Stavba

Keywords: Cadastre, Expert, Construction

Úvod

Zákon č. 162/1995 Z. z. o katastri nehnuteľností a o zápise vlastníckych a iných práv k nehnuteľnostiam (katastrálny zákon), v znení neskorších predpisov bol v posledných piatich rokoch novelizovaný štyrikrát, avšak novela zákonom č. 212/2018 Z. z., s účinnosťou od 01.10.2018 a v niektorých bodoch (Čl. I, bod 32. a 39. a Čl. II., bod 6.) od 01.10.2019 je dôležitá pre znaleckú činnosť, či už výkonnú alebo pre rozšírenie informácii k súvislostiam problematiky.

Ďalšia novela katastrálneho zákona bola realizovaná zákonom č. 225/2019 Z. z., ktorým sa mení a dopĺňa zákon č. 461/2003 Z. z. o sociálnom poistení v znení neskorších predpisov.

V §69 ods. 5 bol k subjektom, ktoré majú právo na údaje z katastra doplnená aj Sociálna poisťovňa, pričom je jej poskytnuté aj rodné číslo vlastníka nehnuteľnosti a iný identifikátor, ak ide o cudzinca.

Nakoniec posledná novela katastrálneho zákona bola uskutočnená zákonom č. 325/2022 Z. z., ktorou sa zmenil v zákone pojem integračné obslužné miesto na poštový podnik vykonávajúci činnosť osvedčujúcej osoby, pričom je účinná od 01.11.2022. Podľa § 69 ods. 6 katastrálneho zákona, Úrad ako ústredný orgán štátnej správy na úseku katastra prostredníctvom poštového podniku vykonávajúceho činnosť osvedčujúcej osoby poskytuje výpis z listu vlastníctva, kópiu z listu vlastníctva, kópiu z katastrálnej mapy alebo kópiu z mapy určeného operátu, ak sú požadované údaje vedené v elektronickej podobe.

Informačný systém katastra pre znalca z odboru stavebníctvo

V katastrálnom zákone je nové vymedzenie katastra z hľadiska účelu jeho využitia, pričom ide o demonštratívne vymedzenie, teda sú tu uvedené príklady, a to využitie katastra na:

- Ochranu práv k nehnuteľnostiam
- Daňové účely a poplatkové účely

[1] JUDr. Ján Amos Florián Gajniak, Stavebná fakulta STU v Bratislave

- Oceňovanie nehnuteľnosti, najmä pozemkov
- Ochranu poľnohospodárskeho pôdneho fondu a lesného pôdneho fondu
- Tvorbu a ochranu životného prostredia
- Ochranu nerastného bohatstva
- Ochranu národných kultúrnych pamiatok a ostatných kultúrnych pamiatok, ako aj chránených území a prírodných výtvorov
- Budovanie ďalších informačných systémov o nehnuteľnostiach.

Z pohľadu právnej úpravy využitia katastra na oceňovanie nehnuteľnosti je prínos pre znalcov, avšak rozsah využitia katastra je potom v ďalších ustanoveniach katastrálneho zákona zúžený, čo môže pre znaleckú činnosť mať vážny praktický dosah, hlavne v oblasti vypracovania znaleckých posudkov pre súdy a iné orgány štátnej a verejnej správy.

Ide o to, že v ustanovení § 68 Verejnosť katastrálneho operátu je právo do katastrálneho operátu nahliadať a robiť si z neho pre svoju potrebu výpisy, odpisy, náčrty alebo kópie, ak nie sú v zákone výnimky.

V tomto ustanovení je pozitívne vymedzenie práva pre znalcov z odboru stavebníctvo – odvetvie odhad hodnoty nehnuteľností, ďalej pre znalcov z odboru poľnohospodárstvo – odvetvie odhad poľnohospodárskej pôdy a znalcov z odboru lesníctvo – odvetvie odhad hodnoty lesov, ktorá vyhotovuje cenové mapy, že majú prístup k údajom o cene nehnuteľnosti. Sú tam tiež vymenované ešte ďalšie subjekty, ktoré majú rovnaké práva ako znalci. Čo však komplikuje znalcom v odbore stavebníctvo výkon ich činnosti je, že majú obmedzené právo prístupu k zbierke listín (k listinám uloženým v zbierke listín), hoci iným vymenovaným subjektom toto právo patrí (napr. znalcom z odboru geodézie a kartografie, súdnym exekútorom a iným subjektom). V praxi určite tieto listiny znalci budú potrebovať, aby znalecký posudok bol v súlade s právnymi predpismi k znaleckej činnosti, resp. súvisiacimi osobitnými právnymi predpismi.

Z ustanovenia § 69 Poskytovanie údajov katastra bohužiaľ vyplýva, že znalci nemajú prístup k rodnému číslu vlastníka nehnuteľnosti, eventuálne k inému identifikátoru, ak ide o cudzinca (hoci iné subjekty toto právo majú).

Nové pojmy a charakteristiky nehnuteľnosti

Veľký význam pre znalcov majú nové pojmy a charakteristika nehnuteľnosti podľa katastrálneho zákona.

Podľa ustanovenia § 6 Predmet katastra, je novým pojmom stavba, ktorá je vymedzená ako spojenie so zemou pevným základom, a to prienikom so zemským povrchom alebo priemetom jej vonkajšieho obvodu na zemský povrch, ktorá:

- Je označená súpisným číslom
- Nie je označená súpisným číslom
- Je rozostavanou stavbou v súvislosti so vznikom, zmenou alebo zánikom práva k nim
- Je podzemná stavba, a to v miestach jej prieniku so zemským povrchom

Podmienkou zápisu stavby do katastra je však, že musí byť ohraničená obvodovými stenami a strešnou konštrukciou a podmienkou zápisu rozostavanej stavby je stavebnotechnické usporiadanie a funkčné usporiadanie jej prvého nadzemného podlažia.

Pri rozostavanom byte alebo nebytovom priestore musí byť stavba, v ktorej sa rozostavaný byt alebo rozostavaný nebytový priestor nachádza, ohraničená obvodovými stenami a strešnou konštrukciou a jednotlivé rozostavané byty alebo rozostavané nebytové priestory sú stavebnotechnicky oddelené. Ďalej pri podzemnej stavbe, v ktorej sa rozostavaný byt alebo rozostavaný nebytový priestor nachádza, musí byť uzavretá stropná konštrukcia stavby a jednotlivé rozostavané byty alebo rozostavané nebytové priestory sú stavebnotechnicky oddelené.

Čo je však v tejto súvislosti najdôležitejšie pre znalcov z hľadiska ich výkonu činnosti, že katastrálny zákon (§ 46) vyššie uvedené rozostavané stavby zapíše iba za podmienky, že je na ne vypracovaný znalecký posudok o stupni rozostavanosti, pri dodržaní vyššie uvedených zákonných ustanovení katastrálneho zákona.

Legislatívny stav právnej úpravy katastrálneho zákona v Českej republike

V Českej republike (ďalej ČR) je zápis stavieb právne upravený v zákone č. 256/2013 Sb., o katastru nemovitostí (katastrální zákon). V nami sledovaných súvislostiach, teda participácie znalca pri zápise stavieb a nových právnych inštitútov katastrálneho zákona v Slovenskej republiky (ďalej SR), môžeme konštatovať, že v prvom rade tento katastrálny zákon ČR je z roku 2013, z účinnosťou od 01.01.2014, oproti nášmu katastrálnemu zákonu z roku 1995, pričom však u nás bol tento právny predpis novelizovaný 18 krát a u našich západných susedov 10 krát od jeho prijatia.

V druhom rade v komplexnosti právnej úpravy a špecifikácie jednotlivých inštitútov katastrálneho zákona v ČR je tento zákon oproti katastrálnemu zákonu SR v niektorých aspektoch menej rozpracovaný.

Teraz však podrobnejší prístup k inštitútom v zmysle pohľadu na inštitúty stavieb a rozostavaných stavieb a participácie znalcov na ohodnocovaní týchto nehnuteľnosti.

V celom katastrálnom zákone ČR nie je participácia znalcov pri zápise nehnuteľnosti uvedenú vôbec, hoci v ustanovení § 8 písm. f) katastrálneho zákona ČR je charakteristika rozostavanej jednotky, však len v tom zmysle, že sa uvedie číslo jednotky a že ide o rozostavanú stavbu. V právnej úprave katastrálneho zákona SR, ako už bolo uvedené, je participácia znalca obligatórna a rovnako aj špecifikácia rozostavanej stavby je určená veľmi presne, čo napomáha znalcovi, stavebníkovi ako aj katastru.

Pravdepodobne iba jedna formulácia § 15 ods. 1, písm. d) katastrálneho zákona ČR napovedá, že by eventuálne mohol byť potrebný znalecký posudok pre zápis stavby, eventuálne rozostavanej stavby do katastra, a to že prílohou vkladového konania je listina, pokiaľ jej potreba vyplýva z iného právneho predpisu. Toto spojenie už spoluautori príspevku právne neanalyzovali.

Čo sa týka poskytovania údajov z katastra v rámci katastrálneho zákona ČR, táto právna úprava je všeobecnejšieho rázu ako v našom katastrálnom zákone SR v tom zmysle, že uvádza o čo žiadateľ môže požiadať katastrálny úrad, avšak nie sú uvedené priamo obmedzenia pre vymenované subjekty, len je v § 55 katastrálneho zákona ČR odkázané na vykonávací predpis, ktorý upravuje poskytovanie údajov a ich formu. Po právnej analýze vyhlášky č. 358/2013 Sb., o poskytnutí údajů z katastru nemovitostí, ve znení vyhlášek č. 354/2015 Sb. a č. 256/2018 Sb., bolo preukázané, že nie je ustanovenie o vymedzení subjektov, ktoré majú obmedzenia k údajom či už z katastrálneho operátu alebo zbierky listín.

Celá problematika o poskytnutí údajov z katastra nehnuteľností je sústredená koncepčne na to, kto má povinnosť platiť za poskytnuté služby (diferenciácia subjektov) a akou formou sa výstupy majú poskytnúť a čo tieto subjekty musia splniť, aby im boli úradne potvrdené výstupy poskytnuté (pri elektronických služba a pod.).

Záver

Právna analýza katastrálneho zákona SR bola vykonaná z dôvodu, aby sme priblížili znalcom právno-teoretické podklady k znaleckej činnosti, ktorú prakticky vykonávajú. Je predpoklad, že prevody rozostavaných stavieb (domov, bytov a nebytových priestorov) sú dosť časté a táto dôležitá novela katastrálneho zákona SR v tomto smere znalcom pomôže pri ohodnocovaní stavieb tohto typu.

Čo sa týka právnej úpravy verejnosti katastrálneho operátu, tak tu vidíme „dieru“ pri oprávnenom prístupe k listinám uloženým v zbierke listín. Predpokladáme, že táto nevýhoda by mohla byť legislatívne upravená na podnet znalcov vo forme návrhu zmeny, resp. doplnenia katastrálneho zákona.

Legislatívy Slovenskej republiky a Českej republiky v danej problematike sú dosť podobné (koncepcia katastrálneho zákona), čo je odôvodnené spoločnou históriou ako aj územnou a kultúrnou blízkosťou a neposlednom rade aj spoločným členstvom v Európskej Únii, pritom vykazujú viacero osobitosti, ako bolo v príspevku uvedené v špecializovanej téme participácie znalcov na zápise nehnuteľnosti, resp. pri príprave podkladov pred podaním návrhu na vklad zmlúv. V danom smere je jasnejšia právna úprava v SR, kde aspoň špecializovane je uvedená táto participácia znalcov, naproti tomu v katastrálnom zákone ČR nie je vôbec, aj keď predpokladáme, že v praxi sa realizuje, lebo v podstate zápisy pri rozostavaných stavbách by neboli možné.

Literatúra a súvisiace odkazy

[1] Zákon č. 162/1995 Z. z. o katastri nehnuteľností a o zápise vlastníckych a iných práv k nehnuteľnostiam (katastrálny zákon), v znení neskorších predpisov

[2] Zákon č. 256/2013 Sb. o katastru nemovitostí (katastrální zákon), ve znění zmien provedených zákony č. 86/2015 Sb., č. 139/2015 Sb., č. 318/2015 Sb., č. 106/2016 Sb., č. 298/2016 Sb., č. 183/2017, č. 225/2017 Sb., č. 481/2020 Sb., č. 261/2021 Sb. a č. 371/2021 Sb.

[3] Vyhláška č. 358/2013 Sb., o poskytnutí údajů z katastru nemovitostí, ve znení vyhlášek č. 354/2015 Sb. a č. 256/2018 Sb.

[4] Web: https://www.cuzk.cz/Predpisy/Pravni-predpisy-v-oboru-zememerictvi-a-katastru.aspx, Dátum poslednej aktualizácie: 05.11.2022.

Obstarávanie stavebných prác a nárast cien stavebných materiálov

Procurement of construction works and increase in prices of construction materials

Patrik Šťastný[1], Simona Feninová[2]

Zaradenie článku: Odborný

Abstrakt

Inflácia a nárast cien sú momentálne veľmi aktuálnou témou. Tento problém postihuje globálne všetky odvetvia. Nárast cien má taktiež dopad na verejné zákazky, ktoré sú súčasťou verejného obstarávania. Preto je potrebné venovať zvýšenú pozornosť tomuto problému, nakoľko sa nepriamo dotýka nás všetkých. Výrazný nárast cien sa premietol do stavu, kedy úspešní uchádzači pristupujú k navyšovaniu cien prostredníctvom dodatkov, alebo v horšom prípade nastáva odstúpenie od zmluvy zo strany úspešného uchádzača z dôvodu nemožnosti plnenia záväzku. Následne tak nastáva situácia, kedy je problematické dokončiť dielo. Tento príspevok sa zaoberá problémami súvisiacimi s nárastom cien, ktoré vplývajú na vyššie uvedené verejné obstarávanie stavebných prác, opisuje rôzne scenáre vývoja procesov a navrhuje rôzne metódy na zlepšenie.

Abstract

Inflation and price increases are a very hot topic at the moment. This problem affects all industries globally. The increase in prices also has an impact on public contracts, which are part of public procurement. Therefore, it is necessary to pay increased attention to this problem, as it indirectly affects all of us. A significant increase in prices was reflected in a situation where successful bidders increase prices through addenda, or in the worst case, the successful bidder withdraws from the contract due to the impossibility of fulfilling the obligation. Subsequently, a situation arises where it is problematic to complete the work. This paper examines the price escalation issues affecting the aforementioned public procurement of construction works, describes different process development scenarios and suggests different methods for improvement.

Kľúčové slová: Verejné obstarávanie, Obstarávanie stavebných prác, Nárast cien

Keywords: Public procurement, Procurement of construction works, Increase in prices

Úvod

Mnoho publikácií svedčí o fakte, že verejné obstarávanie nie je typické len pre Európu [1,2], ale je využívané v celom svete [3,4,5]. Cieľom verejného obstarávania je efektívny výber zhotoviteľa pri získavaní tovarov, prác a služieb, ale taktiež aj prevencia voči korupcii a potenciálnemu konfliktu záujmov. Za ďalší cieľ verejného obstarávania možno považovať rovnosť šancí a rovnaké zaobchádzanie vo vzťahu k záujemcom, resp. uchádzačom. Jedným z novších cieľov verejného obstarávania je určite efektívne uplatňovanie ,,horizontálnych politík" vo verejnom obstarávaní. Pod pojmom ,,horizontálne politiky vo verejnom obstarávaní" si môžeme predstaviť sociálne ciele, priemysel ale aj v súčasnosti veľmi aktuálnu tému, ktorou je životné prostredie a naňho nadväzujúce zelené verejné obstarávanie. Za ciele verejného obstarávania možno taktiež považovať otvorenie trhov verejného obstarávania v rámci jednotlivých členských krajín Európskej únie a zvýšenie efektívnosti celého procesu verejného obstarávania, ako aj kvality ponúkanej práce. Všetky tieto ciele môžeme považovať za hlavné ciele verejného obstarávania. Tieto ciele taktiež zabezpečujú efektívny pomer ceny a kvality.

Z globálneho hľadiska možno pojem verejné obstarávanie definovať ako zákonom stanovený postup zadávania zákaziek. Tento zákonom stanovený postup je povinný pre určitý okruh osôb, ktoré majú povinnosť aplikovať zákon o verejnom obstarávaní na celý postup zadávania zákazky a na uzavretie zmluvy s úspešným uchádzačom. Verejné

[1] Ing., Patrik Šťastný, PhD., Stavebná fakulta STU v Bratislave
[2] JUDr., Simona Feninová, Úrad pre verejné obstarávanie, Bratislava

obstarávanie je vnímané aj ako špecificky upravené zadávanie verejných zákaziek. Čo sa týka povinných osôb, ktorých úlohou je plniť zákonom stanovený postup zadávania zákaziek, patria medzi ne napríklad ministerstvá, vyššie územné celky, obce a mestá, školy, nemocnice, súdy a iné. V tejto súvislosti je potrebné zdôrazniť, že tieto povinné osoby sa nemôžu vyhnúť aplikácii zákona o verejnom obstarávaní, teda nemôžu svojvoľne zadávať zákazky vybraným dodávateľom. Ak nastane situácia, kedy povinné osoby porušia zákonom stanovený postup, musia strpieť následky s tým spojené. Najčastejšie si je pod týmito následkami možno predstaviť uloženie pokuty zo strany Úradu pre verejné obstarávanie.

V aplikačnej praxi však existujú aj prípady, kedy je možné zadávať zákazky priamo, takzvaným priamym rokovacím konaním. V takomto prípade verejný obstarávateľ vyzve na rokovanie jedného, alebo viacerých vybraných záujemcov s ktorými rokuje o podmienkach zákazky, najmä o technických, administratívnych a finančných podmienkach [6].

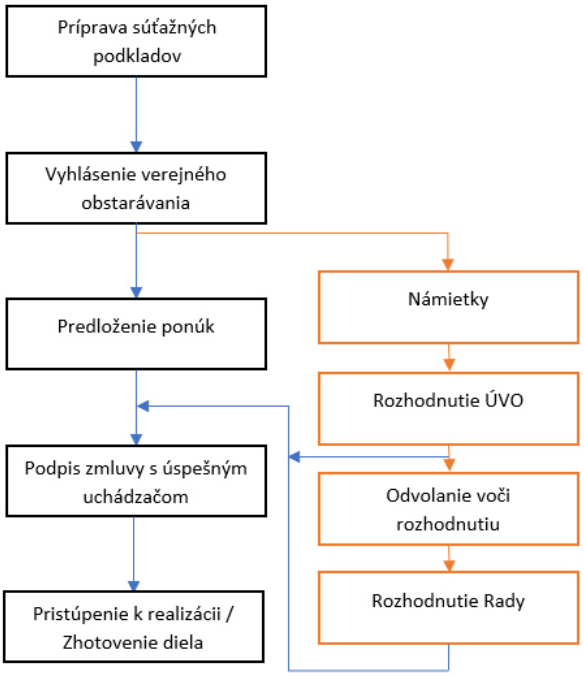
Ako bolo vyššie uvedené, verejné obstarávanie je definované rôznymi autormi v niekoľkých publikáciách. Napríklad podľa Ellmersa [7] je verejné obstarávanie nástrojom verejnej politiky, ktorý odráža financovanie rozvoja a tiež jeho hospodárske a sociálne výsledky. Globálne však možno verejné obstarávanie označiť ako jeden z najväčších zdrojov možnej korupcie vo verejnom sektore. Sociálne a ekonomické dôsledky korupcie vo verejnom obstarávaní sú podľa Schappera, Malta a Gilberta značné hlavne v rozvojových krajinách [8]. Korupcia v oblasti verejného obstarávania spôsobuje značné problémy v oblasti poskytovania verejných služieb ako sú nedostatočná kvalita zdravotnej starostlivosti a školstva. Tieto problémy sú citeľné najmä u sociálne slabších a tiež marginalizovaných skupín obyvateľstva, a teda narúšajú snahy o odstránenie, resp. zmiernenie chudoby ako takej. Transparentnosť procesov verejného obstarávania eliminuje možnosť vzniku korupcie.

Na Slovensku definuje pojem verejné obstarávanie § 2 ods. 1 Zákona č. 343/2015 Z. z. o verejnom obstarávaní a o zmene a doplnení niektorých zákonov ako pravidlá a postupy podľa tohto zákona, ktorými sa zadávajú zákazky, koncesie a súťaže návrhov [6].

