



Janez Koželj, univ. dipl. inž. arh.

Arhitekt Janez Koželj, rojen 1945 v Ljubljani, je zaključil dolgoletno akademsko kariero na Fakulteti za arhitekturo Univerze v Ljubljani kot redni profesor za urbanistično oblikovanje. Od leta 2006 je podžupan Mestne občine Ljubljana s funkcijo mestnega arhitekta. Je projektant v podjetju 3biro, v katerem s številnimi izvedbami promovira inovativno uporabo lesa v arhitekturi.

Svoje razprave je objavil v knjigah in številnih znanstvenih člankih ter jih predstavil na mednarodnih srečanjih. Razstavljal je na številnih predstavah slovenske sodobne arhitekture v Evropi in Ameriki. Njegova dela so bila večkrat predstavljena v domačih in tujih revijah za arhitekturo.

Med zgrajenimi projekti so najbolj pomembna dela: poslovno-stanovanjska hiša na Poljanski cesti v Ljubljani 1988, telovadna dvorana Poljane v Ljubljani 1991, stanovanjska hiša v stavbnem otoku Novi Tabor v Ljubljani 1991, skupina stanovanjskih hiš v stanovanjskem naselju "Schieszstaette" v Gradcu v Avstriji 1998, zabaviščno trgovski center Portoval v Novem mestu (soavtor Jože Jaki) 2003 in viadukt Črni Kal na avtocesti Klanec-Srmin (soavtor zasnove in konstruktor M. Pipenbaher) 2004.

Za svoja dela je prejel Plečnikovo nagrado 1988, priznanje G. B. Piranesi 1992 in leta 2005 nagrado revije DETAIL za najboljšo arhitekturo v vzhodni Evropi ter Zlati svinčnik ZAPS za svoj opus.

Foto / Photo: Sandi Fišer

LES – EDINA ALTERNATIVA ZA TRAJNOSTNO PREOBRAZBO

Pri gradnji lesenih stavb večjih dimenzij nas v Sloveniji bolj kot inženirsko znanje in izkušnje, ovirajo na eni strani predsodki in na drugi strani strogi predpisi, ki ne podpirajo hitrejšega razvoja sodobne gradnje s konstrukcijami iz industrijsko obdelanega lesa. Omejena je že dovoljena višina gradnje. Pomembno pa je, da se počasi vendarle obnavljata in razvijata veriga industrijske obdelave ter predelave lesa in tudi tehnologija sodobne zaščite lesa. Kljub temu smo graditelji v glavnem še vedno vezani na uvoz lepljenih lesenih konstrukcij in veznih sredstev. V prvi vrsti torej manjka tako več politične podpore države in občin kot tudi sistemskih spodbud za hitrejši preboj gradnje iz lesa. Tako je pri nas še vedno vsak malo večji ali zahtevnejši objekt iz lesa unikatna, poskusna gradnja, ki nam pomaga pridobivati dragocene izkušnje in nas spodbuja k iskanju novih priložnosti in novih rešitev. Še posebej javne zgradbe in objekti iz lesa so pri nas neke vrste raziskovalni projekti, ki so rezultat posebnih okoliščin.

**V PRVI VRSTI TOREJ
MANJKA TAKO VEČ
POLITIČNE PODPORE
DRŽAVE IN OBČIN
KOT TUDI SISTEMSKIH
SPODBUD ZA HITREJŠI
PREBOJ GRADNJE IZ LESA.**

Seveda pa se sodobna arhitektura in inženirstvo soočata s povsem novimi nalogami, kot so podnebne spremembe, varčevanje z energijo in uporaba obnovljivih virov. Naraščajoča okoljska kriza nas opozarja, da ima prav gradnja zaradi množične uporabe surovin, energije in kapitala ter onesnaževanja in degradacij, ki jih povzroča, dejansko največji in najbolj neposreden vpliv na tveganje za okolje. Gradnja z lesom, ki je poleg izjemnih uporabnih in estetskih lastnosti predvsem obnovljivi vir, je potemtakem edina alternativa za trajnostno preobrazbo mest. Trajnostno pa pomeni načrtovati in urejati mesta sonaravno, po metodah in s sredstvi, ki temeljijo na naravnih sistemih. Takšen je tudi način sonaravnega gospodarjenja z gozdom, ki je hkrati gospodarski vir, kulturna dobrina, ekološki sistem, varovalni prostor in biokemična tovarna. Namen sonaravnega upravljanja virov je namreč vzpostaviti trajno ravnovesje v naravi, kljub temu da jo koristimo za svoje potrebe.