Aktuálne problémy verejného obstarávania stavebných prác

Počiatočný problém, ktorý nastal v roku 2020 a v značnej miere ovplyvnil plynulosť výstavby a predĺžil trvanie procesov verejného obstarávania, bola pandémia. K tomuto problému sa pridružili aj rastúce ceny stavebných materiálov a ich nedostatočné množstvo na trhu. Tieto problémy sa však postupne stabilizovali, čo malo za následok zlepšenie situácie na trhu. Následne v dôsledku vojnového konfliktu na Ukrajine prišlo k výpadku dodávok niektorých vybraných druhov materiálov, ako je napríklad oceľ, ale aj mnoho ďalších. To opäť spôsobilo problémy s realizáciou obstarávaných diel.

Zatiaľ čo v minulosti pri príprave súťažných podkladov nebolo komplikované pripraviť rozpočet, ktorý určoval predpokladanú hodnotu zákazky, v súčasnosti je situácia oveľa zložitejšia. Ceny niektorých materiálov sa neustále menia, najmä z dôvodu ich nedostatku. To má za následok, že rozpočet pripravený v štádiu predloženia ponuky sa nemusí zhodovať s finálnou cenou diela po ukončení súťaže. Tento fakt je spôsobený aj skutočnosťou, že celý proces trvá dlhšiu dobu, počas ktorej sa jednotlivé ceny vyvíjajú a menia. Tento proces znázorňuje Obrázok 1. Táto schéma opisuje nielen jednotlivé štádiá procesu verejného obstarávania, ale taktiež uvádza potenciálne komplikácie, ktoré do daného procesu vstupujú počas jeho trvania. Tie majú za následok mnohokrát predĺženie trvania obstarávania. Existuje viacero variantov, ako sa môžu jednotlivé procesy vyvíjať. Tieto možné scenáre vývoja budú opísané nižšie.



Obr. 1: Schéma procesu obstarávania stavebných prác vo verejných obstarávaniach vyhlásených do 31.12.2022 (zdroj: autori)

a) Plynulý vývoj – Pri takomto variante prechádza proces verejného obstarávania 5 hlavnými fázami uvedenými na obrázku 1 (príprava súťažných podkladov, vyhlásenie verejného obstarávania, predloženie ponúk, podpis zmluvy s úspešným uchádzačom, pristúpenie k realizácii). Pri takomto scenári vývoja nevznikajú žiadne komplikácie, ktoré by narušili plynulosť procesu verejného obstarávania a oddialili, resp. skomplikovali podpis zmluvy s úspešným uchádzačom. Dĺžka trvania takéhoto verejného obstarávania nie je ovplyvnená negatívnymi fázami. Existujú však faktory, ktoré zohrávajú dôležitú úlohu pri celkovej dĺžke trvania jednotlivých obstarávaní. Medzi tie sa radí napríklad náročnosť prípravy súťažných podkladov, ktorá vo veľkej miere závisí od náročnosti samotnej zákazky. V tomto bode je potrebné rozlišovať aj to, či súčasťou obstarávania stavebných prác bude aj vypracovanie projektovej dokumentácie a inžinierska činnosť súvisiaca s vydaním stavebného povolenia. V prípadoch, kedy sú predmetom verejného obstarávania jednoduchšie stavebné práce bežného charakteru, ako napríklad zateplenie budovy, výmena okien a podobne, je možné a zväčša aj žiadúce proces verejného obstarávania skončiť v dobe 3 až 4 mesiacov.

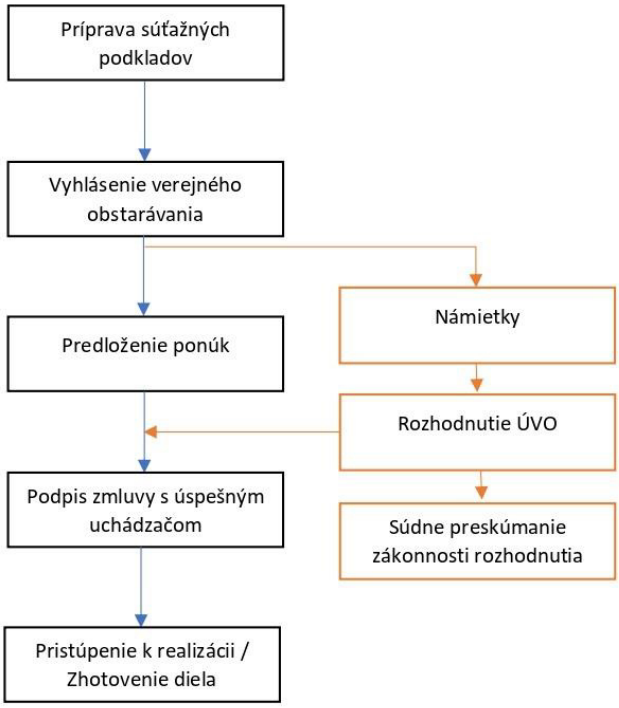
b) Vývoj s námietkami – Pri takomto scenári sú v rámci predmetného verejného obstarávania podané námietky zo strany jedného, alebo viacerých záujemcov, resp. uchádzačov. V takomto vývoji nastáva komplikácia a predĺženie trvania po vyhlásení verejného obstarávania. V tomto bode je možné podať námietky podľa § 170 ods. 3 Zákona č. 343/2015 [6], ako napríklad námietky proti súťažným podkladom, námietky proti vylúčeniu, námietky proti vyhodnoteniu ponúk a podobne. Následne musí úrad v lehote 30 dní odo dňa doručenia kompletnej dokumentácie vydať rozhodnutie v predmetnej veci. V ojedinelých prípadoch dochádza k predĺženiu lehoty na vydanie tohto rozhodnutia (napr. verejný obstarávateľ nedoručí kompletnú dokumentáciu, je potrebné vypracovanie odborného stanoviska, resp. znaleckého posudku pre účely vydania rozhodnutia). Úrad môže vydať rozhodnutie podľa § 174 zákona o verejnom obstarávaní, ktorým zastaví konanie o preskúmanie úkonov kontrolovaného, zamietne námietky v zmysle § 175 ods. 3 zákona o verejnom obstarávaní alebo nariadi odstrániť protiprávny stav, resp. úrad môže nariadiť aj zrušiť použitý postup zadávania zákazky podľa § 175 ods. 1 zákona o verejnom obstarávaní. Po nadobudnutí právoplatnosti predmetného rozhodnutia sa proces vracia do priebehu plynulého vývoja podľa bodu a). Tento proces taktiež reprezentuje obrázok 1.

c) Vývoj s námietkami a odvolaním voči rozhodnutiu – V konaní o preskúmanie úkonov kontrolovaného začatom do 31. decembra 2022 možno podať proti rozhodnutiu podľa § 175 zákona o verejnom obstarávaní odvolanie. Tento proces verejného obstarávania môžeme považovať za najdlhší. Postup je zhodný ako v predchádzajúcej schéme 'Vývoj s námietkami', až do bodu, kedy rozhodnutie úradu nenadobudne právoplatnosť, nakoľko príde k odvolaniu voči predmetnému rozhodnutiu. Možnosť podať námietky má v prípade rozhodnutia podľa § 175 ods. 1 Zákona o verejnom obstarávaní [6] každý uchádzač alebo záujemca. O opodstatnenosti tohto odvolania následne rozhoduje Rada úradu. Rada môže zastaviť konanie, potvrdiť rozhodnutie úradu alebo zmeniť rozhodnutie úradu. Na vydanie rozhodnutia má Rada 45 dní odo dňa podania odvolania. Proti rozhodnutiu Rady o odvolaní nemožno podať opravný prostriedok. Rozhodnutie Rady o odvolaní je preskúmateľné súdom. Žaloba musí byť podaná do 30 dní odo dňa doručenia

rozhodnutia Rady o odvolaní. Po správoplatnení rozhodnutia v predmetnom verejnom obstarávaní sa proces opäť vracia do plynulého priebehu, kde prichádza následne k podpisu zmluvy a zhotoveniu diela.

V tejto súvislosti je potrebné povedať, že námietky môžu byť v predmetnom verejnom obstarávaní podávané viacerými uchádzačmi alebo záujemcami aj opakovane. Opakovane podávané námietky môžu vytvoriť cyklický proces, ktorý môže trvať niekoľko mesiacov a v horších prípadoch až niekoľko rokov. To predlžuje následne celý proces verejného obstarávania. Predlžovanie procesu verejného obstarávania má za následok, že predpokladaná hodnota zákazky neodráža reálne ceny po ukončení spomínaného cyklického procesu spôsobeného opakovanými námietkami. Neustále zvyšovanie cien stavebných materiálov a neaktuálnosť vysúťaženej ceny úspešného uchádzača môže spôsobiť aj situáciu, že úspešný uchádzač odstúpi od zmluvy, nakoľko nevie zrealizovať predmet zákazky za zazmluvnenú cenu.

Dňa 31.03.2022 nadobudol účinnosť zákon č. 395/2021 Z. z., ktorým sa mení a dopĺňa zákon č. 343/2015 Z. z. o verejnom obstarávaní a o zmene a doplnení niektorých zákonov v znení neskorších predpisov a ktorým sa menia a dopĺňajú niektoré zákony. Účelom tejto novely bolo okrem iného zrýchliť a zefektívniť proces verejného obstarávania s ohľadom na jeho dĺžku. Túto zmenu reprezentuje obrázok 2.



Obr. 1: Schéma procesu obstarávania stavebných prác vo verejných obstarávaniach vyhlásených od 1.1.2023 (zdroj: autori)

d) Vývoj s námietkami a súdne preskúmanie zákonnosti rozhodnutí – V konaní o preskúmanie úkonov kontrolovaného začatom od 1. januára 2023 nemožno podať odvolanie proti rozhodnutiu podľa § 175 zákona o verejnom obstarávaní. Postup je zhodný ako v predchádzajúcej schéme 'Vývoj s námietkami'. Zmena ale nastáva v zavedení jednoinštančného administratívneho konania na úrade. Zákonnosť rozhodnutia úradu je možné preskúmať súdom. Účelom tejto zmeny by malo byť skrátenie dĺžky verejných obstarávaní.

Návrh opatrení zabraňujúcich predlžovaniu obstarávania stavebných prác

Ako bolo vyššie spomenuté, rôzne schémy procesov obstarávania majú rôznu dĺžku trvania. Je potrebné zamerať sa najmä na zefektívnenie a urýchlenie celého procesu, nakoľko predlžovanie má v mnohých prípadoch vplyv aj na výslednú sumu zhotoveného diela a jeho úspešnú realizáciu.

Existuje viacero možností, ako by sa dal celý proces urýchliť, čo by výrazne napomohlo k finálnemu priblíženiu výslednej sumy k predpokladanej hodnote zákazky.

Ako prvé prichádza do úvahy možnosť zastaviť zjavne nedôvodné námietky. Inštitút zjavne nedôvodných námietok bol súčasťou vyššie spomínanej novely zákona o verejnom obstarávaní. Úrad má teda možnosť zastaviť konanie, ak je

mimo rozumnú pochybnosť zrejmé, že námietky sú zjavne nedôvodné. Ten, kto podá zjavne nedôvodnú námietku, zodpovedá v zmysle § 174 ods. 3 zákona o verejnom obstarávaní za škodu, ktorá tým inému vznikne. Vyššie uvedené ustanovenie zákona o verejnom obstarávaní by vo veľkej miere mohlo odradiť od podávania tendenčných námietok, ktoré sú podávané najmä za účelom predĺženia alebo skomplikovania procesu verejného obstarávania. Je však treba poznamenať, že veľmi dôležité akým spôsobom bude k tomuto inštitútu pristupované v aplikačnej praxi.

Druhou možnosťou je profesionalizácia zamestnancov, ktorí sú zodpovední za proces verejného obstarávania, nakoľko v mnohých prípadoch prichádza k nedbanlivosti zo strany týchto zamestnancov. Tá je spôsobená v mnohých prípadoch nedostatočnou úrovňou kvalifikácie, resp. skúseností najmä pri komplikovanejších zákazkách, ktoré si vyžadujú náročnejšiu prípravu a väčšiu mieru skúseností, ale aj určité poznatky o predmete verejného obstarávania. Mieru profesionalizácie by dokázali zvýšiť odborné školenia, diskusie a workshopy.

V súčasnosti sa do popredia dostáva profesionalizácia verejného obstarávania a spolu s ňou inštitút odborného garanta pre verejné obstarávanie. Odborný garant je fyzickou osobou alebo právnickou osobou, ktorá splnila zákonom stanovené predpoklady spočívajúce v preukázaní odbornej praxi a vo vykonaní skúšok. Následne úrad takúto osobu zapíše do Zoznamu odborných garantov. Nakoľko dnes je poskytovanie služieb v oblasti verejného obstarávania voľnou živnosťou a vykonávať ju môže takmer ktokoľvek, profesionalizáciu verejného obstarávania ako takú možno považovať za krok správnym smerom. Inštitút odborného garanta a vlastne profesionalizácia verejného obstarávania ako taká by mala zvýšiť mieru transparentnosti a skvalitniť celý proces obstarávania.

Diskusia

Vyššie uvedené možnosti slúžiace k zefektívneniu procesu verejného obstarávania sú návrhmi autorov. Je však otázne, či po zapracovaní preukážu takéto návrhy dostatočnú mieru efektivity a samotného urýchlenia procesu verejného obstarávania stavebných prác.

Bude potrebné dlhodobé sledovanie jednotlivých procesov a taktiež návrhy aj iných možností pre zefektívnenie. To bude mať za následok pozitívny dopad na celý proces z hľadiska dĺžky a taktiež kvality.

Záver

Cieľom verejného obstarávania je hospodárne nakladanie s verejnými zdrojmi. V mnohých prípadoch nastávajú v procese určité problémy, ktoré boli uvedené v tejto publikácii. Tieto problémy majú mnohokrát za následok predĺženie trvania verejného obstarávania a s tým súvisiace navýšenie finálnej ceny za dielo. Je jasné, že nebude možné zefektívniť všetky procesy verejného obstarávania, nakoľko každá súťaž je špecifická a líši sa úrovňou náročnosti ale aj okolnosťami, ktoré sprevádzajú jej vyhlásenie. Bude potrebné navrhnúť viacero opatrení, ktoré napomôžu k čo najvyššej možnej hospodárnosti. Tento článok ponúka niekoľko možností, ktoré by mali napomôcť k želanému efektu.

Literatúra a súvisiace odkazy

[1] F. Ochrana and P. Stehlik, “Overpricing of Public Procurement for Construction Works in the Czech Republic,”Ekonomický Časopis, vol. 63(3), pp. 227-238, 2015.

[2] R. Caranta, P. C. Gomes, “Public procurement and innovation,” ERA Forum, 2021. https://doi.org/10.1007/s12027-021-00674-6

[3] D. R. Rai, “Progress Payments in Public Procurement of Construction Works in Nepal,” IJRAR, vol. 7(1), pp. 122-126, 2020.

[4] A. O. F. Dita et al., “Risks of Public Procurement for Construction Works,” 2020 IOP Conf. Ser.: Mater. Sci. Eng., vol. 930, pp. 012002, 2020. https://doi.org/10.1088/1757-899X/930/1/012002

[5] D.S. JONES, “Public Procurement in Southeast Asia: Challenge and Reform,” Journal of Public Procurement, vol. 7(1), pp. 3-33, 2007.

[6] Zákon č. 343/2015 Z. z. o verejnom obstarávaní a o zmene a doplnení niektorých zákonov. Dostupné: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2015/343/ (28.10.2022)

[7] B. ELLMERS, “Helping or hindering? Procurement, tied aid and the use of country systems in Bangladesh,” Brussels, European Network on debt & development, pp. 39, 2011.

[8] P. R. Schapper, J. N. Veiga Malta and D. L. Gilbert, "An analytical framework for the management and reform of public procurement," Journal of Public Procurement, vol. 6, pp. 1-26, 2006. https://doi.org/10.1108/JOPP-06-01-02-2006-B001

Vliv typu zelené střechy na provozní náklady v době energetické krize

The effect of green roof type on operating costs during the energy crisis

Martin Mohapl[1]; Jan Jílek[2]; Ondřej Porwisz[3]

Zaradenie článku: Odborný

Abstrakt

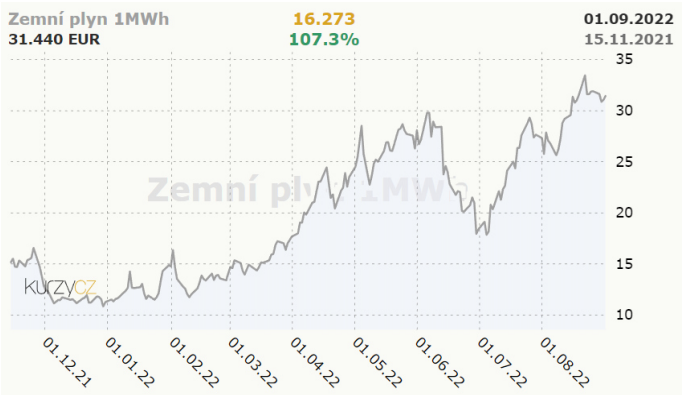
Článek pojednává o vlivu zelené střechy na náklady spojené s provozem dané budovy v období energetické krize. Nejprve jsou stanoveny náklady na energie dle situace před energetickou krizí, kde porovnáváme více typů zelených střech a jejich vlivy na energetickou náročnost. V dalších kroku započítáváme nárůst cen za stavební práce v období nové cenové úrovně. Proti této částce je v dalším kroku stanoven náklad na energie, který byl vypočten pomocí národního kalkulačního nástroje a ten je přepočten dle ceny za energie v období energetické krize. Na konci je stanovena prostá doba návratnosti investice.

Abstract

The article discusses the effect of a green roof on the costs associated with the operation of a given building during the energy crisis. First, energy costs are determined according to the situation before the energy crisis, where we compare several types of green roofs and their effects on energy efficiency. In the next step, we take into account the increase in prices for construction work in the period of the new price level. Against this amount, in the next step, the cost of energy is determined, which was calculated using a national calculation tool, and it is recalculated according to the energy price during the energy crisis. At the end, a simple payback period is established.

Klíčová slova: Zelená střecha, Energie, Energetická krize, Provozní náklady, Růst cen

Keywords: Green roof, Energy, Energy crisis, Operating costs, Rising prices



Obr. 1: Graf růstu ceny energie v roce 2022. [1]

Situace před energetickou krizí

Situace ve stavebnictví před energetickou krizí byla neméně jednoduchá jako situace během krize, jelikož se ceny stavebních materiálů vyšplhaly k historickým rekordům. Izolační materiály jako byl expandovaný polystyren šly skokově nahoru o několik desítek procent, avšak ceny energií nezaznamenávaly vysoké výkyvy do doby válečného konfliktu na Ukrajině.

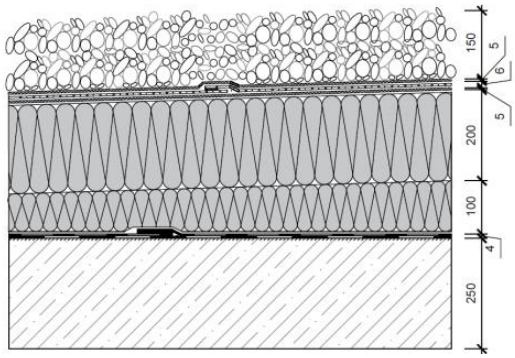
[1] Ing. Martin Mohapl, Ph.D., VUT v Brně, Fakulta stavební
[2] Ing. et Ing. Jan Jílek, VUT v Brně, Fakulta stavební
[3] Ing. Ondřej Porwisz, VUT v Brně, Fakulta stavební

Na porovnání cen provozních energii byl vybrán referenční objekt bytového domu, který byl zpracován do fáze projektové dokumentace pro stavební povolení. Součástí dokumentace byl energetický štítech budovy. Důležitými údaji pro vypracování byly zejména výpočty prostupů tepla konstrukce, které byly následně vkládány do nástroje pro stanovení množství energie potřebné pro provoz budovy. Samotné výpočty nejsou přílohou ani součástí této studie. Bytový dům byl vytápěn pomocí kondenzačního plynového kotle, bereme tedy údaje, které se vztahují k ceně za jednotky zemního plynu.

Na původním objektu byla navržena plochá střecha s PVC folií, která v alternativních případech byla nahrazena různými typy střech s rozdílnou horní vrstvou. První byla střecha s praným říčním kamenivem. Druhý typy byl extenzivní zelená střecha a posledním typem byla intenzivní zelená střecha s vysokou tloušťkou substrátu.

Typy zelených střech

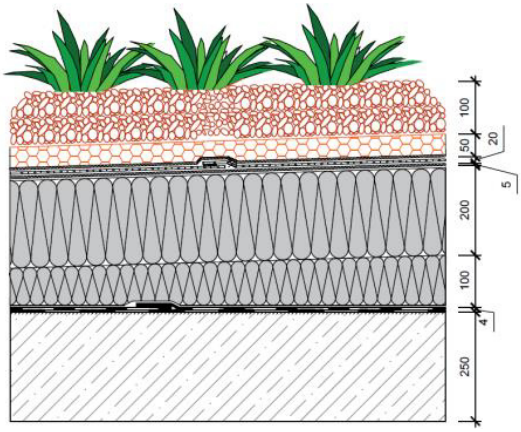
- Střecha s kamenivem



Obr. 2: Schéma střešní krytiny s kamenivem. [2]

Jedná se o konstrukci nenáročnou na realizaci a s nízkými pořizovacími náklady. Tepelně izolační vlastnosti jsou na dobré úrovni. Bezúdržbová střecha s občasnou kontrolou a revizí střešních vpustí.

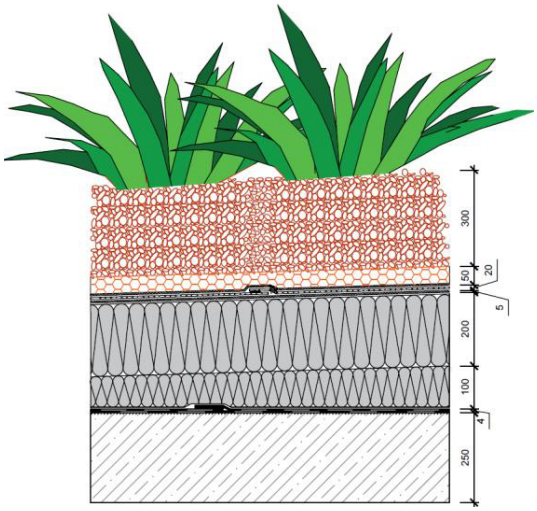
- Extenzivní zelená střecha



Obr. 3: Schéma extenzivní zelené střechy. [2]

Střešní skladba s náročnějšími požadavky na realizaci a s vyššími pořizovacími náklady než u varianty předchozí. Energetická hodnoty na výborné úrovni. Revizní náklady a údržba častější, nikoli však nákladná, protože se jedná o bezúdržbový typ zelené střechy. Údržba se týká zejména kontroly vpustí a občasného vyplevelení.

- Intenzivní zelená střecha



Obr. 4: Schéma intenzivní zelené střechy. [2]

Tento typ střechy je velmi nákladný, jedná se o střechu, které vyžaduje pravidelnou údržbu. Energetické hodnoty jsou na výborné úrovni vzhledem k tloušťce substrátu. Nosné konstrukce u těchto typů zelených střech je před provedením nutno staticky posoudit, aby nedošlo ke zborcení.

Náklady na realizaci plochých střech

Náklady na realizaci jednotlivých typů střech byly stanoveny dle rozpočtového softwaru BuildPowerS v období prvního pololetí roku 2022. Střecha má daný tvar a danou plochu stejnou pro všechny modely, aby došlo k správnému porovnání.

Tab. 1: Cena realizace plochých střech v období 22/I. [2]

Typ střechy	Cena realizace [EUR]
PS1	29 855
PS2	32 329
PS3	35 820

Spotřeba energie budovy s daným typem ploché střechy

Výpočet potřeby energie byl stanoven dle NKN (národního kalkulačního nástroje). Do výpočtu byly vloženy veškeré vstupní hodnoty potřebné pro určení správné hodnoty energie – plocha konstrukcí, součinitele prostupu tepla konstrukcí, tepelné zdroje, geometrické vlastnosti budovy aj.

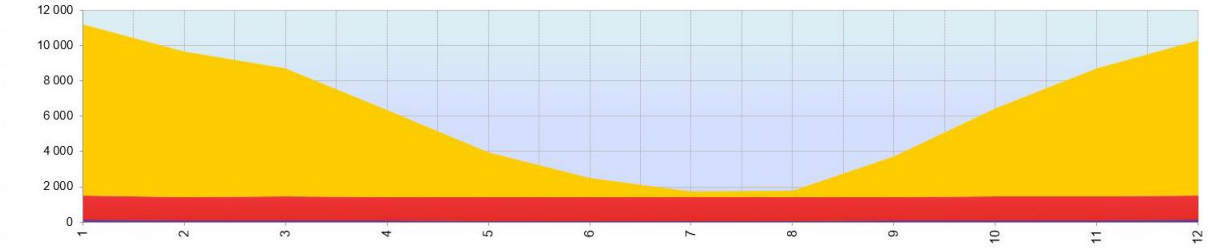
Tab. 2: Spotřeba energie budovy s danou střechou v období 22/I. [2]

Typ střechy	Množství energie [kWh/rok]
PS1	74 742
PS2	74 131
PS3	73 988

Výstupem z národního kalkulačního nástroje byl graf, který vyznačoval spotřebu energie v průběhu celého roku. Nebylo zde započítáno osvětlení, protože typ zelené střechy neovlivní náklad na osvětlení. Z grafu lze také vyčíst, že náklady na provoz jsou nejvyšší v zimním období.

Dílčí dodaná energie	leden	únor	březen	duben	květen	červen	červenec	srpen	září	říjen	listopad	prosinec	Celkem
Vytápění	9 720	8 262	7 273	4 933	2 523	1 116	311	346	2 330	4 980	7 261	8 824	**57 877**
Chlazení	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Větrání	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Příprava teplé vody	1 354	1 294	1 354	1 334	1 354	1 334	1 354	1 354	1 334	1 354	1 334	1 354	**16 110**
Osvětlení	134	110	92	75	62	57	57	62	77	91	110	133	**1 060**
Celkem	**11 208**	**9 667**	**8 719**	**6 342**	**3 939**	**2 507**	**1 723**	**1 762**	**3 741**	**6 425**	**8 704**	**10 311**	**75 048**
Započitatelná produkce energie:													
PV systém - export	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Termické solární kolektory	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Graf: Dílčí dodané energie podle požadavků vyhlášky 78/2013 Sb.



Obr. 5: Potřeba energie na provoz budovy. [3]

Náklady na provoz před krizí

Z grafu č. 1 lze vyčíst, že v období 6.1.2022, kdy byla zpracována studie na spotřebu energie byla cena za 1 MWh 11,63 EUR. Když tedy vynásobíme cenu za jednotku energie počtem kWh z výpočtu a přepočteme, dostaneme následující čísla.

Tab. 3: Náklady na provoz budovy za rok v období 22/I. [autor]

Typ střechy	Cena [EUR]
PS1	869,25
PS2	862,14
PS3	860,48

Náklady na provoz jsou nejmenší u varianty č. 3 s intenzivní střechou, což je vzhledem k nejmenší energetické náročnosti střechy odpovídající.

Situace během energetické krize

Situace se ovšem po započetí válečných aktivit prudce změnila. Ceny energií šly nahoru o desítky procent. A v období července a srpna ceny dosáhly meziročních vrcholů.

Náklady na realizaci plochých střech

Náklady na materiál a práci během roku rostly jen o zhruba 6 % a cena se tedy pohybovala v těchto hodnotách.

Tab. 4: Cena realizace plochých střech v období 22/2. [2]

Typ střechy	Cena realizace [EUR]
PS1	31 646
PS2	34 268
PS3	37 969

Potřeba energie se v závislosti na stejných materiálových a geometrických vlastnostech nezměnila a vycházíme tedy z tabulky č.2.

Náklady na provoz během krize

Ceny energií však šly strmě vzhůru a v období července a prosince se cena 1 MWh zemního plynu vyšplhala až na 33,467 EUR. Na základě tohoto růstu by pak ceny za provoz bytového domu byly následující.

Tab. 5: Náklady na provoz budovy v období 22/II. [autor]

Typ střechy	Cena [EUR]
PS1	2 501,4
PS2	2 480,9
PS3	2 476,2

Cena energií se nám zvedla během krize o **300%**.

Závěr

V původní studii, která byla zpracována na dobu návratnosti investice, která se vkládala do rekonstrukce vrchního pláště zelené střechy bylo vypočítáno, že investice by se vrátila v případě střechy s kamenivem za **17 let**, v případě extenzivní zelené střechy za **18 let**, resp. **20 let** v případě intenzivní zelené střechy.

Tyto hodnoty ale počítaly se standartním růstem ceny energie. V případě takto rapidního navýšení ceny by se investice do vhodnějšího zateplení a provedení ploché střechy vrátila mnohem dříve.

Za předpokladu, že by cena zůstala dlouhodobě na tak vysoké cenové úrovni je návratnost investice v případě střechy s kamenivem **6 let**, v případě extenzivní zelené střechy je návrat investice za **7 let** a v případě poslední intenzivní zelené střechy je to **8 let**. Ve výpočtech bylo počítáno s reálnou dobou návratnosti.

Trend rychlých růstů cen ovšem nepokračuje a v období konce roku 2022 se cena pomalu vrací do nižších hodnot, nelze tedy s přesností říci, jakým směrem se energie budou obracet a v závislosti zmíněných faktů odhadovat návratnost těchto investic.

Poděkování

Článek vznikl v rámci řešení juniorského specifického výzkumu č FAST-J-21-7378 „Analýza stavebně-technologických procesů při realizaci, provozování a údržbě environmentálně šetrného zastřešení budov“.

Literatura a související odkazy

[1] https://www.kurzy.cz/komodity/zemni-plyn-graf-vyvoje-ceny/.
[2] JÍLEK JAN. Thermal insultation effect of a building with green roof on the operation related expenses. Brno, 2021, Master’s thesis, Brno University of technology, Institute of forensic engineering.
[3] NATIONAL CALCULATION INSTRUMENT - NKN II [online]. Prague: Department of Building Services Engineering, Faculty of Civil Engineering, CTU, 2014 [cited. 2022-06-01]. Available from: http://nkn.fsv.cvut.cz
[4] ČSN 73 0540-4. Thermal protection of buildings - Part 4: Calculation methods Prague: Office for Technical Standardization, Metrology and State Testing, 2005.
[5] ŠIMEČKOVÁ J., Svaz zakládání a údržby zeleně z.s. 9/2016, Zelené střechy - Naděje pro budoucnost II., Brno 2016, p. 4-8.

Účinnosť technológie prevetrávaných podláh

The effectiveness of ventilated floor technology

Simona Michalisková[1]; Rastislav Ingeli[2]

Zaradenie článku: Odborný

Abstrakt

Všetky stavby a stavebné konštrukcie postupom času degradujú vekom, ale aj vplyvom nedostatočnej alebo žiadnej údržby, čo má za následok ich úplnú alebo čiastočnú stratu životnosti. Tento nežiadúci efekt zapríčinené vlhkosťou, nenastávajú len pri historických stavbách a objektoch s chýbajúcou funkčnou hydroizoláciou, ale objavujú sa aj v novostavbách. Vlhkosť má potom za následok nielen degradáciu obvodovej konštrukcie, ale aj zvyšovanie tepelných strát. Technológia odvetrávaných podláh, najmä jej účinnosť, je podceňovaná a zvyčajne sa používa len ako doplnková v kombinácii s inou technológiou. Príspevok sa zaoberá mierou účinnosti sanačnej technológie bojujúcej so vzlínajúcou vlhkosťou a následnou deštrukciou jednotlivých konštrukčných prvkov.

Abstract

All buildings and construction structures degrade over time due to age, but also due to insufficient or no maintenance, which results in their loss of service life. Inconveniences caused by moisture do not only occur in historic buildings and objects with a lack of functional waterproofing, but increasingly also in new buildings. Moisture then results not only in the degradation of the building envelope, but also in the increase of heat losses. The technology of floor ventilation, in particular its efficiency, is underestimated and usually used as an ancillary in combination with another method. The paper deals with the degree of effectiveness of remediation technology fighting rising moisture and the subsequent destruction of individual structural elements.

Kľúčové slová: Sanácia, Odvetrávací systém, Vzduchová dutina, Vlhkosť, Protivlhkostná analýza

Keywords: Remediation, Ventilation system, Air cavity, Humidity, Anti-humidity analysis

Fig. 1: Surface layer destroyed by moisture

[1] Ing, Simona Michalisková, Department of Building Construction, Faculty of Civil Engineering STU in Bratislava
[2] doc. Ing, Rastislav Ingeli, PhD., Department of Building Construction, Faculty of Civil Engineering STU in Bratislava

The principle of operation and an overview of current knowledge about the investigated method

The method of ventilated floors has been used since ancient times, is easy to implement, and also does not significantly disturb the structure of the building. It has become a favorite of the Regional Monuments Office as the walls which are decorated with rare paintings and the like are not disturbed. It is also suitable from the point of view of statics, since there is no radical intervention in the structure, and possible vibrations during its implementation.

The air flow depends on the correct placement of the ventilated layer between the surface of the ground and the inner part of the floor. The ideal condition is if the air flows is at a low speed so that there are minimal losses of escaping heat from the exhaust holes. A very slow airflow is sufficient to remove moisture from the structure. The air cavity will allow moisture to be removed even before it starts to condense [1].

The propulsion force ensuring the movement of moisture from the structure is the movement of air caused by the temperature gradient, i.e. the temperature difference between the air particles of the ventilated layer and the surrounding atmosphere. Air particles are affected by Archimedean buoyancy forces, which become less dense as the temperature rises, whereupon they begin to move upward of their own. The surfaces in the ventilated layer have a different temperature than the air in this layer. Heating from the floor (especially in winter and at night) reduces the density of the air in the gap, which then becomes thinner and rises to the higher outlet hole. During this process, the rising air is replaced by an equal amount of cooler air that is drawn in through the lower inlet [2] [3]. If we follow the design correctly and place the outlet hole at a sufficient height above the inlet hole, the flow will be ensured due to the positive excess of heat compared to the surrounding air.

With certain types of buildings (historical buildings, monuments) it is not always possible to ensure sufficient elevation of the openings and it is necessary to ensure additional measures or mechanisms supporting air flow [4]. A suitable solution can be, for example, the placement of openings according to the prevailing wind. The supply holes are placed on the windward side. When we designate one side as the supply side and one side as the exhaust side, the resulting pressure difference in the gap caused by the wind will be the pressure difference between the supply side and the exhaust side. This pressure thus induces flow in the gap. On the contrary, resistance forces act against the air flow. These pressure losses can be caused by friction on the surface of the ventilated layer or local resistances. These are various obstacles such as grids at the inlet and outlet holes.

The last option to reliably achieve air flow is forced ventilation. Forced ventilation is ensured by means of a fan, which is used in cases where air flow would not work naturally. However, the entire system is then dependent on the supply of electricity. In the case when maximum efficiency is required (drying of the substructure after a flood), an air heater can be used, but the cost of implementation is of course higher [5].

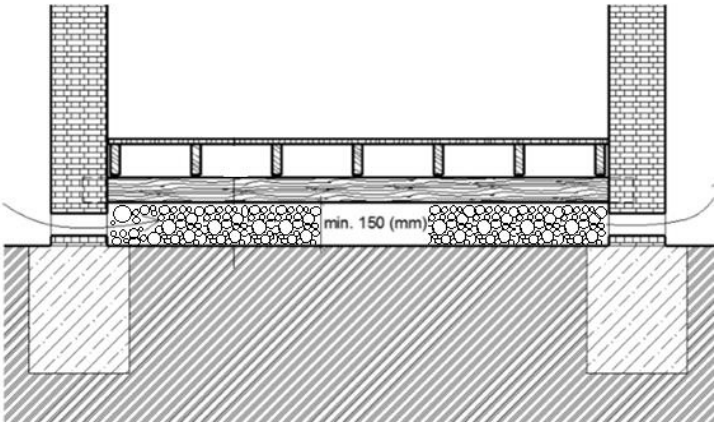


Fig. 1: Illustration of air flow in a ventilated layer.

The ventilated layer will be filled with foamglass granulate. This is a progressive way of using the ventilated layer, in which we can achieve better thermal insulation properties of the floor. The technology also helps to eliminate thermal bridges, heat losses through the floor and reduce building operating costs.

As it is currently very important to work with recyclable materials that have suitable thermal insulation properties, foamglass was chosen as the filling material, which is a 100 % recycled product from old glass. The material itself is

also completely recyclable. The value of thermal conductivity λ varies around 0,040-0,080 $W/m.K$, depending on the compaction of the material. The density of the loosely packed folded granulate is 150-170 kg/m^3, it is also resistant to freezing and subsequent thawing and belongs to the fire resistance class A1. Practical measurements show that even the chemical composition and properties of the material do not change over time. The structure of the closed pores prevents the penetration of water into the material [6].

Results of previous research

The research methodology consisted of the analysis of the measured values, which are realized in situ at the building in the south of Slovakia. It should be added that the measurements are still ongoing and the contribution will be based on the results measured so far, and it is assumed that the final output may change partially, but no significant change is expected.

The measurement was realize at the apartment building on the street Okániková 2 in Bratislava. The building is based on a slope on concrete foundations. The building was built in 1935 and has 4 above ground floors and 1 underground floor. The perimeter masonry is made of solid fired brick with thickness of 450 mm. The basement masonry has the original horizontal waterproofing made of asphalt screed with thickness of approx 10 mm.

The first inspection of the building was realized on October 29, 2021. During the inspection, several assessment measurements were taken at randomly selected places of the basement masonry, which showed the surface moisture of the structure in the range of 8,0 % to 12,0 %, which is very high moisture. The Czech standard ČSN P 73 0610 [7] was chosen as the evaluation standard. In this period, the implementation of remedial works was also completed, during which new remedial plasters were made. In order to ventilate the floors, drainage hoses with a diameter of 100 mm were placed in the inner part of the perimeter masonry, while one end of the hose will be connected to the inlet hole located in the groove of the masonry through PVC fittings. The inlet hole (150 x 150 mm) is located 200 mm above the floor and covered with an insect screen. The other end of the outlet hole is connected to the chimney vent and serves to remove the sucked air from the space under the floor. Two such separate ventilation circuits are implemented in the building.

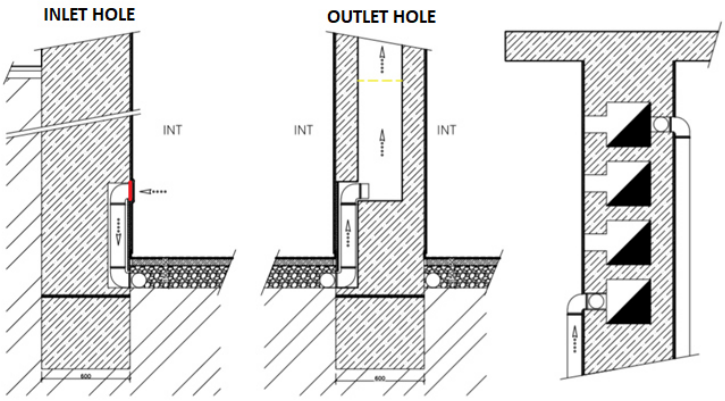


Fig. 2: Drainage pipe connection details where the red and yellow lines show the measurement level.

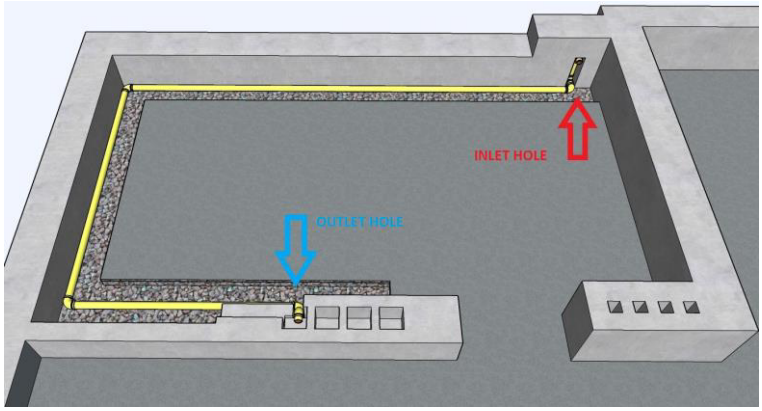


Fig. 3: Renovated space with markings of inlet and outlet hole

The first measurements was realize on the dates from 28 October 2022 to 02 November 2022. Temperature and humidity meters (TESTO 174-H) were installed in the outlet hole at a height of 1.2 m (Figure 2) and the inlet hole. The measured values during the measurement are listed in Table 1. The frequency of temperature and humidity recording was set to an hourly interval.