**Eva Prelovšek Niemelä, univ. dipl. inž. arh.,
raziskovalka na InnoRenew CoE**

Eva Prelovšek Niemelä je raziskovalka v centru odličnosti InnoRenew CoE in arhitektka.

Izobrazbo s področja arhitekture je pridobila na Tehniški univerzi na Dunaju ter na Akademiji upodablajočih umetnosti na Dunaju. Podiplomski magistrski študij arhitekture je opravila v Ljubljani na Fakulteti za arhitekturo. Od leta 2005 je delala kot samostojna arhitektka v lastnem studiu Atelje Prelovšek, v tem času je realizirala več objektov ter postavitev razstav v Narodni galeriji v Ljubljani in drugih galerijah po Sloveniji, v Avstriji, Češki republiki, Braziliji, Makedoniji in na Japonskem.

V letih 2015–2017 je bila glavna urednica arhitekturne revije HIŠE ter kustosinja in moderatorka dogodkov v okviru Mesta oblikovanja.

POTREBUJEMO VELIKO SLIKO

Ob nedavnem globalnem podnebnem štrajku, ki je sledil splošni razpravi 74. zasedanja generalne skupščine ZN, se je pojavilo jasno sporočilo, da je čas za spremembe tukaj in zdaj. Rešitve niso enostavne in do sedaj so preživele le tiste, ki so za seboj prinesle hitri ekonomski uspeh. Razvijali smo delne rešitve, ki so odgovorile le na del okoljskih težav. Če smo zaradi povečane energijske varčnosti hiš potrebovali več izolacije, smo je več proizvedli in je posledično tudi več prodali. Zmanjšali smo porabo energentov za ogrevanje stavb, vendar smo hkrati povečali proizvodnjo izolacij, ki so hkrati povečale porabo energentov v industriji in ustvarile velike količine materialov, ki jih ni mogoče reciklirati. Namesto delnih rešitev, potrebujemo veliko sliko, *big picture* ali pogled na celoto. Kaj dejansko prinaša nedvomne okoljske koristi in možnosti za zniževanje toplogrednih plinov?

Kar hitro ugotovimo, da je premalo celostnih študij, ki bi nam jasno pokazale, kakšne koristi imajo različni tipi gradenj na okolje. Veliko vemo o energijsko varčnih hišah, o pametnih tehnologijah, izolativnosti materialov in energijski porabi med obratovanjem; nekaj manj vemo o vzdrževanju, še posebej novih gradbenih materialov, naprav in tehnologij, ki jih vgrajujemo v stavbe; še manj pa vemo o njihovem recikliranju in ponovni uporabi. Priznati si moramo, da smo še zelo daleč od pogleda na celoto ali razumevanja celotnega življenjskega cikla stavb. Poglejmo primerjavo uporabe betona in lesa za konstrukcijo velikih stavb.

Stavbe so kompleksni sistemi, en material vpliva na drugega in na celotno stavbo (statična trdnost, toplotna izolativnost, zvočna izolativnost, požarna odpornost, teža stavbe in struktura temeljev itd.). Medsebojna soodvisnost vseh naštetih parametrov se jasno kaže tudi pri lesenih stavbah. Če je lesena masivna stena, ki jo praviloma postavimo v velikih lesenih stavbah, toplotno bolj izolativna od betonske, je hkrati v isti debelini zvočno manj izolativna, po drugi strani pa je lažja, za proizvodnjo in postavitve potrebuje bistveno manj energije in časa. Les po odsluženju uporabi v gradbeništvu omogoča kaskadno rabo, saj omogoča več stopenj ponovne uporabe. Hkrati pa v času njegove uporabe že raste novo drevo. Beton po drugi strani lahko zgolj zdrobimo in uporabimo kot agregat ali polnilo. Surovine, iz katere ga proizvedemo, ne more-

mo obnoviti. Les lahko znova uporabimo na več načinov – za manjše konstrukcije, stavbno pohištvo, različne lesene produkte in na koncu življenjskega cikla kot gorivo. Zato le hiter pogled v življenjski cikel lesenih stavb pokaže, da konstrukcijski sistemi iz lesa ustvarjajo manjši okoljski odtis, kot drugi ekvivalentni gradbeni materiali.