The measurement records in Figure 4 and 5 show the air temperatures and the relative humidity course, which implies that moisture is still present in the pipe.

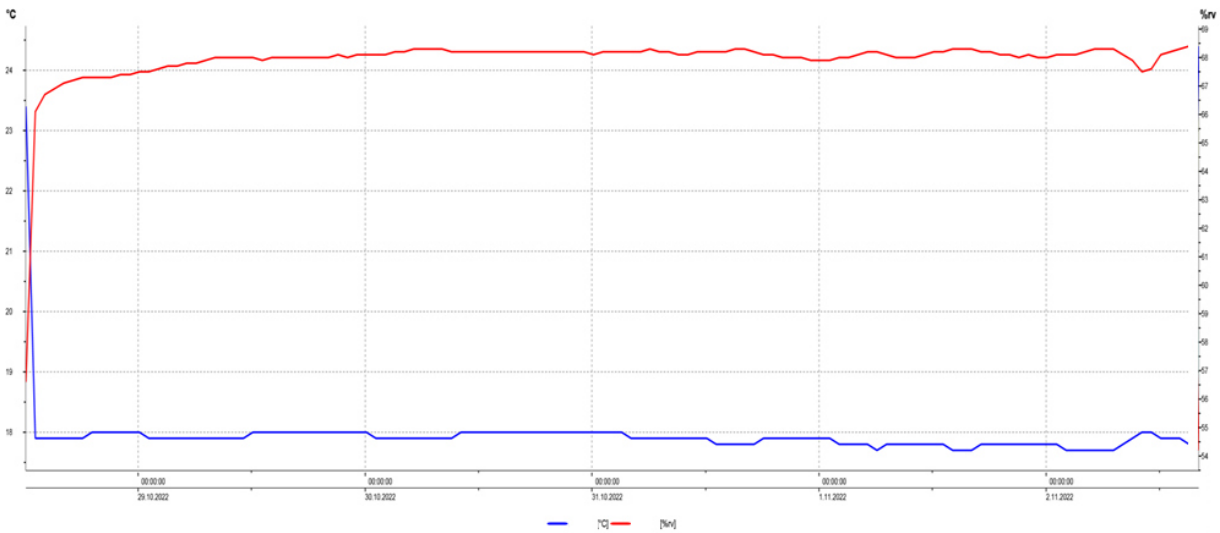


Fig. 4: Course of relative humidity and air temperature in the period from 28.10.2022 to 02.11.2022 at the inlet hole.

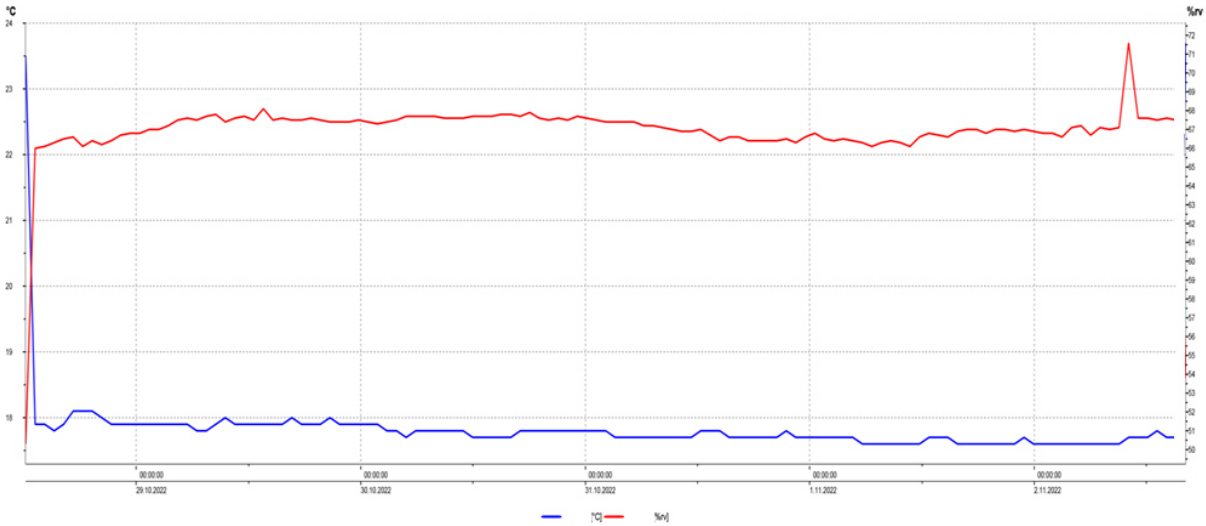


Fig. 5: Course of relative humidity and air temperature in the period from 28.10.2022 to 02.11.2022 at the outlet hole.

Tab. 1: Records of selected measurements of the relaive humidty and the air temperature.

Date	Inlet hole		Outlet hole	
	°C	% rh	°C	% rh
28.10.´22	17,9	66,1	17,9	66,0
29.10.´22	18,0	67,9	17,9	68,1
30.10.´22	18,0	68,2	17,7	67,7
31.10.´22	17,8	68,2	17,8	66,7
01.11.´22	17,8	68,2	17,7	66,8
02.11.´22	17,9	68,2	17,8	67,5

Conclusion

As it is a fresh reconstruction, the internal relative humidity shows higher values caused by technological drying of wet processes. From the analysis of the results so far, it can be concluded that the measured values shown in the graph and the table do not prove the effectiveness of the investigated technology of the ventilated floor, but it is necessary to carry out long-term research that will confirm or refute the effectiveness of the system used to dehumidify the object. For this reason, regular surveys of the measurement of humidity on the surface of the structure are planned, as well as the installation of a probe for monitoring the humidity in the structure. Measurements will also take place in other buildings where the technology of ventilated floors was also applied. It will help to clarify the conclusion, whether it can be considered functional, effective and we can ensure the extension of the life of construction objects.

References

[1] Bomberg, M.; Trechsel R. Moisture Control in Buildings: The Key Factor in Mold Prevention. 2nd Edition. Baltimore,U.S.A.: ASTM International, 2009. 2nd. ISBN 978-0-8031-7004-9.

[2] Moisture Analysis and Condensation Control: in Building Envelopes. 1. vyd.Philadelphia, PA: ASTM in the U.S.A., 2001, s. 221. 1. ISBN 0-80312089-3.

[3] Staněk, K. Stavební fyzika 2: Větraná dutina. In: Fakulta stavební, ČVUT v Praze: Katedra konstrukcí pozemních staveb [online]. 02/2012. Praha: ČVUT v Praze, 2012 [cit. 2014-06-17]. Dostupné z: http://kps.fsv.cvut.cz/.

[4] ČSN EN 1991-1-4(73 0035), Eurokód 1: Zatížení konstrukcí – Část 1-4: Obecná zatížení – Zatížení větrem.

[5] Balík, M. et al. Odvlhčování staveb. Vyd. 1. Praha: Grada Publishing, a.s.

[6] http://www.azflex.sk/category/penove-sklo/strkove-penove-sklo.

[7] ČSN P 73 0610: Hydroizolace staveb, Sanace vlhkého zdiva, Základní ustanovení.

Porovnanie povrchových teplôt medzi jednoplášťovou a vegetačnou strechou

Comparison of surface temperatures between a single plate and a vegetation roof

Martin Zagyi[1] Rastislav Ingeli[2]

Zaradenie článku: Odborný

Abstrakt

Povrchy strešných konštrukcií sú ovplyvnené vonkajšími a vnútornými vplyvmi prostredia . V tomto článku sú porovnávané teploty vnútorných a vonkajších plôch na testovacej komore s vegetačnou a klasickou strechou pomocou simulačného programu DesignBuilder. V závere článku sú zhodnotené rozdiely povrchových teplôt medzi jednotlivými strešnými konštrukciami.

Abstract

The surfaces of roof structures are affected by external and internal influences of the environment. In this article, the temperatures of the internal and external surfaces on a test cell with a vegetated and classic roof are compared using simulation program - DesignBuilder. At the end of the article are evaluated the differences in surface temperatures between individual roof structures.

Kľúčové slová: Vegetačná strecha, povrchová teplota, experimentálna bunka, simulácia

Keywords: Vegetation roof, surface temperature, experimental cell, simulation

1. Introduction

Vegetation roofs help to improve the internal environment of buildings and also positively affect their surroundings, aesthetically and environmentally [1]. The application of a vegetated roof has a beneficial effect on the need for energy for cooling, a decrease in the surface temperature of the roof structures, an increase in the insulating effect of the roof structure in winter by 3 to 10% (depending on the location, the thickness of the vegetation layer, the layer of the substrate, the penetration of moisture) and an additional thermal resistance R from 0.14 – 0.40 m 2 K/W (depending on the height of the substrate) [2 - 5]. The article contains a comparison of a vegetated roof with a classic single-skin roof using the simulation of an experimental cell in the simulation program DesignBuilder [6].

2. Simulation of an experimental cell

The experimental cell was designed in cooperation with the Isover company , on which vegetation and a classic single-layer roof are simulated. The layout of the cell is divided into a zone with a vegetated roof and a single-classis roof. The experimental cell also includes a measuring room (this room is not the subject of the simulation and forms only a boundary condition).

2.1 Construction of the experimental cell

The supporting structure of the experimental cell consists of wooden elements that are placed on reinforced concrete footings. The perimeter walls of the cell are made of 120 mm thick PUR panels. Windows with an aluminum frame and double glazing are installed in PUR panels . The floor and roof structure is made up of system solutions from the company Isover.

[1] Ing. Martin Zagyi, Slovenská technická univerzita, Stavebná fakulta, Bratislava
[2] Doc. Ing. Rastislav Ingeli, PhD, Slovenská technická univerzita, Stavebná fakulta, Bratislava

2.2 Simulation model and input data

Based on the documents, a simulation 3D model of the experimental cell was created in the DesignBuilder program . The model is designed for simulating surface temperatures in winter stadiums.

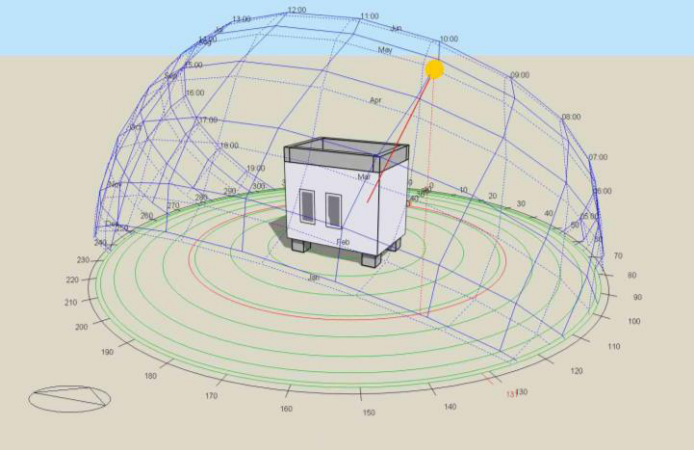


fig. 1: 3D model of the experimental cell in the DesignBuilder program

The 3D model is divided into 3 zones: 1 is the measuring room, CLASSIC is a room with a classic single-layer roof, and VEGETATIVE is a room with a vegetated extensive roof. Internal gains from people, lighting and electrical devices are neglected in the simulations. The maintenance of the internal air temperature is ensured by a technical device and the temperature is set to 0 -5 °C maximum temperature in the DesignBuilder program).

The object model is simulated in the Bratislava location, for which the climate year Bratislava LO (TRY IWEC) is used.

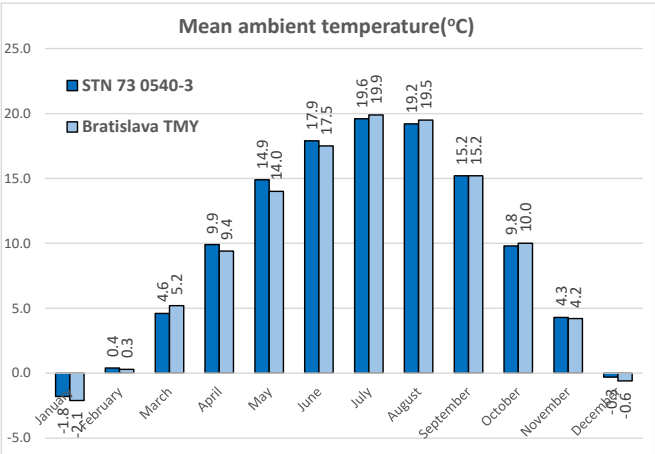


fig. 2: Comparison of the mean ambient temperature with the STN norm

3. Summarizing the results

The result of the simulation is the detection of interior and exterior surface temperatures on the roof structures of the simulated experimental cell. Graphs in picture no. 6 and no. 7 show the simulation throughout the year and in pictures no. 8 and no. 9 shows the week with the highest temperatures during the given climatic year.

Values displayed in graphs in °C :

- Inside Surface Temp – temperature on the internal surface of the structure
- Ext Surface Temp – temperature on the outer surface of the structure
- Outside Dry-Bulb Temperature - temperature of the outside air
- Surface Outside Face Temperature – the temperature of the outer surface of the structure
- Surface Inside Face Temperature – the temperature of the internal surface of the structure

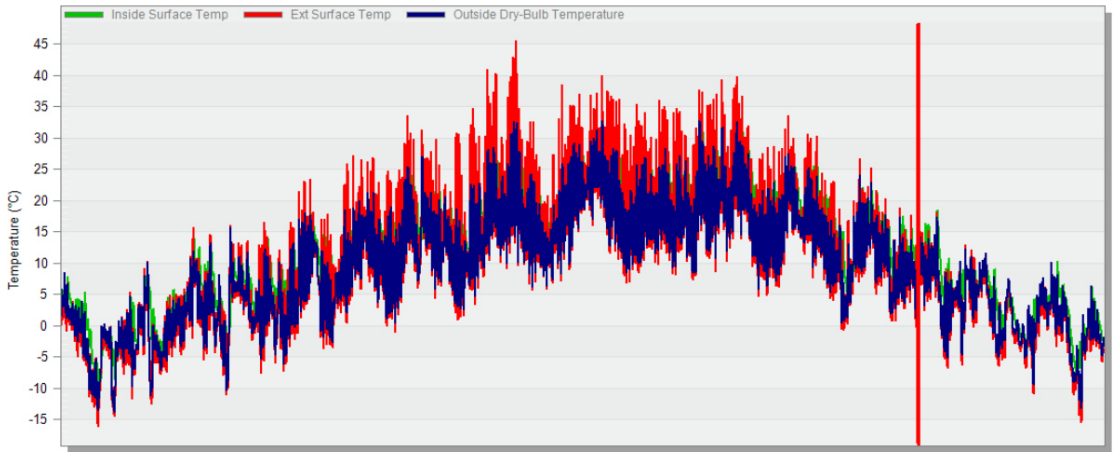


fig. 3: Temperature course during the annual simulation - vegetation roof

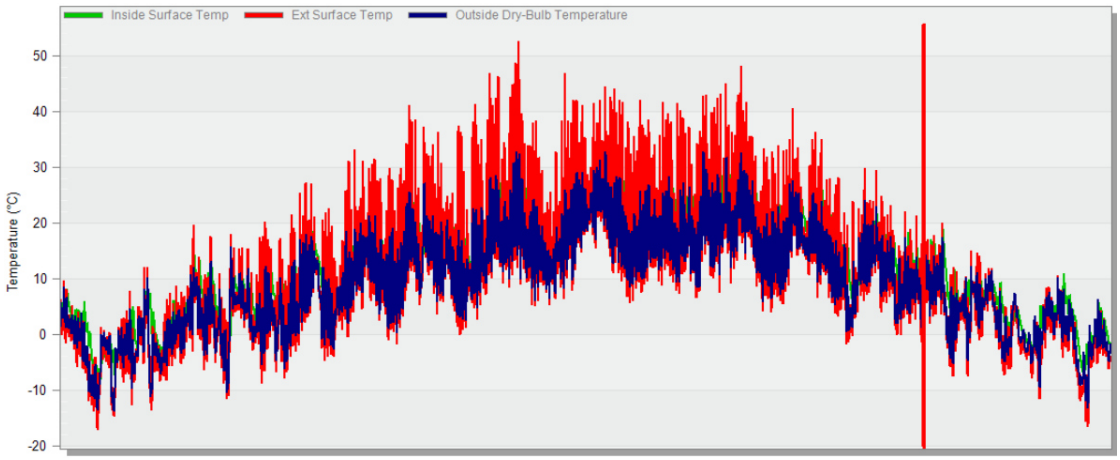


fig. 4: Temperature course during the annual simulation – classic single-skin roof

On the outer surface of the roof construction with a vegetation roof, the temperature is 7 K lower than on a classic single-skin roof. The internal difference of interior surface temperatures is 0.5 K. The difference of surface interior temperatures is minimal considering the size of the experimental cell.

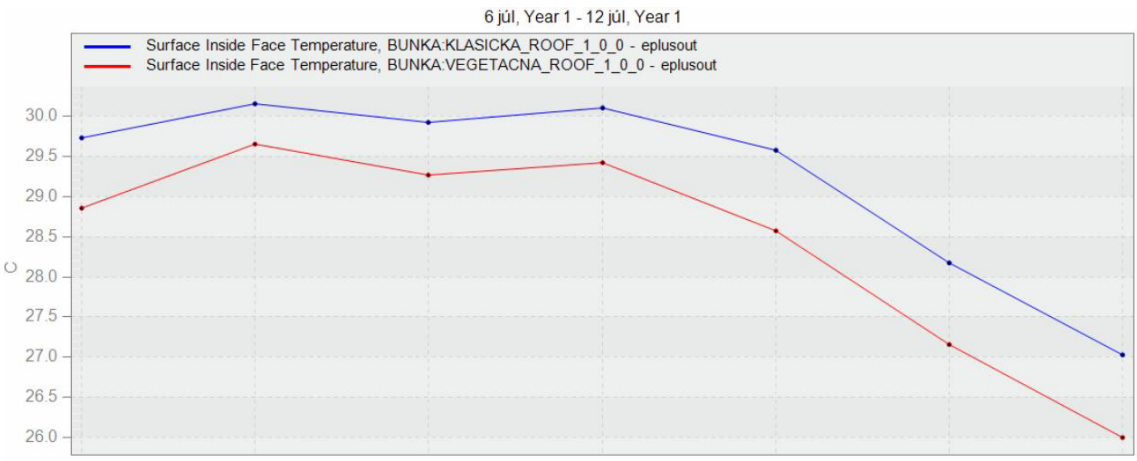


fig. 5: Course of internal surface temperatures during the extreme week (July 6 - July 12) - comparison of a vegetated roof with a classic single-layer roof

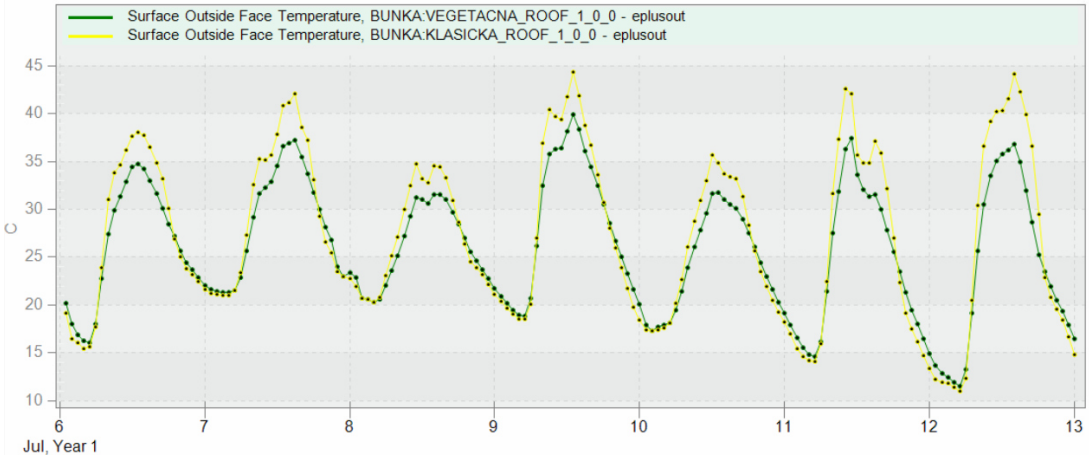


fig. 6: Course of external surface temperatures during the extreme week (July 6 - July 12) - comparison of a vegetated roof with a classic single-layer roof

4. Conclusion

Based on the results of the simulation, we can conclude that there is a temperature change in the examined constructions, and thus on their surfaces. In the graphic displays of the results, you can see slight temperature differences on the surfaces of the vegetated roof and the classic single-layer roof. The article shows a decrease in interior and exterior surface temperatures. The next step of the research is to fine-tune the model of the experimental cell more precisely and compare it with the experimental measurement for more accurate results. At the same time, I will use the data of the measured values at the winter training stadium for modeling and simulating the winter stadium with the application of a vegetation roof.