Da bi stvarjem prišli do konca, se v inštitutu InnoRenew CoE aktivno ukvarjamo s pogledom na celoto. Izvajamo analize življenjskega cikla (LCA, life cycle assessment) gradbenih materialov in lesenih stavb. Z njimi na objektivni način dokazujemo okoljske prednosti lesenih gradenj vseh velikosti. Le pogled na celoto bo lahko dal zadovoljive rezultate in odgovore na vprašanje, kako graditi v prihodnosti.

**LES PO ODSLUŽENI
UPORABI V
GRADBENIŠTVU
OMOGOČA KASKADNO
RABO, SAJ OMOGOČA
VEČ STOPENJ PONOVNE
UPORABE. HKRATI PA V
ČASU NJEGOVE UPORABE
ŽE RASTE NOVO DREVO.**

Lesene stavbe velikih dimenzij so dober pokazatelj vseh prednosti lesene gradnje, saj pri njih praviloma uporabljamo masivne križno lepljene plošče in lepljene lesene nosilce, ki so za arhitekto zelo atraktiven material. Gradnja poteka hitro, tiho in čisto. Arhitekti smo navdušeni nad nivojem natančnosti, ki se ne more primerjati z umazano, relativno površno in dolgotrajno betonsko gradnjo. Prav tako je vizualni občutek in občutek toplotnega ugodja veliko boljši v lesenih stavbi. Lesene površine glede na raziskave našega inštituta ugodno vplivajo na počutje in zmanjševanje stresa v delovnem okolju. Prav tako je v lesenih gradnjah zaznana boljša kakovost zraka z manj zdravju škodljivih emisij. Les je obnovljiva naravna surovina. Rast dreves se v

nekaterih državah pospešuje s plantažnimi nasadi hitrorastočih vrst, ki jih z novimi tehnologijami, kljub njihovi nizki gostoti in slabim mehanskim lastnostim, lahko uporabimo v zahtevnih aplikacijah, kot so konstrukcije. Z ustreznim gospodarjenjem z gozdom in umno rabo lesa po načelih kaskadne rabe bomo imeli lesa vedno dovolj.

Če želimo narediti korenite spremembe v smeri okolju prijazne gradnje, moramo pospešiti leseno gradnjo vseh dimenzij in pri tem popolnoma opustiti uporabo vseh fosilnih surovin. Naj to postane naše skupno poslanstvo in boju proti podnebnim spremembam.



Dr. Jure Kotnik, arhitekt in urednik

Jure Kotnik je arhitekt in urednik, ki vodi lasten studio v Ljubljani in Parizu. Deluje na različnih področjih arhitekture, raziskovanja in oblikovanja. Je avtor številnih arhitekturnih rešitev, ki so vzbudile pozornost medijev. Med njimi so kontejnerska vikend hiša 2+, mobilni svetilnik za pariško пристanišče, vrtec Kekec in začasni vrtec Ajda. Kotnik redno piše za različne revije in je avtor številnih knjig. Kot avtor prve knjige s področja kontejnerske arhitekture, *Container Architecture* (LINKS, 2008), ki je postala mednarodni "bestseller", je leta 2009 prejel Plečnikovo nagrado. Kotnik je pripravil in kuriral prvo Kontejnersko arhitekturno razstavo, ki je potovala po številnih mestih v Evropi in ZDA. V zadnjih petih letih se je posvetil arhitekturi stavb v izobraževalne namene s projekti v Sloveniji, Franciji, na Cipru in v Belorusiji. Napisal je dve knjigi in več člankov o sodobnem oblikovanju vrtcev. Od leta 2011 dalje dela kot arhitekturni svetovalec za Svetovno banko in Razvojno banko Sveta Evrope (CEB) na področju optimizacije in oblikovanja predšolskih in šolskih objektov. Leta 2012 predava kot gostujoči profesor na Ecole Speciale d'Architecture v Parizu. Leta 2014 je zagovarjal doktorat z raziskovalno nalogo o hibridni metodologiji arhitekture. Od leta 2015 dalje sodeluje s Steve Jobs School na razvoju bodočih učnih okolij. V letu 2018 je bil nagrajen z nagrado Europe 40 Under 40, nagrado za najbolj inovativne mlade arhitekta in oblikovalce v Evropi.

Foto / Photo: Neja Kotnik

GRADNJA V LESU: NIŽJA CENA, VIŠJI REZULTATI

Gradnje v lesu se drži nekaj stereotipov, nekateri med njimi so bolj, drugi manj resnični. Zagotovo gradnja v lesu, še posebej masivnem, predstavlja najvišji gradbeni standard in je še posebej primerna za naše z gozdovi bogato okolje, saj je gradiva v izobilju. Med serijo pozitivnih učinkov sodi tudi njegova sonaravnost; les je edini gradbeni material, ki ima pozitiven ogljični odtis. V zadnjem času ljudje, tudi zaradi montažne gradnje in sovpadanjem le-te s sodobnimi principi in vrednotami, vse bolj sprejemajo leseno gradnjo. Pri javnih stavbah gre trend rasti nekoliko počasneje. Še največji preboj med slednjimi so naredili izobraževalni objekti, predvsem vrtci. Študije, kot na primer Šola brez stresa (SOS, Moser, 2009), kažejo še posebno primernost lesene gradnje za izobraževanje. Učenci v učilnicah iz masivnega lesa imajo v povprečju nižji srčni utrip, se lažje koncentrirajo in so povprečno manj pod stresom kot sošolci v tradicionalni betonski gradnji. Les torej vpliva na srce, ožilje, živčni sistem ter izboljšuje kakovost življenja.

Med stereotipi, ki ne držijo nujno, izstopa predvsem stereotip o dragi leseni gradnji. Ta je pogojno sicer lahko pravilen in drži predvsem takrat, ko se zapostavljajo možnosti za optimalno in kakovostno načrtovanje stavb. Na to vpliva sicer cela kopica dejavnikov od slabo pripravljenih projektnih nalog do kriterija najnižje cene projektne dokumentacije do izpada kriterijev za načrtovalce in izvajalce. Pasti se pojavljajo tudi pri nepripravljenih naročnikih, tradiciji načrtovanja, gradnje in uporabe stavb pa vse do zakonodaje in tolmačenja le-te na upravnih enotah. Ta spirala, če izpostavimo samo legalne dejavnike, vodi v to, da so javni objekti po nepotrebnem dražji od tistih na trgu, tako za gradnjo kot kaksneje za vzdrževanje.

Nekatere države, med njimi na primer tudi Francija, ravnajo drugače in za gradnjo izbirajo konzorcije od projektiranja do izvedbe, pri čemer je vsem v interesu, da izberejo najboljše sodelavce, saj se tudi odgovornost za končni finančni učinek projekta prenaša skozi različne faze in izvajalce. Tovrsten pristop omogoča tudi profilacijo stroke in s tem tudi z vsakim projektom boljše končne rezultate. S tem se lažje izognejo temu, da lahko objekt istega namena in kapacitete dosega večkratnik cene na trgu, kar bi moralo biti za davkoplačevalce nesprejemljivo. Posebej kadar se denar zapravlja za zidove, namesto da bi se porabil za boljše opremo, program ali uporabnike.

LES TOREJ VPLIVA NA SRCE, OŽILJE, ŽIVČNI SISTEM TER IZBOLJŠUJE KAKOVOST ŽIVLJENJA.

Načelo osredotočanja na končnega uporabnika v kombinaciji z optimizacijo investicije zasledujemo tudi skozi projektiranje. Tak je primer športnega vrtca v Minsku, ki ga je priznalo slovensko podjetje za montažno gradnjo zgradilo v beloruski prestolnici leta 2016. Prvotni projekt lokalnih projektantov je bil ocenjen na 4,5 milijona evrov. S preprojektiranjem smo končnemu naročniku namesto betona zagotovili ne le največji javni objekt v lesu, ampak tudi prvo javno stavbo v državi s certifikatom energetske učinkovitosti A+. Objektu smo zasnovali serijo inovativnih elementov (fasadni goli, hibridna športna oprema v notranjosti, serija didaktičnih koticov) in projekt je bil nagrajen z zlato medaljo arhitekturnega Bienala v Minsku (2017) za končno ceno investicije 2,5 milijona evrov.