Acknowledgment

This research was supported by the VEGA research project No. 01/0229/21 - Construction and physical nature of a building with almost zero energy needs in the context of environmental aspects.

Literature

[1] POLIZIN, N.: Dachbegrünungen als Ausgleichsmaßnahme for one Eingring in Natur und Landschaft .2017. Available on: https://repos.hcu-hamburg.de/bitstream/hcu/156/1/Polzin_Nils_Master_20181113.pdf
[2] Internet source: http://www.falcosystem.cz/files/Zelenestrechy.pdf
[3] Internet source: https://mothership.sg/2019/09/timothy-seow-ntu-adm-building/
[4] VAN RENTERGHEM, T./BOTTELDOOREN, D.: Numerical evaluation of sound propagating over green roofs . 2008. Available at: https://users.ugent.be/~tvrenter/publicaties/greenroofs.pdf
[5] ISOVER. Alternative solution of green roofs . (2014). Available at: http://www.isover.cz/alternativni-reseni-zelenych-strech
[6] https://designbuilder.co.uk/

Procesné listy stavebnej konštrukcie ako nástroj pri metodike zefektívnenia údržby

Process Sheets of Building Structures as a Tool in the Methodology of Streamlining Building Maintenance

Martin Hanko [1]; Eva Jankovichová [2]; Silvia Ďubek [3]

Zaradenie článku: Odborný

Abstrakt

Udržateľnosť je v súčasnosti pojem, s ktorým sa budeme stretávať v každej oblasti, aj v stavebníctve. Vo fáze užívania stavebných objektov je možnosť ovplyvniť ich údržbu už minimálna. Cieľom príspevku je upozorniť na kvalitnú údržbu budov a to pomocou jej plánovania už počas návrhu stavebných konštrukcií. Jedným z nástrojov, ktorý nám pri tomto plánovaní pomáha je práve procesný list stavebnej konštrukcie. V príspevku je opísaný návrh metodiky na zefektívnenie údržby stavebných konštrukcií s poukázaním na využitie procesných listov. V príspevku sú vypracované procesné listy pre tri rôzne obvodové konštrukcie.

Abstract

Sustainability is currently a concept that we will encounter in every field. Construction is one of the industries in which we still have huge reserves for improving its impact on the environment. In the phase of use 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. The article describes the proposal of a methodology for streamlining the maintenance of building structures with reference to the use of process sheets. In the article, process sheets for three different perimeter constructions are developed.

Kľúčové slová: Procesný list, Údržba, Metodika

Keywords: Process Sheets, Maintenance, Methodology

Fig. 1: Illustration Image

[1] Ing. Martin Hanko, PhD., Slovak University of Technology, Bratislava
[2] Assoc. Prof. Eva Jankovichová, PhD., Slovak University of Technology, Bratislava
[3] Ing. Silvia Ďubek, PhD., Slovak University of Technology, Bratislava

Introduction

Maintenance planning and evaluation is crucial for the quality maintenance of building structures. 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. 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 efficiency of the investment process is determined by the optimal life cycle costs of the building (LCC), namely investment costs and operating costs.

For maintenance quality control, the maintenance manuals of construction structures define process sheets setting out the units of measure by which key performance KPIs are determined. The content of process sheets for construction structures is processed in tab. 1.

Determination of Process Sheets of Building Structures

Processing of facility management documents:

- maintenance manual of building structures,
- maintenance process sheet,

has a direct impact on the determination of future maintenance costs.

The basis for determining maintenance costs is the maintenance manual for the building structure. Process sheets are one of the basis and part of the manual. It defines individual activities of maintenance of building structures with their periodicity. The proposed procedure for solving the methodology is shown in Fig.2 for better clarity. The diagram shows the course of the 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 LCC, the investor will choose a suitable solution. The methodology was incorporated for three variants of cladding 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.

Tab. 1: Content of Process Sheets [1]

Subject of the Maintenance Process:	Basic Definition of the Subject of Activities.
Maintenance Periodicity:	How often the maintenance process is repeated.
Maintenance Duration:	Process preparation and implementation time.
Responsible Person:	The worker who manages the implementation of the process.
Provider / Performer's Professional Competence Required:	Minimum education, certificates from educational programs, authorizations, certificates, professional examinations, characteristic profile of the provider.
Legislative and Normative Requirements:	National, international, internal regulations.
Technical Equipment:	Instruments, machines, equipment.
Description of Maintenance Activities:	Detailed, precise description of the process, process steps.
KPI:	Units of measure - reaction time, implementation time.

The KPI can continuously check the performance of individual maintenance processes of building structures. The criteria must be specifically defined in order to be monitored and evaluated. These criteria may be:

- completion of the process according to the planned time limit,
- the duration of the process,
- execution of the process,
- the quality of the process carried out,
- implementation of the process according to the technological regulation,
- the duration of arrival and repair in the event of an emergency.

It is also possible to measure the quality of the process also using the satisfaction of the users of the building.

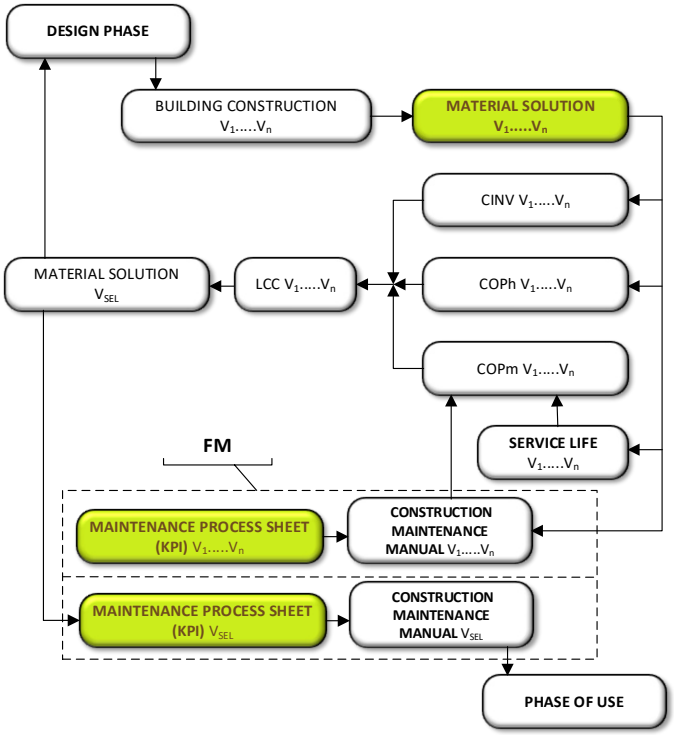


Fig. 2: The Use of Process Sheets in the Methodology for Streamlining Maintenance

For individual variants, the selected part of the manual maintenance of construction structures has been processed in the application part: Rules for the maintenance of structures and the process sheets, that have a direct impact on the determination of future operating costs. The process sheets are processed in Tables 1-3.

Tab. 1: Process Sheet V1

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. [2]	
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	

Tab. 2: Process Sheet V2

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.[3]	
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	

Tab. 3: Process Sheet V3

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.[4]	
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	

Conclusion

Quality-processed maintenance process sheets are the basis for the development of a building construction manual. Facility managers mainly participate in the processing together with the designer. It is essential to use them as a basis for designing buildings, where they determine the main role. According to the developed facility management documents for all solution variants, maintenance costs are determined, which form part of the future operating costs of the building life cycle. 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. The appropriate choice of material solution and high-quality maintenance planning directly affect the sustainability of the construction industry.

References

[1] SOMOROVA, V.: Facility management. Professional publishing Prague. 2014. ISBN 978-80-7431-141-3.
[2] Thermoshield.sk: Technical sheet. [accessed at 2020-12-10]. Available at: http://www.thermoshield.sk/dokumentacia-thermoshield/technicky-list-thermoshield
[3] Baumit.sk: [accessed at 2020-12-10]. Available at: http://www.baumit.sk/pimdam/SK/pdb/PDBL_MPI_20.pdf
[4] Lmmont.sk: Glass maintenance instructions. [accessed at 2021-10-13]. Available at: http://lmmont.sk/navod-na-udrzbu-skla
[5] HANKO, M.: Streamlining the maintenance of building structures in the FM system. Dissertation thesis. STU Bratislava, 2017.

Využitie manuálu údržby stavebných konštrukcií vo facility managemente

The Use of the Maintenance Manual of Building Structures in Facility Management

Martin Hanko [1]; Eva Jankovichová [2]; Silvia Ďubek [3]

Zaradenie článku: Odborný

Abstrakt

Manuál údržby budov je hlavným podkladom pre správcov budov aj facility manažérov, práve tí by však mali zohrávať hlavnú úlohu pri jeho vytváraní. Úlohou príspevku je objasniť podstatu manuálu údržby budov, čo má obsahovať, kedy sa používa a aké sú jeho možnosti využitia. V príspevku boli spracované jeho vybrané časti pre tri varianty stavebných obvodových konštrukcií budov na vybranej administratívnej budove. V súčasnosti by mala byť práve udržateľnosť v stavebníctve prioritou. Je potrebné zabezpečiť bezporuchovú a nízko nákladovú prevádzku budov, k čomu môže prispieť práve kvalitné vypracovanie manuálu.

Abstract

The building maintenance manual is the main basis for building managers and facility managers, but they should ensure its creation. The task of the article is to clarify the essence of the building maintenance manual, what it should contain, when it is used and what are its possibilities of use. In the paper, selected parts of it were processed for three variants of building structures - facades on the selected administrative building. Currently, sustainability in the construction industry should be a priority. 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.

Kľúčové slová: Stavebné konštrukcie, Údržba, Facility management

Keywords: Building Structures, Maintenance, Facility Management

Fig. 1: Illustration Image

[1] Ing. Martin Hanko, PhD., Slovak University of Technology, Bratislava
[2] Assoc. Prof. Eva Jankovichová, PhD., Slovak University of Technology, Bratislava
[3] Ing. Silvia Ďubek, PhD., Slovak University of Technology, Bratislava

Introduction

One of the prerequisites for improving the maintenance of building structures is the creation of a maintenance manual which sets out the maintenance rules as defined in the plan for the use of public works. Wear and change of function is compensated by the maintenance of building structures, which leads to the maintenance of the desired building characteristics.

Building maintenance is a part of the technical management of buildings that provides maintenance of building construction and maintenance of technical equipment installed in the building. Building maintenance in terms of facility management represents a complex of services designed to ensure the safe operation of buildings and their technologies. It's a continuous process. [1] According to STN EN 13306 maintenance is a combination of all technical administrative and management activities throughout the life cycle of a building to maintain or restore the condition in which it can perform the required function. [2] Standard STN EN ISO 41011 defines facility management as ntegration of processes within an organization to help ensure and develop agreed services that help and streamline the organization's core business.[3] The goal of FM is to reinforce all processes, with the help of which workers work with the highest efficiency in the workplace, thus ensuring the overall economic growth and success of the organization.[4]

Current Situation in Legislation and the Use of the Manual

Unlike the Slovak Republic in the Czech Republic, the legislation does not require the obligation to draw up a plan for the maintenance of public works. Paradoxically, many large-scale buildings and residential homes have a processed manual of building use under different names, such as: the standard user guide, the user guide, and building managers.

According to the Finnish National Construction Standards, the "Building and Construction Manual" is mandatory for the construction project to draw up a "Use and maintenance manual", ie a manual of use and maintenance for residential and work buildings, also to be developed when changing the purpose of an existing building. The manual must include the planned lifetime of the building and the building structure. The building will not pass through the building approval unless the manual is completed and handed over to the investor.[5]

At present, sustainable building management is a stable part of Dutch governmental environmental policy. Research in the Netherlands focuses on new construction projects and "sustainable maintenance" of buildings.

In Slovakia Building Act 50/1976 Coll. obliges the owner of the building to keep the building in good condition so that there is no risk of fire and hygiene defects, so as not to impair or jeopardize its appearance and maximize its usefulness. [6] Under Act 254/1998 Coll. on public works [7], the builder must ensure that the plan for the use of public works is drawn up. The planner and the contractor must work together. The plan must be designed so that during the use phase "there is no danger to persons, property" or that the public building is not damaged or that it is not "prematurely worn". The law defines the content of the plan: "rules of use, rules of technical inspections, maintenance rules, correction rules." The plan is processed during construction. The Ministry of Construction and Regional Development of the Slovak Republic published in 2001 a practical manual for the elaboration of the plan. The contents of the Maintenance Manual of Buildings is proposed in Table 1.

For large building projects, the investor may entrust the designer with a building maintenance manual that is being processed during the implementation phase. The manual for private work does not have the content given by the legislation. Private investors consider building construction to be maintenance-free at extra costs, neglecting their need, and thus increasing repair costs, often damaging objects.

Processing of the Maintenance Manual of Building Structures

Most building maintenance is currently being implemented as so-called "Induced maintenance". Such a maintenance task can cause triple to four times the cost increase than the same repair if implemented with a maintenance plan. This practice is ineffective. The roles of maintenance that are being invoked are mostly focused on repairing existing phrases, not on the cause of the failure, thereby increasing frequency and repair and maintenance costs. As a result, it is necessary to focus on preventive maintenance (planned). Maintaining and storing reliable information about the state of the building and its structures is essential for quality maintenance planning.

The optimal functioning of the building is conditional on the application of FM, which has an impact on the efficiency of maintenance of building structures.

The purpose of facility management is to create, improve, plan and maintain the indoor environment of the building with minimum resource requirements in such a way as to strengthen the main activities of the company, both the investor and the tenants of the building.

Tab. 1: Proposed contents of Buildings Maintenance Manual [8]

Parts	Definition	Contents	
Terms of Use of Buildings	Define the requirements for adequate use to prevent early wear and damage to health and property	Construction part	bearing capacity, cleaning and management work
			education of users
			building structures resistance to the action of chemicals
			proposal manipulation of doors, windows and fastening objects on building structures
			communication for the transport of specific equipment
		Technical and technological part	define requirements for secure, cost effective and trouble-free operation
			regulations, instructions, manuals
The Technical Inspection	Their task is to determine the current condition and the severity of defects in structures and technical and technological equipment in order to prevent future failures		Inspections are focused on:
			discovery of deficiencies and defects during the warranty period and the subsequent application of remedies by the manufacturer / contractor
			finding faults at an early phases, where correction could result in increased financial costs
Rules for Building Maintenance	Define the course of planning. Their output is maintenance schedule	Maintenance Schedule	elements with long service life: foundations, vertical loadbearing structures, horizontal load-bearing structures and roofs, staircase
			elements with short-lived: treated wall surfaces, floors, filling the openings, metalwork, plumbing and joinery
		Repair and Maintenance	defined time intervals for preventive maintenance
			provides employment and financial resources
			setting standards of maintenance

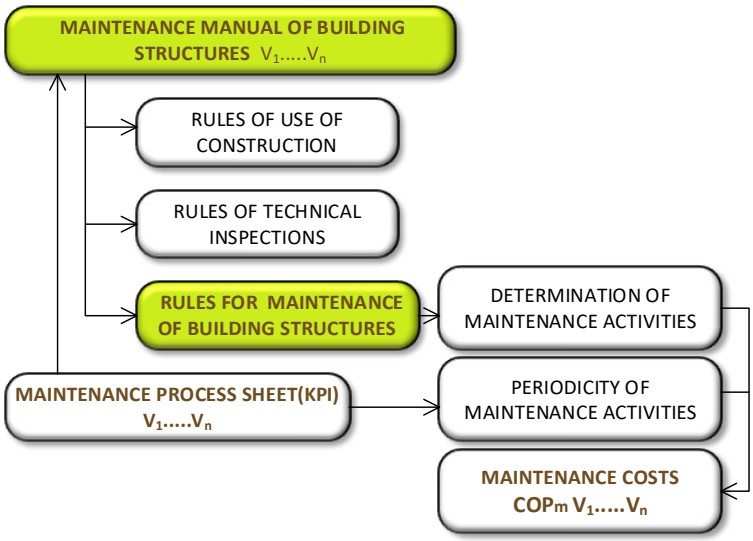


Fig. 2: Determination of Maintenance Costs

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 (tab. 2-4). Content of these rules have a direct impact on the determination of future operating costs. The proposed methodology for determining costs for the maintenance of building structures is shown in fig. 2.

Tab. 2.: Rules for the Maintenance of Structures V1

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.

Tab. 3.: Rules for the Maintenance of Structures V2

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.

Ta. 4.: Rules for the Maintenance of Structures V3

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.

Conclusion

Processing of facility management document as maintenance manual of building structures, has a direct impact on the determination of future maintenance costs. 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. In this way, we will achieve the possibility to influence the future operational efficiency of buildings and thereby contribute to the saving of resources, energy saving and thus also to the sustainability of construction objects.

References

[1] SOMOROVÁ, V.: Building maintenance. Facility management. 2010.
Publisher SUT Bratislava. ISBN 978-80-227-3372-4
[2] STN EN 13306. Maintenance. Maintenance terminology. Bratislava. SÚTN.
[3] STN EN ISO 41011. Facility management. Terms and definitions. Bratislava. SÚTN.
[4] SOMOROVÁ, V.: Building maintenance. Facility management. 2010.
Publisher SUT Bratislava. ISBN 978-80-227-3372-4

[5] Ym.fi: Use_and_maintenance_manual. [accessed at 2020-12-10]. Available at: http://www.ym.fi/enUS/Land_use_and_building/Legislation_and_instructions/The_National_Building_Code_of_Finland/Use_and_maintenance_manual
[6] Act 50/1976 Coll., On Spatial Planning and Building Regulations (Building Act), as amended
[7] Act 254/1998 Coll. on public works, as amended
[8] SOMOROVÁ, V.: Facility management. 2014. Professional Publishing. Praha. ISBN 978-80-743-1141-3
[9] HANKO, M.: Streamlining the maintenance of building structures in the FM system. Dissertation thesis. STU Bratislava, 2017.

Dôvody, pôvod a definície konceptu Inteligentného mesta

Reasons, Origin and Definitions of the Smart City concept

Ondrej Gajniak [1]

Zaradenie článku: Odborný

Abstrakt

Tak ako v zahraničí tak aj u nás v SR sa pojem Smart City stáva čoraz populárnejším a naberá na váhe, pričom je čoraz otáznejšie, čo to Smart City vlastne je. Táto otázka je dôležitá, pretože vznikajú stále nové a nové definície, pričom stále chýba akákoľvek oficiálna alebo právne relevantná definícia.
Je nepopierateľným faktom, že Smart City prináša výhody tak dodávateľom IKT a iných technológií, ako aj obyvateľom miest. V súvislosti so Smart City sa stále vynára množstvo zaujímavých otázok, pričom najpálčivejšie je, či vieme správne posúdiť alebo zmerať „Inteligenciu“ či Chytrosť toho ktorého mesta a teda či vieme vyhodnotiť, ktoré mestá patria medzi najinteligentnejšie, resp. či dokážeme zostaviť rebríček Inteligencie miest.

Abstract

Just as the term Smart City is becoming more popular and gaining more weight abroad as well as here in the Slovak Republic, it is becoming more and more questionable what a Smart City actually is. This question is important, as more and more new definitions are added, while any official or legally established definition is still absent.
It is an undeniable fact that the Smart City brings its benefits both to suppliers of ICT and other technologies, and to city dwellers. A number of interesting questions still arise in connection with the Smart City, with the most pressing being whether we can correctly assess or measure "Intelligence" or The smartness of which city and thus whether we can evaluate which cities are among the most intelligent, or whether we can compile a ranking of the Intelligence of cities.