Drugi primer je vrtec v Šmartnem pri Slovenj Gradcu, zgrajen iz masivne konstrukcije CLT z leseno fasado, tipološko zasleduje odprti tloris tudi s povezavami med igralnicami in odpiranjem proti skupnim prostorom kot podaljškom igralnic. Navedeno spodbuja srečevanja in komunikacijo otrok različnih skupin in starosti in pa stik z različnimi okolji in izkušnjami. Vrtec

ima namreč 65 različnih igralnih koticov, med temi na primer didaktično stopnišče s skrivališčem pod njim in je prvi vrtec pri nas, ki ima notranji tobogan. Višina investicije skupaj z zunanjo ureditvijo in opremo je pri 1,45 milijona evrov na primer več kot trikrat nižja kot pri vrtcu enake kapacitete v prestolnici in nižja od vseh primerljivih investicij v zadnjih letih povsod po državi. Pomembno je poudariti, da nižja cena ne pomeni nižje kakovosti – ravno nasprotno. Priznana angleška revija The Economist je vrtec Šmartno v članku »Razred boljši« (McDermott, 2017) zaradi inovativnega izobraževalnega okolja umestila med vrtece prihodnosti, domača strokovna javnost pa je projektu podelila nagrado Lesena ikona (2017). Oba navedena vrtca je mednarodna organizacija za ekonomski razvoj OECD izpostavila kot primera najboljše prakse investicij v izobraževanje. To dokazuje, da so lahko javni objekti grajeni ceneje, z materiali boljše kakovosti in predvsem lahko tudi vsebinsko konkurirajo na globalnem trgu.



Lenka Kavčič, arhitektka in direktorica arhitekturnega festivala ODPRTE HIŠE SLOVENIJE

Lenka Kavčič je arhitektka, mentorica, predavateljica in zagovornica arhitekture. Deluje na področju izobraževanja in ozaveščanja o kakovostno grajenem prostoru tako v Sloveniji kot v tujini. Vodilo njenega delovanja je trajnostno, smotno in razumno oblikovan prostor, ki ljudem ponuja priložnost za kakovostno bivanje in delo. Ukvarja se z inovativnimi pristopi in posegi v prostor in se zavzema za dvig kulture bivanja. Je registrirana profesionalka DGNB in svetuje na področju trajnostnega načrtovanja. Spodbuja investitorje, kupce in najširšo javnost za uporabo odličnih trajnostnih arhitekturnih rešitev.

Svoje izkušnje je pridobivala v okviru priznanih domačih in tujih ustanov. Med leti 2009–2013 je bila prodekanja na Visoki šoli za dizajn. Kot gostujoča profesorica na milanski Politehnici je bila mentorica diplomskim študentom s področja oblikovanja interierjev. Je ustanoviteljica zavoda aFRONT, ki v Sloveniji že deset let organizira in vodi največji arhitekturni festival Odprte hiše Slovenije in največji spletni portal sodobne slovenske arhitekture www.odprtehisleslovenije.org. Odprte hiše Slovenije OHS so del največjega svetovnega arhitekturnega festivala Open House Worldwide. Festival OHS je bil v Sloveniji nagrajen z najvišjo slovensko nagrado s področja arhitekture Plečnikovo medaljo.

Za svoje delo je prejela Plečnikovo medaljo tudi za projekt Igriva arhitektura, ki se ukvarja z izobraževanjem otrok o arhitekturi in zlato medaljo na mednarodnem bienalu industrijskega oblikovanja BIO 16. S svojim delom sledi poslanstvu, ki se zavzema za dvig prostorske kulture in uveljavitev najvišjih standardov v arhitekturi, saj je prostor v prvi vrsti namenjen ljudem. Trdno verjame, da samo s sodelovanjem lahko ohranimo in ustvarimo boljši prostor za našo prihodnost.

VIZIJA: GRADITI

Brez kančka dvoma lahko napišem, da ni nikogar v Sloveniji, ki o lesu ne bi vedel povedati kaj pozitivnega in vznesenega.

Recimo: da ima vrsto zelo koristnih in merljivih lastnosti: uporaba lesa in lesnih izdelkov bistveno prispeva k zniževanju izpustov CO₂, in povečujejo ponore CO₂, predstavlja obnovljiv vir energije, leseni izdelki so lahko trajni, lahko jih recikliramo ali uporabimo večkrat. Da je zelo uporaben gradbeni material nizke teže in velike nosilnosti, z odličnimi trdnostnimi in izolativnimi lastnostmi. In ne nazadnje, da je iz lesa mogoče narediti večino stvari, ki jih uporabljamo v vsakdanjem življenju.

Lesene stavbe omogočajo zdrave bivalne razmere – les prijetno diši, ne oddaja škodljivih snovi in ne povzroča alergij, v prostorih uravnava vlažnost zraka in je antistatičen. Z uporabo lesa blažimo podnebne spremembe in posredno skrbimo za naše gozdove. Z umno povečano uporabo lesa v vsakdanjem življenju bi si lahko oblikovali trajnostni prostor za naše bivanje in zagotovili skupno blaginjo. In bilo bi nam lepo.

O prednostih in nujnostih uporabe lesa se načeloma strinjamo – vsi. Zeleno in trajnostno usmeritev našega gospodarstva in ekonomije podpira država. Z vizijami, zakoni, uredbami, akcijskimi načrti, smernicami ... Slovenski les, če želimo izkoristiti njegov gospodarski potencial, moramo predelati v izdelke z visoko dodano vrednostjo v Sloveniji in jih potem uspešno prodati. Samo na takšen način imajo zastavljene strateške usmeritve smisel in bodo prispevale k domačemu gospodarskemu razvoju, posledično tudi ekonomski in družbeni blaginji. A to še vedno ni prioriteta.

Obilni domači ponudbi hlodovine navkljub v Slovenijo še vedno uvažamo lesene proizvode z visoko dodano vrednostjo. Predvsem zaradi tega, ker doma še vedno nimamo visokotehnološkega lesnopredelovalnega centra. Da ga/ju/jih Slovenija nujno potrebuje, je zapisano tudi v Akcijskem načrtu. A od strategije do realizacije se vedno kje zatakne. Takšni centri naravno surovino spremenijo v visokotehnološki izdelek. Zanimiv za inženirje, statike, arhitekto, investitorje in nove lastnike. Tudi z ekonomskega vidika.

Z Uredbo o zelenem javnem naročanju smo si predpisali obvezno uporabo najmanj 30 odstotkov lesa in lesnih tvoriv, ki so v stavbo vgrajena (brez notranje opreme) gledano na prostornino vseh vgrajenih materialov. Pa zato nimamo več (javnih) stavb zgrajenih iz lesa.

ZAKAJ GRADIMO MALO ALI SKORAJ NIČ JAVNIH STAVB? ZAKAJ NE UPORABLJAMO LESA?

Imamo vrtce, nekaj telovadnic, večjih športnih objektov, prileskov k šolam, razglednih stolpov in opazovalnic, vrsto zanimivih enodružinskih hiš in vzorčnih večstanovanjskih stavb. Ne premoremo pa javnih stavb, ki bi les kot tradicionalen gradbeni material uporabljale na sodoben, času primeren način. Takšnih, ki bi jasno izkazovale trajnostno usmeritev države in skrb za naše okolje, ljudi in kulturo.

A na področju arhitekturnega načrtovanja in izgradnje pomembnih javnih stavb ni najhujše to, da niso iz lesa. Morda je zaskrbljujoče, da jih nimamo. Takšnih sodobnih, trajnostnih, atraktivnih, lepih, dovolj prostornih in uporabnih. Mesto Ljubljana še danes nima razvitega značaja prestolnice z ustreznimi stavbami za državne protokole, ministrstva, upravne stavbe, fakultete, muzeje, znanstvena središča, narodno knjižnico in druge. Za nekatere od naštetih sicer že obstajajo projekti, vendar ostajajo neizvedeni. To so poleg NUK-a II in SNG Drama Ljubljana še Potniški center Ljubljana, sodna stavba, Prirodoslovni muzej Slovenije, umetniške akademije, ministrstva na Dunajski cesti ...

Nimamo tudi slovenskega centra "Proles". Tudi učinkovitost avstrijskega vzornika »Proholz«, ki s promocijo ozavešča o ekoloških, gospodarskih in tehnoloških prednostih lesa kot gradbenega materiala ter spodbuja njegovo večjo uporabo, se zavzema za povečanje obsega gradnje z lesom z zglednimi primeri in strokovnimi informacijami, nas ne prepriča o njegovi nujnosti.

Situacije, v kateri smo, v njenem bistvu ne razumem. Zakaj gradimo malo ali skoraj nič javnih stavb? Zakaj ne uporabljamo lesa?