Kľúčové slová: Inteligentné mesto, Definícia Inteligentného mesta, Dôvody vzniku Inteligentného mesta

Keywords: Smart city, SMART CITY Definition, SMART CITY reason of Emergence

1. Backround of Smart City concept

A hundred years ago, there were fewer than 20 cities worldwide with a population of more than 1 million people. In the 18th century, less than 5% of the world's population lived in cities, while the vast majority of people engaged in activities that provided basic human needs such as food and housing. Already in 1955, the share of the urban population reached 30% of the total number of inhabitants (approx. 2.75 billion) of our planet. Today, more than 50% of the population lives in the city and this ratio is growing. According to analyzes and surveys of the United Nations (UN) at least two-thirds of the population will live in cities worldwide by 2050. It is believed that this development will be even more pronounced in the European Union. European commision assumed that up to 80% of the population would live in cities in 2020. Statistics in Slovakia show a greater balance between the quantitative share of the urban and rural population. Data for 2011 indicate the share of the urban population at the level of 54.4% and the rural population at 45.6%.

From an economic point of view, cities have turned into agglomeration centers for global services. By becoming such centers, cities accumulate human and economic capital. At the political level, through growing economic influence, cities develop their political influence outside the city, the region, and even to the national level. On the management level, on the other hand, as part of the global trend of decentralization of state administration, political management systems are gradually changing from a state model of management of cities and regions to a local or self-governing model of management that better knows local conditions and thus knows how to recognize the tools suitable for

[1] JUDr., Ondrej Gajniak, Katedra humanitných vied Stavebná Fakulta STU, Bratislava

solving them. This political-management model represents a multi-level administration of state and city affairs, while this creates greater economic and legal freedom for cities in relation to the state.

It is evident that every city has its specific problems, the solution of which is a challenge for the Smart City concept and its available tools. These problem areas of cities mostly go beyond the traditionally defined systems of the city, or relate to several city systems at the same time. Before we present the individual dimensions of Smart City, the available definition framework, we name the basic problem areas of contemporary cities that must be effectively solved using the tools of the SMART CITY concept:

1. Affordable housing

Housing affordability is an important concern in the EU region. All families need a safe, stable, healthy place to live. High housing prices, or the unavailability of regulated rental housing, damage the economic, physical and emotional well-being of families. Housing costs are the main expenditure of many European households. In the European context, these costs include rent or mortgage payments, but also the costs of services such as water, electricity, gas or heating. Such costs are considered an excessive burden for the household when they represent more than 40% of the household's equivalent disposable income. This level is usually considered too large because it leaves little financial room for other important expenses. Eurostat uses this indicator, referred to as "excessive housing costs", as a signal of a lack of housing affordability.

In 2018, 11.3% of EU residents lived in households that spent 40% or more of disposable income on housing. There are significant differences between EU member states. On the one hand, there are several countries in which a relatively small part of the population lives in households where housing costs exceed 40% of their disposable income, especially in Malta (1.1%), Cyprus (3.9%), Ireland (4.6%), in Slovakia and Finland (4.9%). On the other hand, 40.9% of people in Greece and about one in six households in Romania (15.9%), Germany (15.6%) and Denmark (15.1%) spent more than 40% of their disposable income on housing . Thus, the share of households with excessive housing costs in 2018 was significantly higher in Bulgaria, Denmark, Germany, Greece, Romania and the United Kingdom than in other EU countries. Excessive housing costs are a particular problem for younger households.

House price inflation and high rents in big cities are hurting the employment prospects of millions of young workers across the European Union, according to a new World Bank report ('the report'). The World Bank report entitled: "Life and migration: housing, mobility and well-being in the European Union" analyzes how housing affordability affects labor productivity, growth and opportunities for citizens in the 28 EU member states. Those living in 26 of the 28 EU capitals said that: "finding good housing at reasonable prices is not easy".

"Housing in Europe's metropolitan areas has become unaffordable for many because new construction is not keeping pace with demand," said Gabriela Inchauste, senior poverty and equity economist at the World Bank and co-author of the report. "Since a large part of the housing stock is owned by the older generations, this excludes the younger generations from participating in the housing stock because they cannot afford to live in the most productive locations with the best job opportunities in the EU capitals."

2. Brain migration

The right of free movement of workers in the EU, which is one of the fundamental rights of European citizens, has facilitated labor mobility within the EU. However, in some cities (so-called "sending cities"), this freedom has led to a significant migration of highly educated labor to other cities (so-called "receiving cities"). This is due to the growing competition for talented workers and the limited ability of sending cities to create attractive conditions for these workers. Municipal authorities in sending cities have to deal directly with the socio-economic consequences caused by the significant loss of talented and productive people. Addressing these effects requires the formulation of appropriate municipal policies and measures to retain, acquire or regain a highly educated workforce.

In 2017, there were almost 17 million migrant workers from EU countries, of which approximately one third (32%) were in the 15-34 age group. The majority of migrants from the EU go to the big cities of Germany and the United Kingdom, which are also the two most interesting destinations for younger (15-34) European migrants. The main countries of origin are Romania, Poland, Italy and Portugal. In 2017, 25% of EU migrants in working age (15 to 64 years) have a university degree. These highly educated European labor migrants mainly support the urban environment and the northern regions of the EU (Sweden, Ireland, Estonia, Denmark, as well as several regions in the United Kingdom) with their labor migration. They also tend to have very high employment rates. Statistically, according to profession, the most "migrating brains" within the EU since 2003 were: 1. secondary school teacher; 2. doctor of medicine; 3. nurse; 4. physiotherapist; 5. dentist.

3. Urban sprawl by occupying arable land

One of the main challenges facing today's low-density cities is their expansion through land use. The problem of urban sprawl by occupying agricultural land relates to problems with the efficient use of natural resources, transport infrastructure and the location of public and private services.

Insufficient regulation of urban planning or the enforcement of inappropriate territorial urban regulations is a common deficiency in many European countries, while this allows private capital, often seeking immediate and disproportionate profit, to disproportionately occupy productive arable land. In the long term, all city dwellers pay extra for these degraded public resources. The European Environment Agency has expressed serious concern over the development of urban sprawl in the EU in the form of agricultural land grabbing.

The ongoing trend of urban growth can be explained by several factors. Many people settle in suburban areas because they can find better quality housing with more living space per inhabitant. There is still a large difference in average living space per person between cities: 15 m² per person is the average in Romanian cities, compared to 36 m² per person in Italian cities and 40 m² per person in German cities.

For example, increased gentrification of city centers drives people to seek more affordable housing further from the city center, while the middle and upper classes remain in the city center, the poorer social classes leave the centers and move to cheaper neighborhoods further from the city center. The massive economic development in the member states of Central and Eastern Europe has led to the fact that private development companies have built massively in suburban areas, regardless of the criteria of architectural quality, land use or spatial plans. The growth of cities by taking arable land can also be caused by insufficient spatial planning, in combination with the interest of city politicians in maximizing city revenues from property taxes.

4. Growing polarization in the social sphere

European cities are traditionally characterized by less segregation and less social and spatial polarization, compared to, for example, American cities. This is especially true for cities in countries with strong social systems. But there are many signs that polarization and segregation are growing. The economic crisis since 2009 further strengthened the effects of globalization and the gradual retreat of the welfare state in most European countries.

Although the average standard of living has increased over time, there are signs of growing disparities not only in the incomes of the wealthier classes, but also among the poorer classes of the population. In some places, the local population suffers from a concentration of social inequalities: unaffordable housing, low quality of education, unemployment and problems or inability to access some services (health, transport, ICT). Stagnant municipal budgets in many cities have in many cases exacerbated this problem. With fewer opportunities in the labor market due to economic stagnation or crisis, there is a risk of increased intolerance and even greater polarization between those who actively contribute to the tax and levy system and those who benefit from social contributions. The situation is very diverse in Europe, and some cities are significantly worse off than others, while the countries of Central, Eastern and Southern Europe, where political restructuring has led to new models of social and spatial segregation, are significantly affected by this phenomenon.

The wealthier cities of Western Europe also face the challenge of growing segregation and polarization. Based on data from the EU survey on income and living conditions, it has been shown that there is a higher proportion of materially disadvantaged people in the urban population of Western European countries compared to the rest of the population in the EU.

5. Transport problems

Different urban systems such as the economy, buildings, and people are accumulated in cities, while these are connected by transport systems. Managing such a complex urban system is becoming increasingly difficult. Due to the ever-increasing traffic load, the costs of transporting goods and people are increasing in city economies. The increase in the number of inhabitants in cities, more active tourism and global trade generate more and more passengers and transported goods. Another problem related to transport systems is the ever-increasing demand for parking spaces. Due to the spatial limitations of city centers, it is difficult to find space for new parking spaces.

As cities transform into metropolitan areas, the distance between city centers and residential areas increases. This leads to an increase in the total travel time required to travel between employment, services, schools and home. Without smart solutions, most public transport systems are used with insufficient or excess capacity. In city centers, due to congestion, there is a reluctance of citizens to use public transport during rush hour. In more distant suburban areas, inefficient use of public transport systems arises precisely because of the low population density. Traffic

congestion also has a negative impact on the environment. Pollution caused by traffic affects the quality of life of city dwellers. Traffic accidents are another negative aspect of traffic problems in cities. The priority for cities should be solving traffic jams and eliminating their side economic effects. Cities tend to allocate more financial resources and physical space to the car transport sector, while solutions for pedestrians and cyclists are often under-supported. The solution could be urban pedestrian zones with social activities in large open spaces and the possibility of social interaction between citizens.

6. Communication

Communication systems connect citizens, business companies, state, city authorities and institutions as one interconnected nervous system. With the help of mobile technologies and Internet connection, all participants of this "nervous system" require communication services, ideally without time and location limitations. With the growing population and technological advances in the field of ICT, there has been an excessive demand for digital communication and connectivity. Since 2000, the number of Internet users has increased by approx. 200%.

Ongoing urbanization and population growth in cities create excessive demand, which brings the need for new investments in infrastructure and ICT. Without these investments, broadband connectivity and the flow of data between different participants in digital communication could be disrupted. The consequence would be a slowdown in economic activity in cities and a reduction in their efficiency in relation to the operations they provide for society.

7. Global warming

Global warming increases the overall temperature of the atmosphere and oceans. Greenhouse gases are one of the main causes of temperature change. The main greenhouse gases are water vapor, carbon dioxide (CO2), methane (CH4) and ozone (O3). Urbanization and industrialization increase greenhouse gas emissions. Global CO2 emissions increased by more than 45% between 1990 and 2010, which was mainly caused by the growth and development of cities. Cities emit a large proportion of CO2, but they are also the center of economic development and technological improvements. The transport system is one of the main consumers of energy and a producer of CO2 emissions. Transport and buildings account for 25% of total CO2 emissions in cities.

On a global scale, it is cities that should assume a significant role in controlling and reducing greenhouse gas emissions. Municipal authorities and political actors in cities are under pressure to advocate for the preparation of legal regulations and make a significant contribution to environmental sustainability and the reduction of greenhouse gas emissions on a global scale. Cities are increasingly taking this environmental issue into account in their development and planning. For example, the Europe 2020 initiative, which covers 400 European cities, is working on a strategic plan to maintain smart and sustainable economic development. One of the main goals is climate change and energy issues. The goal of the European Union is to reduce greenhouse gas emissions by 20% by 2020, which is less than in 1990, to increase energy consumption from renewable sources by 20% and to increase energy efficiency by 20%.

2. The arrival of the SMART CITY concept

After the year 2000, the term "Smart" became a commonly used word in connection with the development of urban units, while it was primarily related to the use of information and communication technologies (hereinafter referred to as "ICT") for the purpose of increasing the productivity and efficiency of urban infrastructure and services.

Ecological and demographic problems of cities are currently a big challenge and require ICT-based solutions and the active involvement of as many residents as possible. With the current trend of rapid urbanization, it seems necessary to involve technical solutions from the field of information and telecommunication technologies, as it has been proven by the operation itself that these modern systems can perform processes in the city much more efficiently, more agilely, more flexibly and more economically. It has been proven by practice that city services based on ICT technologies change the cities themselves as well as the habits of their inhabitants in a short time after the introduction of ICT technologies.

The term "smart growth" was used in the mid-2000s by some technology companies such as IBM, Cisco and Siemens, with the aim of integrating information systems into city infrastructures and services. These infrastructures and services are primarily buildings, transportation systems, electrical, water and sewage infrastructure, health care and public safety. The approach in urban development with smart growth techniques and methods later accompanied the

emergence and development of the Smart City concept, which relies on progress in planning, development, operation and sustainability of ICT-based urban services and facilities.

In addition to the advantages brought by the deployment of ICT in the urban environment, thanks to which the Smart City concept is an increasingly frequently used approach in urban development, the growing interest in the use of ICT in the urban environment may also be related to the ability of the Smart City concept to successfully challenge challenges in the field of inter- urban competition, where it is about acquiring human, financial and political capital in the strong competition of existing urban units.

Transnational economic activities brought intercity competition after the 1980s. This competition has diversified the cities economically, with some cities gaining the unofficial status of "World Cities". Advances in ICT and transportation technologies have enabled the global circulation of finance, information, and skilled labor. World cities are using these technological conveniences to expand their economic activities into international marketplaces.

In addition to this ongoing inter-city economic competition in the market of capital, labor and finance, already during the economic crisis of 2008, cities began to compete for the human capital of generation Y and generation Z, which will be the creator of the new economic power within the concept of Smart Cities.

Generation Y people were born between 1983 - 2000. They are also called "Echo Boomers" or "Millennial Generation". The term "Generation Y" first appeared in 1993 in a magazine called Advertising Age, which describes teenagers. A general characteristic of people belonging to Generation Y is the daily use and work with the Internet, e-communication, multimedia and digital technologies.

Generation "Z" is the designation for the generation of people who were born in the years 1989 - 2010. They are also called iGeneration, NetGeneration or Internet Generation. While Generation Y people, born in the 1980s and early 1990s, experienced the transformation of analog technologies to digital, Generation Z people did not have the opportunity to experience the era before the widespread use of mobile phones and the Internet. Generation Y people were born at the beginning of the "digital revolution", but Generation Z is the first generation that can rightfully be called "native" in the era of social networks and high-speed Internet. The use of the Internet and mobile technologies by generations is increasing dramatically every year. Generation Z people are seamlessly connected to the Internet and many of them are online every day using ICT and other media devices such as the World Wide Web (www), instant messaging (sms), mobile phones, YouTube, Facebook and so on. This is why they are called "Digital Natives". They are not dependent on an Internet connection to their home computers, but access the Internet through their mobile phones almost instantly and are always online.

Cities want to attract these younger generations, often labeling them as the "creative class", not only to build the city's youthful image, but more importantly, mainly for the future economic growth of the city itself. While globalization has created a connected world, this connectivity is still concentrated in a relatively small number of cities and regions. In order for a city to become "smart", it must attract people of Generation Y and Z. It should be a "digital city" that meets the demands of these Internet users. In particular, it should offer public access to high-speed Internet and a public wireless network.

The current era requires the city to communicate with its citizens through the Internet, digital interfaces, and not offices with long lines, paper forms and bureaucracy. These new creative classes are the source of economic development for smart cities, and their members have the potential to contribute their energy and ideas to companies and organizations. Generation Z is the workforce, intellectual capital and source of innovation for smart cities. Waiting in line and wasting time is completely unusual and incomprehensible for them. Cities are already adapting and starting to enable new agile forms of interfaces and connectivity to provide services such as education, access to healthcare or employment. The benefit of this effort is to capture the creativity and entrepreneurship of generation Y and Z, which is supposed to be the engine of future economic growth. The current corona crisis has accelerated the demand of the digitally focused layer of the city's inhabitants for the accelerated creation of a "smart city" even more, making the onset of the SMART CITY era definitively inevitable.

3. Definitions of SMART CITY concept

As the term Smart City becomes more popular and gains more weight abroad as well as here in the Slovak Republic, it is increasingly questionable what the Smart City concept actually represents, what it brings and how it should be perceived from the point of view of its users. This question seems to be important, as this term is used by various business corporations as well as others, larger or smaller "players" of world trade across economic sectors, as well as users of the concept itself, and they do not have the idea of what SMART CITY represents and what it actually, on the definitional level, it is completely uniform.

Currently, according to available sources, there is no unified legal definition of the Smart City concept. The term Smart City is currently more frequent in the terminology intended for technical fields and sciences than in the terminology intended for the legal sector. In any case, there are interfaces in the Smart City concept for legal science and practice as well.

Currently, one of the most watched problems is the involvement of the technological part of the Smart City concept in the legally protected area of personal data protection. Another critical aspect is generating a lot of data coming from public sources (such as cameras or Internet of Things "IoT") and using it in the private sector and storing it on the CLOUD.

The legal "municipality" is demanding the creation of a new "Smart Law" for the Smart City, which could just be created by dividing the existing national law into a law for cities and municipalities and a law for cities that are or want to be Smart Cities. The law in the field of Smart City should have a motivating effect, especially for the stage of introducing new Smart solutions, so that entities benefiting from such Smart solutions in the future overcome the initial reluctance to incur increased investment costs for the purchase of such Smart solutions. The motivation of entities to invest in Smart solutions in the economic and tax sphere appears to be relatively simple and effective, e.g. the existence of subsidies for the purchase of photovoltaic panels, for house insulation, or tax relief for companies using Smart solutions that save the environment. In the legal field, it is possible to motivate subjects, e.g. so that if they invest and implement Smart solutions in their business, the state authorities will shorten the deadlines for handling administrative procedures, which often burden companies more than the taxes and fees themselves. In Chicago (USA), the Smart Law in the field of construction law regulates the possibility of shortening the deadline for issuing a building permit for an applicant who complies with the passive energy standard of the house during the design and actual implementation and leaves a certain undeveloped part of the land for the purpose of green areas. It seems necessary, in order to adopt Smart law, not only to involve lawyers more and more in the topic of Smart City, but also to continuously familiarize them with new technologies, their use and impacts on practice.

Below are several generally recognized and used definitions of Smart City, while it would be possible to categorize them according to the professional focus of individual authors or it is possible to determine the author's professional background or the area in which he works from the given definition, after abstracting the individual dimensions of Smart city from the definition, since mostly consciously or subconsciously, the author of that definition emphasizes precisely the dimensions - areas of Smart City, in which he is professionally "at home" or are in some way essential to him and his focus, research or business.

In the individual Smart City definition frameworks used, dimensions can be recognized - areas or urban themes or urban systems that occur in most modern cities and are most communicated inwardly, toward the inhabitants, or outwardly, toward the commercial companies providing the technology and service for this concept. In some cities, certain dimensions may be dominant and some less developed, which is precisely what gives the Smart city concept direction in a given city.

Definition according to the European Commission of the EU:

The basic characteristic of a Smart city according to the European Commission (EC) is that smart cities are cities that use technological solutions for the purpose of improving city management and the efficiency of the urban environment. According to the EC, a Smart City is a city where traditional networks and services are built and used more efficiently, using digital and telecommunication technologies, for the benefit of its residents and businesses. An intelligent city also uses ICT for the purpose of more efficient use of resources and production of a smaller amount of emissions. It means smarter urban transport networks, modernized water supply and waste disposal facilities, more efficient ways of lighting and heating buildings. It also means a more interactive and citizen-oriented city administration, safer public spaces and meeting the needs of an aging population.

Definition according to ISO (International Organization for Standardization):

The definition of the Smart city concept according to the International Organization for Standardization is as follows: Smart cities rely on interconnected and integrated strategies and systems in order to effectively provide better services and increase the quality of life, while ensuring equal opportunities for all participants and protecting the environment. Smart city continuously strives to improve the social, economic and environmental sustainability of outputs. It responds to challenges such as climate change, rapid population growth, political and economic instability, using methods of collaborative leadership, available data, working across disciplines in urban systems.

Definition according to ITU (International Telecommunication Union):

The definition of a Smart City according to the International Telecommunication Union is as follows: An intelligent and sustainable city is an innovative city that uses information and communication technologies to improve the quality of life, the efficiency of urban activities and services, competitiveness, while ensuring that the needs of current and

future generations are met with respect for economic, social and environmental aspects. This definition emphasizes that a Smart City is not just a city that uses modern technology, but a complex ecosystem created for stakeholders such as city residents, businesses, communities and industry.

Definition according IBM:

IBM states that a Smart City is an instrumental, connected and intelligent city. In the area of Smart Cities, it primarily operates in areas such as Smart Healthcare, Smart Mobility, Smart Infrastructure, Smart Security, Smart Governance.

Definition according Cisco:

According to Cisco, a Smart City is a city that uses digital technologies to connect, protect and improve the lives of city residents. The Internet of Things, video cameras and social media, as well as other inputs, act as the city's nervous system, providing the city with constant feedback in order to make decisions based on information. Smart City collects and analyzes data from sensors and video cameras so that responsible city officials can take the necessary actions. As the main advantages of Smart city, he names the involvement of the population in decisions and their applied solutions, improving the lives of residents thanks to more efficient city services, increasing business activity thanks to new knowledge, secured by connectivity and sensors.