Zgrajene stavbe bi imele v hipu neverjetno pozitiven učinek ... bile bi atraktivne, slehernik bi jih lahko obiskal in se na lastne oči prepričal, začutil in prepoznal bistvo. Takšne stavbe bi zelo jasno in enostavno sporočale to, o čemer že leta pišemo, govorimo in pričujemo pričane. Da znamo, vemo, hočemo in zmoremo biti sodobna, napredna, trajnostna in zelena država, ki s svojim naravnim bogastvom ravna v duhu dobrega gospodarja, spoštuje vrednote, skrbi za ljudi in jim omogoča kulturno življenje. Tudi v kakovostni javni arhitekturi.



doc. dr. Iztok Šušteršič, univ. dipl. inž. grad., vodja raziskovalne skupine za trajnostno gradnjo z obnovljivimi materiali na InnoRenew CoE

Dr. Iztok Šušteršič je vodja raziskovalne skupine za trajnostno gradnjo z obnovljivimi materiali v centru odličnosti InnoRenew CoE. Pred tem je bil aktiven tako pri akademskih raziskavah na Univerzi v Ljubljani kot tudi v projektantski praksi v podjetju CBD, d.o.o. Do sedaj je vodil več kot 200 gradbenih projektov in koordiniral ali sodeloval pri 10 nacionalnih in mednarodnih raziskovalnih projektih na temo lesenih in hibridnih konstrukcij, novih adhezivov in potresne analize. Skupaj s sodelavci v projektantskem podjetju je prejel nagrade za posebne dosežke na področju lesene gradnje. Dr. Šušteršič je specializiran za protipotresno projektiranje višjih lesenih objektov in protipotresno utrjevanje obstoječih zgradb. V splošnem poizkuša svoje raziskovalno delo graditi na osnovi zahtevnejših problemov, ki izhajajo iz inženirskega okolja, ukvarja pa se tudi z razvojem novih optimiziranih gradbenih proizvodov z izboljšanimi konstrukcijskimi lastnostmi in manjšim vplivom na okolje. Aktiven je pri pripravi novih Evrokod standardov, je član več COST akcij in vodja produktnega področja lesenih konstrukcij Strateških razvojno-inovacijskih partnerstev. Je avtor ali soavtor več kot 30 publikacij in soavtor dveh slovenskih ter enega evropskega patenta.

PROJEKTIRANJE VIŠJIH LESENIH STAVB

V svetu je že dlje časa prisoten trend gradnje visokih lesenih stavb. Rekordi padajo tako rekoč leto za letom, v povprečju vsako leto dobimo kako dodatno etažo. Leta 2008 postavljen Stadhaus Murray Grove v Londonu jih je imel osem. Trenutno najvišja čista lesena stavba na svetu (ne hibrid z armiranobetonskim jedrom), Mjøstårnet na Norveškem, ki v višino meri več kot 85 m (približno toliko kot novi betonski hotel na Bavarskem dvoru v Ljubljani), jih ima osemnajst. Ekipe strokovnjakov, ki so zadolžene za nove rekorderje, načeloma resnično dobro poznajo to specifično področje lesene gradnje in vse posebnosti, ki spadajo zraven. Pa še tu včasih prihaja do dilem, saj določene tematike preprosto še niso dovolj raziskane (recimo dušenje pri vetru), zato se takrat uporabljajo bolj konservativni pristopi. Po drugi strani pa v svetovnem merilu danes nove 8-etažne lesene stavbe skoraj ne najdejo več mesta v časopisju. Postale so nekaj običajnega – vsaj v srednji, zahodni in severni Evropi.

Za stavbe s 6 in 10 etažami uporabljamo izraz »mid-rise«, tj. srednje visoke, in predstavljajo največji delež trga stanovanjske gradnje. Zaradi svoje popularnosti in potenciala na trgu obnemem, a trenutno še vedno šibkega kritja v gradbenih standardih, lahko te zgradbe v prihodnje, če se jih bodo lotevale neizkušene projektantske ekipe, postanejo tudi problematične. Projektiranje lesenih konstrukcij je namreč bolj zahtevno kot pa projektiranje armiranobetonskih ali jeklenih. V primerjavi z drugimi materiali je les izrazito ortotropen material. To pomeni, da se njegovo obnašanje razlikuje v različnih smereh in glede na smer in obliko obtežbe – bistveno bolj kot pa na primer beton, kjer je največja razlika pri obnašanju v nategu ali tlaku. Pri lesu je pomembna še orientacija vlaken (vzporedno ali pravokotno), poleg razlike v tlaku in nategu pa je pomembno tudi, v kateri smeri vlaken delujejo strižne sile. Vendar so to šele osnove. Pomembno je še, s kakšno vrsto inženirskega lesa gradimo (masiven, lepljen, furnirji, plošče) ter kako elemente medsebojno spajamo. Ti spojni elementi pa ne narekujejo samo nosilnosti, pač pa tudi togost konstrukcije, ki je zelo pomembna v primeru njene dinamične analize, predvsem odziva na potres in veter. Ko v enačbo dodamo še požarne in akustične zahteve, postane projektiranje še zahtevnejše.