Definition according Siemens:

According to SIEMENS, the SMART CITY concept is primarily about smart services based on intelligent infrastructure. Smart buildings are efficient in a smart city and are automatically able to adapt to changed conditions. SIEMENS also has an idea of smart mobility in a smart city, while digitally integrated platforms supporting mobility in the city support trouble-free and efficient travel by various transport methods as well as intelligent parking and lighting of roads and sidewalks.

Definition according Microsoft:

Microsoft's definition of Smart City is demonstrated by its business platform called Smart City NEXT, which enables cities to be more sustainable, prosperous and inclusive. Its partial product portfolio is primarily focused on cyber security in the cloud and connecting self-governing organizational structures with residents through a full range of functional software solutions.

Definition according Caragliu et al.:

A city is smart when investments in human and social capital, traditional (transport) and modern (ICT) communication infrastructure drive economic growth and quality of life with smart management of the use of natural resources, through participatory city management.

Definition according Kourtit and Nijkamp:

Smart cities are the result of knowledge and creative strategies aimed at increasing the socio-economic, ecological, logistical and competitive factors of cities. Such smart cities are based on the composition of factors such as human capital (educated workforce), infrastructure capital (high-tech facilities), social capital, entrepreneurial capital (creative entrepreneurs).

Definition according Nam and Pardo:

A Smart City combines information with hardware infrastructure to improve convenience, facilitate mobility, add efficiency, improve air and water quality, identify problems and solve them quickly, collect data to make more qualified decisions, allocate resources efficiently, and share data to enable collaboration between entities. and subjects.

Definition according Thuzar:

Smart cities are cities in which citizens have a high quality of life and which strive for sustainable economic development through investments in human and social capital, traditional and modern infrastructure and natural resource management, through participatory politics. Smart cities should also be sustainable, converging economic, social and environmental goals.

Conclusion

I want to emphasize the idea that "People, not technology, must be at the center of any public-private economic or political intervention," Although technological development is very important and has the potential to bring positive

change, it should be based on an inclusive approach, not a platform, which is clearly reserved only for a narrow group of users."

A true "smart city" deals not only with every level of society, but also with parts of the city. It leaves room for spontaneity, flexibility and local government initiatives. It welcomes diversity and embraces active transparency rather than control. In the end, a city is only a reflection of its citizens and their collective will, with the fact that combined with the right cocktail of technologies, it can be a Smart City.

Not only politicians, but also every city dweller should realize that the city he lives in is basically just a reflection of the qualities of its inhabitants and their collective will, with the fact that in combination with a properly mixed cocktail of technologies, any city can become SMART CITY.

Literatúra a súvisiace odkazy

[1] United Nations: World's population increasingly urban with more than half living in urban areas. 2014
[2] Annex of Cities issue paper, the urban agenda, European Commission, 2014
[3] Statistic Office of SR
[4] Statistics of EC a UN-Habitat 2016 based o Eurostat datas
[5] https://www.worldbank.org/en/region/eca/publication/living-and-leaving
[6] http://www.eea.europa.eu/soer/europe/land-use
[7] Tosics, I. (2011): Sustainable land use in peri-urban areas: government, planning and financial instruments: In: Pauleit, S., Bell, S., and Aalbers, C., (eds), Peri-Urban Futures: Land Use and Sustainability, Berlin: Springer
[8] https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions
[9] Library of Congress Cataloging-in-Publication Data Ogden, Jane, 1966– Health psychology:a textbook / Jane Ogden. – 2nd ed ISBN 0 335 20596 8 1. Clinical health psychology. I. Title. [6]
[10] IEA, CO2 EMISSIONS FROM FUEL COMBUSTION: DATABASE DOCUMENTATION (2018 edition)
[11] https://ec.europa.eu/clima/policies/strategies/2020_en
[12] Hodginson S. 2011, Is your City smart Enough?march 2011, report by OVUM
[13] Gonzales J.A. and Rossi (2011) New trends for Smart Cities, open innovation machanism fo Smart Cities, European commision within the ICT policy support programme
[14] Harrison, C., Eckman, B., Hamilton, R., Hartswick, P.,Kalagnanam, J., Paraszczak, J., &Williams, P.(2010). Foundations for smarter cities. IBM Journal of Research and Development, 54(4), 350–365
[15] Gedikli, B. (2001), Globalization and World Cities (GaWC) Research Network. Research Bulletin 65, Retrieved February 22, 2013, from http://www.lboro.ac.uk/gawc/rb/rb65.html)
[16] Francese, P. (2003). Trend Ticker: Ahead Of The Next Wav. Advertising Age
[17] Hawkins, P. and Schmidt, L. (2008). Gen Z: digital natives. http://www.essentialkids.com.au/entertaining-kids/games-and-technology/gen-z-digital-natives-20080716-3g5p.html
[18] https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en
[19] https://www.iso.org/sites/worldsmartcity/
[20] http://www.itu.int/
[21] http://www.ibm.com
[22] http://www.cisco.com
[23] http://www.siemens.de
[24] www.microsoft.com
[25] Caragliu, Andrea & Del Bo, Chiara & Nijkamp, Peter. (2009). Smart Cities in Europe. VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics, Serie Research Memoranda. 18. 10.1080/10630732.2011.601117.
[26] Kourtit, Karima & Nijkamp, P.. (2012). Smart cities in the innovation age INTRODUCTION. Innovation-the European Journal of Social Science Research - INNOVATION. 25. 93-95. 10.1080/13511610.2012.660331.
[27] Nam, Taewoo & Pardo, Theresa. (2011). Smart city as urban innovation: Focusing on management, policy, and context. ACM International Conference Proceeding Series. 185-194. 10.1145/2072069.2072100.
[28] Thuzar, Moe. (2011). Urbanization in Southeast Asia: Developing smart cities for the future?. 10.1355/9789814311694-022.

Zohľadnenie podmienok na stavenisku pri návrhu vežových žeriavov

Consideration of Construction Site Conditions when Designing Tower Cranes

Ivan Vavrík[1]

Zaradenie článku: Odborný

Abstrakt

Pri práci so žeriavmi vplýva na trvanie výstavby a s tým spojené náklady viacero faktorov. Okrem iných to je vzdialenosť miesta nakladania a vykladania, poveternostné podmienky počas práce, náročnosť práce a schopnosti pracovníkov. Tieto faktory ale nie sú zohľadnené v parametroch strojov v technických listoch. Cieľom tohto príspevku je stanovenie koeficientov, ktoré môžu byť použité pri návrhu vežových žeriavov pre vysoké budovy s monolitickou železobetónu konštrukciou a ich overenie na príklade konkrétnej stavby.

Abstract

When working with cranes, several factors affect the duration of construction and the associated costs. Among others, this is the distance of the loading and unloading place, the weather conditions during the work, the difficulty of the work and the skills of the workers. However, these factors are not considered in the machine parameters in the technical sheets. The aim of this article is to determine the coefficients that can be used in the design of tower cranes for tall buildings with a monolithic reinforced concrete structure and their verification on the example of a specific building.

Kľúčové slová: Vežový žeriav, Objektivizácia návrhu, Zariadenie staveniska, Monolitické železobetónové konštrukcie

Keywords: Tower crane, Design objectification, Construction site equipment, Monolithic reinforced concrete structures

Fig. 1: Construction site with tower cranes [author]

Introduction

Cranes are cyclically working machines. However, their work cycle differs from the work cycle of other machines in that its duration depends on the type of mounted element, the lifting height, and the distance of horizontal movement of the element. All these parameters are constantly changing. In addition, the crane also supplies the workplace with other materials during assembly [1].

The aim of the article is to select the most effective design of cranes for the realization of tall buildings formed by monolithic reinforced concrete structures. It is primarily focused on the realization of monolithic reinforced concrete walls using baskets for fresh concrete. The solution consists of determining the coefficient of work efficiency for vertical and horizontal movement, calculating the duration of the work cycle and the necessary number of changes for

[1] Ing. Ivan Vavrík, Faculty of Civil Engineering, Slovak University of Technology, Bratislava

the realization of 100 m^3 of reinforced concrete walls, determining the use of workers using cranes and evaluating the calculated values.

The Method of Determining the Duration of One Work Cycle and the Utilization of Workers

The duration of one working cycle is determined by the formula:

$t_c = t_n+t_z+t_o+t_v+t_o+t_s$ (1)

where: t_c is total duration of the cycle in minutes;
t_n duration of filling the basket, or of hanging the load in minutes;
t_z duration of the lift in minutes;
t_o duration of the rotation of the boom and horizontal shift in minutes;
t_c duration of emptying the basket, or suspension of the load in minutes;
t_s duration of lowering in minutes.

The use of workers who use the crane is determined by the formula:

$\eta = (t_p/t_c)\cdot 100$ (2)

where: η is crew utilization in %;
t_p crew work time in minutes;
t_c total cycle duration in minutes.

Determination of the Working Efficiency Coefficient of the Crane During Concreting of Walls and Columns

The speed of concreting using a tower crane depends on the parameters of the crane. However, the rotation speed of the crane boom and the lifting speed of the crane mentioned in the technical sheets from the manufacturers do not consider influences such as adverse weather conditions (wind, atmospheric precipitation, temperature), lack of space for handling the load, impaired visibility of the crane and the like. Therefore, it is necessary to adjust the speeds from the technical sheets with the coefficients of the crane's working efficiency.

Measurement at the Construction Site

The labour efficiency coefficient was determined based on the measurement of the duration of concreting with baskets on a construction site in Bratislava. The speeds of lifting the load and rotating the boom are taken from the technical sheet of the LIEBHERR manufacturer. [2, 3, 4, 5, 6]

During the first measurement, a reinforced concrete wall was realized. After filling, the crane raised the basket to a height of 7 m, turned it by 70° and at the same time moved it by 25 m. Subsequently, the workers emptied the basket, and the crane transferred it back to the truck mixer. The average duration of the cycle at the first measurement was 05:58.7 min., the work of the basket operator 02:58.5 min. and service utilization 49.77%.

During the second measurement, reinforced concrete columns were realized. After filling, the crane raised the basket to a height of 8.5 m to overcome the obstacle, turned by 95° and at the same time moved it by 32.5 m. After that he lowered it by 8.5 m to the level of the ceiling slab of the first underground floor. Subsequently, the workers emptied the basket, and the crane transferred it back to the truck mixer. The average duration of the cycle during the second measurement was 07:25.7 min., the work of the basket operator 02:34.8 min. and service utilization 34.73%.

During the third measurement, reinforced concrete columns were realized. After filling, the crane lifted the basket to a height of 12.5 m to overcome the obstacle, turned by 145° and at the same time moved it by 45 m. Then he lowered it by 4 m. Subsequently, the workers emptied the basket, and the crane carried it back to the truck mixer. The average duration of the cycle during the third measurement was 07:38.0 min., the work of the basket operator 02:20.6 min. and service utilization 30.70%.

A detailed breakdown of the conditions on the construction site during the individual measurements is given in Table 1. Records from the measurements are given in Tables 2 to 4.

Tab. 1: Conditions during measurements on site [author]

	Measurement No. 1	Measurement No. 2	Measurement No. 3
Type of crane:	Liebherr 130 EC-B	Liebherr 200 EC-H	Liebherr 200 EC-H
Basket volume:	0.75 m^3	1.00 m^3	1.00 m^3
Weight:	2 135 kg (335+1 800)	2 755 kg (355+2 400)	2 755 kg (355+2 400)
Realized construction:	wall	Columns	Columns
Date:	25.03.2019	26.03.2019	08.04.2019
Air temperature:	+9°C	+10°C	+21°C
Weather:	mostly cloudy	mostly cloudy	sunny
Wind speed:	7 $m.s^{-1}$	6 $m.s^{-1}$	4 $m.s^{-1}$
Gusts of wind:	14.5 $m.s^{-1}$	14 $m.s^{-1}$	10 $m.s^{-1}$
Vertical distance:	7 m	8.5 m	12.5 m/4 m
Horizontal distance:	25 m	32.5 m	45 m
Angle of rotation:	70°	95°	145°

Tab. 2: Recording of measurement No. 1 [author]

Activity	Measurement [min]				Speed [m/min]/[rpm]		Speed ratio
	1	2	3	Average	Actual	By TS	
Fulfilment	01:05,3	01:28,1	00:56,7	01:10,0	-	-	-
Lifting	00:26,5	00:13,9	00:11,4	00:17,3	24	60	0,405
Shift	00:47,1	00:32,7	00:46,0	00:41,9	0,28	0,8	0,348
Emptying	01:42,0	04:55,1	02:18,5	02:58,5	-	-	-
Shift	00:54,3	00:31,4	00:26,3	00:37,3	0,31	0,8	0,391
Run	00:14,3	00:13,7	00:12,9	00:13,7	31	60	0,511
Processing	03:41,0	05:28,4	06:04,2	05:04,5	-	-	-

Tab. 3: Recording of measurement No. 2 [author]

Activity	Measurement [min]								Speed [m/min]/[rpm]		Speed ratio
	1	2	3	4	5	6	7	Average	Actual	By TS	
Fulfilment	00:42,5	00:50,8	00:58,3	00:59,3	01:37,4	00:49,8	01:04,4	01:00,4	-	-	-
Lifting	00:10,3	00:21,2	00:17,0	00:37,2	00:24,0	00:28,0	00:29,3	00:23,9	21	60	0,356
Shift	01:08,5	00:50,6	00:59,8	00:36,5	01:00,1	00:40,6	00:41,3	00:51,1	0,31	0,8	0,387
Run	00:32,9	01:03,6	01:12,3	01:03,8	00:48,3	00:54,3	00:35,6	00:53,0	10	60	0,160
Emptying	03:37,0	02:29,7	01:47,4	01:22,8	02:54,4	03:26,5	02:25,7	02:34,8	-	-	-
Lifting	00:07,3	00:12,7	00:09,7	00:15,0	00:16,9	00:15,7	00:17,2	00:13,5	38	60	0,630
Shift	00:38,4	00:44,2	00:39,4	01:01,1	00:38,3	00:42,7	01:00,0	00:46,3	0,34	0,8	0,427
Run	00:49,0	00:31.7	00:47,4	00:21,8	00:29,5	00:34,3	01:15,1	00:42,8	12	60	0,199

Tab. 4: Recording of measurement No. 3 [author]

Activity	Measurement [min]			Speed [m/min]/[rpm]		Speed ratio
	1	2	Average	Actual	By TS	
Fulfilment	01:01,8	01:44,4	01:23,1	-	-	-
Lifting	00:26,1	00:26,1	00:26,1	29	60	0,479
Shift	00:42,7	00:41,4	00:42,0	0,58	0,8	0,719
Run	00:53,5	00:50,8	00:52,2	5	60	0,077
Emptying	02:54,7	01:46,5	02:20,6	-	-	-
Lifting	00:18,2	00:15,1	00:16,7	14	60	0,240
Shift	00:57,2	00:49,3	00:53,2	0,45	0,8	0,568
Run	00:51,1	00:37,2	00:44,2	17	60	0,283

Determination of Labour Efficiency Coefficients

Based on the ratios of the measured speed of the crane movement and the speed of movement according to the technical sheet listed in Tables 2 to 4, the relevant coefficients of the work efficiency of the tower crane for the concreting of walls and columns were determined. The average coefficient of work efficiency was calculated for vertical movement 0.334 and for horizontal movement 0.454.

Calculation of the Total Duration of Work and Calculation of the Use of Staff

During the calculations, three crane designs were considered for the completion of one expansion unit of the complex located in Ružinov, Bratislava. The ground plan dimensions of the proposed building are 39.5 x 20.1 m, and its height is 78.8 m. The first design consists of a LIEBHERR 110EC-B6 crane, with a 120HC tower 90.10 m high, a boom 29.0 m long and a load capacity of 6.0-4.65 t and a LIEBHERR 140EC-H6 crane, with a 120HC tower 106.79 m high, a boom length 41.4 m and load capacity 6.0-3.8 t. In the second proposal, a LIEBHERR 180EC-H10 crane is used, with a 256HC tower of 96.48 m height, a boom length of 41.6 m and a load capacity of 10.0-4.75 t. The third design is a LIEBHERR 280EC-H12 crane, with a 256HC tower of 97.98 m height, a boom length of 51.6 m and a load capacity of 12.0-5.6 t.

The first design using only the LIEBHERR 140EC-H6 crane, the first design with the deployment of the second LIEBHERR 110EC-B6 crane from the 13th above-ground floor and from the 5th above-ground floor are evaluated. The second designed crane is the LIEBHERR 180EC-H10 and the third LIEBHERR 280EC-H12.

The calculation consists of the concreting of the walls, the formwork of the walls and the transport of reinforcement.

When concreting, a basket with a volume of 1.5 m^3 is considered for one lift of the crane and weighing 4,020 kg. The work cycle consists of filling the bucket, lifting, and turning, emptying, and lowering back to the truck mixer. The duration of filling and emptying was determined based on measurements at the construction site. Work efficiency coefficients were used according to the previous chapter.

When form working walls, a formwork part with dimensions is considered for one lift of the crane 2,400 x 3,300 mm and weighing 395 kg. The work cycle consists of hanging the formwork part, lifting, turning, and storing the part. Hanging of the part, turning, lowering, cleaning, and placing the part on the storage area are also considered. The duration of hanging and assembly of the part was determined based on the consultation at the construction site. Work efficiency coefficients were used according to previous chapter. In the formwork of the walls, in some results the utilization of one team was more than 100%. In such a case, two squads will work.

When transporting reinforcement, 2 t of reinforcement is considered for one lift of the crane. This weight was determined according to the carrying capacity of the straps with which the reinforcement is tied. The work cycle consists of hanging the rebar bundle, lifting, turning, and folding the rebar bundle. The duration of hanging and folding the bundle was determined based on the consultation at the construction site. Work efficiency coefficients were also determined, which are worse than in concreting and formwork, as the transport of reinforcement is more demanding and must be handled more carefully.

The evaluation of the results of the total duration of work is shown in the graph on Figure 2 and the average use of teams in the graph on Figure 3.

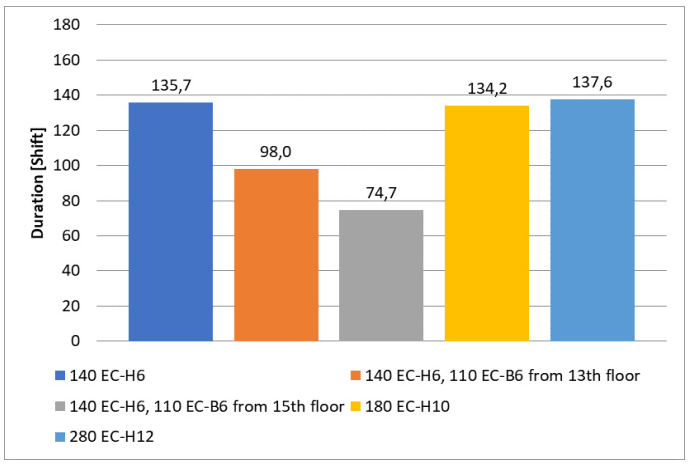


Fig. 2: Comparison of the total duration of work for the execution of 100 m^3 reinforced concrete walls [author]

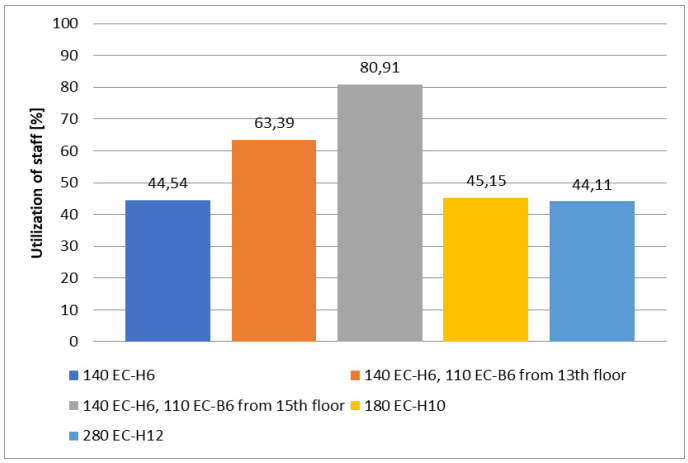


Fig. 3: Average utilization of a complex crew [author]

Conclusion

When comparing individual proposals, the following factors were considered:

- total duration of work,
- the price of the works consisting of the rent for the crane, including the wages of the crane operator and the wages of the workers of the complex crex,
- use of complex crew workers.

The estimated monthly rent for the LIEBHERR 110 EC-B6 crane is 6,750 €, the LIEBHERR 140 EC-H6 7,100 €, the LIEBHERR 180 EC-H10 7,455 € and the LIEBHERR 280 EC-H12 12,000 €. The estimated hourly wage of a crane operator is 12.50 €·$hour^{-1}$. The costs for the wages of the workers of the complex crew were determined on the basis of an average hourly wage of 10 €·$hour^{-1}$, a shift duration of 10 hours and the number of workers 15.

Based on the assessment of the duration of the works, total costs and average use of the crew, the order of the individual proposals is as follows:

1. LIEBHERR 140EC-H6, LIEBHERR 110 EC-B6 from 5th floor,

2. LIEBHERR 140EC-H6, LIEBHERR 110 EC-B6 from 13th floor,

3. LIEBHERR 180 EC-H10,

4. LIEBHERR 140EC-H6,

5. LIEBHERR 280 EC-H12.

It follows from the order of the individual proposals that, considering the considered factors, it is more effective to deploy a larger number of cranes from the beginning of construction. Although the monthly rent is higher, the

duration of deployment is shorter. The price of the work of a complex team is significantly lower, thus the total price is also low. The average utilization of workers is also higher. Detailed results are presented in Tables 5 and 6.

Tab. 5: Price comparison of crane designs per unit of measurement 100 m3 of walls [author]

Type of crane	Total duration	Number of months	Total rent	Price of labour	Total price
140EC-H6	135.7 days	5	52 463 €	203 550 €	256 013 €
140EC-H6, 110 EC-B6 from 13th floor	98.0 days	4	60 025 €	147,000 €	207 025 €
140EC-H6, 110 EC-B6 from 5th floor	74.7 days	3	60 225 €	112 050 €	172 275 €
180 EC-H10	134.2 days	5	54 050 €	201 300 €	255 350 €
280 EC-H12	137.6 days	5	77 200 €	206 400 €	283 600 €

Tab. 6: Comparison of average utilization of crew for individual proposals in % [author]

Type of crane	Wall concreting	Wall formwork		Reinforcement transport	Average utilization
		Assembly	Disassembly		
only 140EC-H6	34,37	55,92	55,92	31,93	44,54
140EC-H6, 110 EC-B6 from 13th floor	47,60	81,80	81,80	42,34	63,39
140EC-H6, 110 EC-B6 from 5th floor	61,10	105,41	105,41	51,73	80,91
180 EC-H10	35,87	55,32	55,32	34,08	45,15
280 EC-H12	34,81	53,71	53,71	34,21	44,11

Literature and Related References

[1] JURÍČEK, I.: TECHNOLÓGIA STAVIEB: Hrubá stavba. Bratislava: Vydavateľstvo Eurostav, spol. s r.o., 2018, s. 200, s. 263. ISBN 978-80-89228-58-4.
[2] Technical Sheet 110 EC-B6 FRtronic
[3] Technical Sheet 112 EC-H8 FRtronic
[4] Technical Sheet 140 EC-H6 Litronic
[5] Technical Sheet 180 EC-H10 Litronic
[6] Technical Sheet 280 EC-H12 Litronic (75 m)

Koncepčný návrh komunálneho vozidla s variantnými pracovnými nadstavbami

Conceptual design of a municipal vehicle with a replaceable working superstructure

Peter Holub[1]; Viktória Chovančíková[2]; Miroslav Nagy[3]; Andrej Korec[4]

Zaradenie článku: Odborný

Abstrakt

Príspevok sa zaoberá návrhom komunálneho vozidla ako univerzálneho nosiča nadstavieb, ktorý nachádza široké uplatnenie najmä v komunálnej sfére pri letnej a zimnej údržbe ciest, ale aj v iných oblastiach, ako poľnohospodárstvo, lesníctvo a stavebníctvo. V týchto sférach sa uplatňuje, najmä vďaka dobrej svahovej a terénnej dostupnosti, ovládateľnosti a využiteľnosti na priestorovo obmedzených miestach, pri obhospodarovaní horských a stavebných plôch. Tiež pri prevoze surovín a materiálov s využitím rôznych nadstavieb a prídavných zariadení , ako sú klanicové a valníkové nadstavby na prevoz, hydraulické ruky a približovacie štíty s navijakom na manipuláciu.

Abstract

The article deals with the design of a municipal vehicle as a universal superstructure carrier, which finds wide application especially in the municipal sphere for summer and winter road maintenance, but also in other areas, such as agriculture, forestry and construction. It is used in these spheres, mainly due to good slope and terrain availability, controllability and usability in spatially limited places, in the management of mountain and construction areas. It is also applies to transporting raw materials and materials with the use of various superstructures and additional equipment, such as rail and flatbed superstructures for transport, hydraulic arms and approach shields with a winch for handling.

Kľúčové slová: Komunálne vozidlo, Nadstavba, Modulárnosť, Flexibilita

Keywords: Municipal vehicle, Superstructure, Modularity, Flexibility

Obr. 1: Vizualizácia komunálneho vozidla určeného pre variantné nadstavby

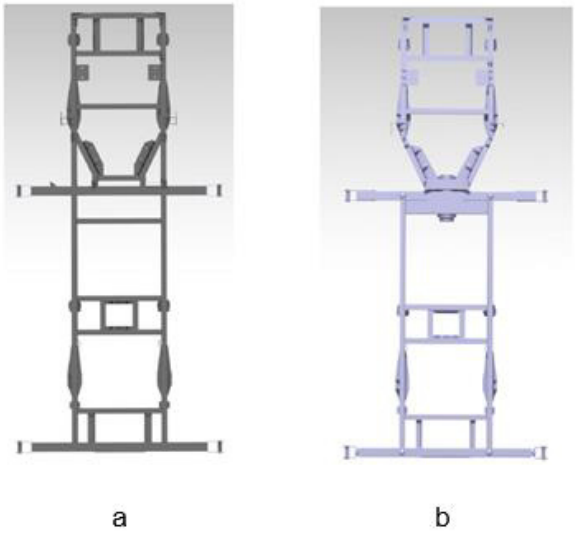
Koncepcia komunálneho vozidla ako nosiča variantných nadstavieb

Aktuálne v rámci projektovej činnosti na Ústave dopravnej techniky a konštruovania SjF STU v Bratislave venovaná pozornosť aj vývoju flexibilných modulárnych konštrukcii mobilných pracovných strojov. V rámci projektu APVV bola zameraná pozornosť na vývoj komunálneho vozidla, ako modulárneho nosiča variantných nadstavieb na báze ich jednoduchej vymeniteľnosti pre širokospektrálne využitie.

[1] Ing. Peter Holub, Strojnícka fakulta STU v Bratislave
[2] Ing. Viktória Chovančíková, Strojnícka fakulta STU v Bratislave
[3] Ing. Miroslav Nagy, Strojnícka fakulta STU v Bratislave
[4] Ing. Andrej Korec, Strojnícka fakulta STU v Bratislave

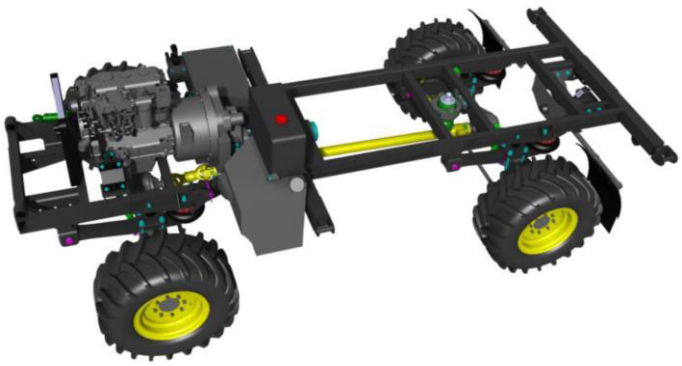
Koncepčný návrh vozidla zohľadňuje súčasné trendy vývoja a výroby komunálnych vozidiel ako nosičov najpoužívanejších komunálnych nadstavieb. Nosič bol navrhovaný tak, aby spĺňal parametre a kritéria Európskych a Slovenských nariadení a noriem, nakoľko spadá do kategórie vozidiel N2, čo sú vozidlá na prepravu nákladu do hmotnosti 3,5 tony. Súčasťou noriem, ktoré vozidlo musí spĺňať sú taktiež emisné normy, na základe čoho bol vymedzený výber pohonu spĺňajúceho dané kritéria.

Vozidlo má podvozkový typ karosérie. Podvozok vozidla (obr. 3) bol navrhnutý vzhľadom na určenie vozidiel v prevádzke v dvoch variantoch, s pevným (obr. 2a) a výkyvným dvojdielnym rebrinovým rámom (obr. 2b) v pozdĺžnej osi nosiča v závislosti od požadovaného využitia. Rám je konštrukčne prispôsobený na adaptáciu rôznych typov nadstavieb a prídavných zariadení. Zavesenie kolies je realizované pomocou tuhých náprav, ktorých odpruženie a tlmenie je prevedené vzduchovým vankúšmi s možnosťou zmeny svetlej výšky spolu s hydraulickými tlmičmi. Zmenou kolies alebo pneumatík je možné meniť jazdné parametre v závislosti od požiadaviek na pracovné podmienky. Kabína bola navrhnutá v zmysle bezpečnostných a rozmerových noriem s ohľadom na usporiadanie ovládacích prvkov.



Obr. 2: a) pevný rebrinový rám, b) výkyvný dvojdielny rebrinový rám

Spaľovací motor spolu s hydromechanickým prevodovým mechanizmom (obr. 3) zabezpečuje realizáciu nadštandardných terénnych možnosti pre jazdu a prácu vozidla v sťažených podmienkach. Vozidlo má alternatívu využitia pohonu prednej alebo oboch náprav, v závislosti od činnosti vozidla spolu s rozdeľovaním výkonu na jednotlivé nápravy alebo kolesá podľa zaťaženia. Neodmysliteľnou súčasťou pre ovládateľnosť vozidla, najmä v obmedzených priestoroch, je možnosť riadenia všetkých náprav, alebo takzvaný krabí chod. Za bežných okolností je riadená predná náprava. Činnosť a riadenie nadstavieb je realizovaná vývodovým hriadeľom na prevodovke s možnosťou využitia hydraulického alebo elektrického pohonu.



Obr. 3: Podvozková časť vozidla (šasi)

Návrh koncepcie nadstavby a prídavných zariadení

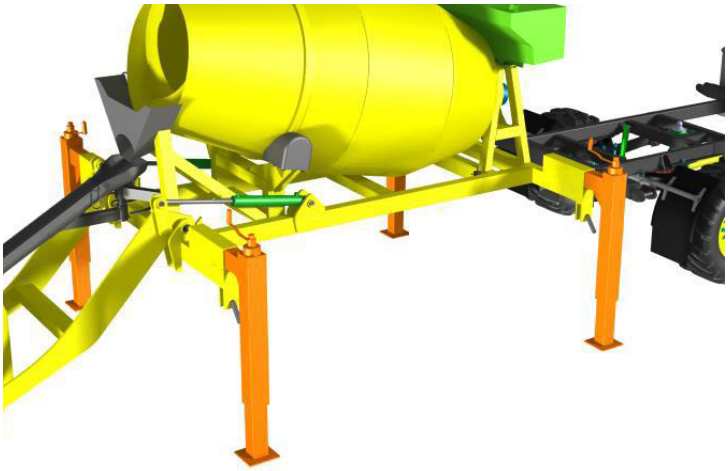
V rámci riešenia projektu s ohľadom na zabezpečenie realizácie rôznych komunálnych technológii bol vypracovaný návrh 6 variantov komunálnych nadstavieb:

- -valníková nadstavba (obr. 4a),
- -posýpacie zariadenie (obr. 4b),
- -domiešavacie zariadenie (obr. 4c),
- -priemyselný drvič odpadu (obr. 4d),
- -cisterna s oplachom (obr. 4e),
- -čistiace prídavné zametacie zariadenie s korbou a vysávačom (obr. 4f)

Obr. 4: Vizualizácia komunálneho vozidla: a) s valníkovou nadstavbou, b) s posýpacím zariadením, c) s domiešavacím zariadením, d) s drvičom, e) s cisternou a oplachom, f) s nadstavbou vysávača s prídavným zametacím zariadením

Jednotlivé propozície zariadení boli navrhované priamo na riešenú veľkostnú kategóriu komunálneho vozidla. Súčasťou nadstavby takmer vo všetkých prípadoch je ich vlastný rám, okrem valníkovej nadstavby, ktorý slúži najmä na jednoduchú výmenu a jeho uchytenie na rám vozidla. Uchytenie a upnutie je realizované rozoberateľnými spojmi na

priečnikoch rámu vozidla, kde sú zaistené čapmi spolu so závlačkami. Na zadnom priečniku je kĺbový spoj, kvôli vyklápacej valníkovej nadstavbe. Výmena nadstavby je zabezpečená pomocou zníženia svetlej výšky vozidla a stojanov, ktoré sa pri výmene zabudujú do rámu nadstavby, obr. 5.



Obr. 5: Výmena nadstavby

Valníková nadstavba, ako neodmysliteľná súčasť každého komunálneho vozidla, je ovládaná pomocou teleskopického jednočinné hydraulického valca umiestneného v strede korby uloženého na ráme nosiča. Vyklápanie je možné prevedené smerom dozadu, respektíve na ľavú a pravú stranu. Pred vyklápaním je vždy potrebné uvoľniť kontaktné uchytenia nadstavby s rámom vozidla podľa potreby.

Posýpacia nadstavba je zložená z rámu nadstavby, zásobníka, dávkovacieho zariadenia, nádrže na vodný roztok soli a rozmetadla. Pohon dávkovača, rozmetadla a čerpadla v nádržiach je zabezpečený hydraulickým prevodníkom ovládaným pomocou tenzometrického snímača na meranie úbytku materiálu v zásobníku, čím ovplyvňuje množstvo dávkovaného materiálu.

Domiešavacie zariadenie bolo navrhnuté na samostatné dávkovanie a plnenie jednotlivých zložiek betónovej zmesi bez pomoci externých zariadení. Preto, okrem rámu nadstavby, miešacieho bubna, nádrže na vodu a dopravných sklzov, je súčasťou celku aj plniaci mechanizmus. Pridaním plniaceho mechanizmu sa zabezpečila funkcia plnenia bubna jednotlivými zložkami na tvorbu betónovej zmesi. Celý mechanizmus je riadený a ovládaný hydraulickým pohonom.

Priemyselný drvič odpadu bol navrhnutý na základe požiadavky mobility jeho zabudovaním na komunálne vozidlo. Pozostáva z rámu, dvoch dopravných zariadení a samotného drviaceho zariadenia. Celý mechanizmus je poháňaný hydraulicky.

Korba s vysávačom a zametacím zariadením bola koncipovaná na rozmery navrhnutého vozidla. Korba vysávača je zložená z funkčných prvkov, ako je rám nadstavby, nádoba na nečistoty a samotný vysávač. Zametacie zariadenie je upevnené na prednej časti vozidla 3-bodovým závesom, zložené z väčších funkčných celkov, ktorými sú kropenie, zberný kôš, kefy, nosný rám. Zametacie zariadenie má viac riešení s využitím rozličných typov kief. Sací mechanizmus vysávača vyúsťuje do zbernej nádoby. Druhý typ nadstavby je cisterna s oplachom, ktorá je umiestnená na ráme vozidla za kabínou pomocou rámu nadstavby a vyúsťuje v prednej časti na kropiacom zariadení. Obidva systémy využívajú hydraulický pohon.

Komunálne vozidlo s variantnými nadstavbami

Variantné možnosti využitia komunálneho vozidla s nadstavbami sú uvedené v tab. 1. Varianty vznikajú kombináciou dvoch funkčných celkov, rámov a disponibilných nadstavieb.

Tab. 1: Variantné riešenia. Rám: 1-Pevný rebrinový rám, 2-Dvojdielny výkyvný rebrinový rám. Nadstavba: a-valníková nadstavba, b-posýpacie zariadenie, c-domiešavacie zariadenie, d-priemyselný drvič odpadu, e-korba s vysávačom a zametacím zariadením, f-cisterna s oplachom.

Variant	Rám		Nadstavba					
	1	2	a	b	c	d	e	f
Variant 1	x		x					
Variant 2	x			x				
Variant 3	x				x			
Variant 4	x					x		
Variant 5	x						x	
Variant 6	x							x
Variant 7		x	x					
Variant 8		x		x				
Variant 9		x			x			
Variant 10		x				x		
Variant 11		x					x	
Variant 12		x						x

Kombináciou rámov a nadstavieb vzniklo 12 variantov komunálneho vozidla prispôsobených aktuálnym požiadavkám používateľov v komunálnej sfére respektíve v stavebníctve. Avšak nie všetky varianty sú vhodné do prevádzky, ako napríklad variant 9, z dôvodu nespĺňajúcich, najmä bezpečnostných parametrov, ako stabilita.

Záver

Cieľom projektu bolo vypracovať koncepčný návrh komunálneho vozidla ako nosiča s dvoma variantmi podvozkového usporiadania v kombinácii s rôznymi typmi nadstavieb. Nadstavby boli navrhnuté s ohľadom na ich adaptáciu na stávajúci rám nosiča s jednoduchou možnosťou výmeny a tiež s ohľadom na jeho nosnosť. Dôležitým aspektom bola požiadavka na dodržanie princípov modularity a flexibility navrhovaných konštrukcii. V súčasnej dobe sa väčšina výrobcov zameriava práve na tieto aspekty z dôvodu nie len efektívnej konštrukcie, ale aj výroby zariadení a ich využitie. V ďalšom období bude pozornosť zameraná na variantne riešenia vyvolané požiadavkami praxe.

Táto práca bola podporovaná Agentúrou na podporu výskumu a vývoja na základe projektu APVV-21-0406: Systém mobilných manipulačných zariadení pre logistickú podporu hasičského a záchranného zboru.

Literatúra a súvisiace odkazy

[1] VLK, F.: *Podvozky motorových vozidel: Pneumatiky a kola, Zavěšení kol, Nápravy, Odpružení, Řídicí ústrojí, Brzdové systémy*. Brno: Nakladatelství a vydavatelství VLK 2001. ISBN 80-238-5274-4.

[2] VLK, F.: *Převodová ústrojí motorových vozidel: Spojky, Převodovky, Rozvodovky, Diferenciály, Hnací hřídele, Klouby*. Brno: Nakladatelství a vydavatelství VLK 2001. ISBN 80-238-5275-2

[3] IKRINSKÝ, A.: *Mechanické a hydraulické prevody*. Bratislava: Nakladateľstvo STU 1994. ISBN 80-227-0700-7.

[4] BELEŠ, L.: *Úpravnícke stroje*. Bratislava: SVŠT v Bratislave 1986. 85-376-86.

[5] POLÁK, J.: *Dopravní a manipulační zařízení II.* Ostrava: VŠB – Technická univerzita 2003. ISBN: 80-24-80493-x.

[6] MAZURKIEVIČ, I., L. GULAN, G. IZRAEL, M. GLATZ: *Mobilné pracovné stroje: teória a konštrukcia základných modulov*. Bratislava: Nakladateľstvo STU 2013. ISBN 978-80-227-3968-9.

[7] DUNAJ, K. 2021. *Koncepčný návrh zametacieho zariadenia a pracovných nadstavieb pre univerzálne komunálne vozidlo*: diplomová práca. Bratislava: STU, 2021. 87 s.

[8] INDRO, A. 2022. *Koncepčný návrh domiešavacieho zariadenia a jeho adaptácia na samohybný podvozok 4x4*: diplomová práca. Bratislava: STU, 2021. 65 s.

[9] ŽILKA, J. 2015. *Návrh koncepcie posýpacieho zariadenia ako nadstavby komunálneho vozidla s výkonom 80 kW*: diplomová práca. Bratislava: STU, 2015. 89 s.

[10] HOLUB, P. 2022. *Koncepčný návrh adaptácie nadstavby dvojrotorového drviča na samohybný podvozok 4x4x*: diplomová práca. Bratislava: STU, 2022. 101 s.

[11] LÁSKAVÝ, J. 2015. *Návrh koncepcie komunálneho vozidla s pracovnými nadstavbami na prepravu materiálu s výkonom 80 kW*: diplomová práca. Bratislava: STU, 2015. 105 s.


Buildustry
Bria Invenia
CORBYN