Pri številnih betonskih konstrukcijah lahko projektanti delajo bolj neodvisno. Statik pokriva zahteve vertikalnih in horizontalnih obtežb. Zahteve za zvočno izolativnost pri betonskih stenah in ploščah zaradi njihove

velike mase niso problematične. Požarno odpornost se rešuje s primerno debelino krovnega sloja betona. Počutje uporabnika pa je pri betonskih konstrukcijah nekoliko irelevantno – beton je hladen material, ki ni posebej prijazen na otip. Ravno obratno pa je z lesom, ki je topel in dokazano pozitivno prispeva k zdravemu bivalnemu okolju. Uporabniki objektov si zato želijo vidne lesene površine. Slednje pa vpliva na protipožarno projektiranje, ki predvsem v večjih objektih zahteva masivnejše preseke nosilnih elementov in pogojuje izbiro požarnih con. Obenem pa vpliva tudi na zvočno izolativnost, pri čemer mora arhitekt izbirati primerne sestave slojev, da zagotovi zahtevano zvočno izolativnost. Dodatni akustični ukrepi – izolativne podložke za križno lepljene stene in izolativni kotniki, ki se vse bolj uporabljajo v večstanovanjski leseni gradnji, spremenijo horizontalno togost vertikalnih nosilnih elementov (sten), kar posledično vpliva na projektiranje vetrnih in potresnih obtežb. Predvsem pri slednji moramo zagotavljati kontinuirnost obtežnega toka po višini, kar v primeru slabih arhitekturnih zasnov ni enostavno. Ne smemo pa pozabiti tudi na preboje konstrukcije zaradi strojnih inštalacij, ki so pogosto problematično poglavje pri vseh vrstah gradnje.

Zgoraj napisano bi utegnilo koga odvrniti od višje lesene gradnje, kar sicer ni moj namen. Upam pa, da bo na ta račun postavljena kakšna slaba lesena gradnja manj. Vse prej opisane težave so namreč rešljive, zahtevajo pa strokovno ekipo, ki dobro pozna leseno gradnjo in svoje znanje črpa širše kot le iz standardov. Poleg inženirjev tehniških strok je izjemno pomembna vloga arhitekta, ki začrta prve linije objekta, postavi njegov koncept in tako tlakuje pot preostalim članom ekipe. In ravno prvotna zasnova objekta predstavlja velik izziv. Izčiščenost začetnega koncepta je pri lesenih konstrukcijah pomembna bolj kot pri drugih. Omogoča kakovostno in tudi cenejšo leseno gradnjo – ne le njeno projektiranje, pač pa tudi izvedbo.

V PRIMERJAVI Z DRUGIMI MATERIALI JE LES IZRAZITO ORTOTROPEN MATERIAL.



B. Eng. Arch. Janez Koželj

WOOD – THE ONLY ALTERNATIVE FOR SUSTAINABLE TRANSFORMATION

Born in Ljubljana in 1945, architect Janez Koželj completed his long academic career at the Faculty of Architecture at the University of Ljubljana as a professor of urban design. Since 2006, he has been Vice Mayor of the City of Ljubljana with the function of City Architect. He is a designer at 3biro company, in which he promotes innovative use of wood in architecture with numerous designs.

He has published his discussions in books and numerous scientific papers and presented them at international meetings. He has exhibited his works as part of contemporary Slovenian architecture in Europe and America. His works have been featured many times in domestic and foreign architecture magazines.

Among the projects that have been completed, the most important works are: a residential building on Poljanska cesta in Ljubljana, 1988; a gym Poljane in Ljubljana, 1991; a residential building in the building island Novi Tabor in Ljubljana, 1991; a group of residential houses in the residential complex "Schiesstaette" in Graz, Austria, 1998; Portoval Entertainment Center in Novo mesto (co-authored by Jože Jaki) in 2003 and the Črni Kal Viaduct on the Klanec-Srmin highway (co-authored by designer and constructor M. Pipenbaher) in 2004.

For his works, he received the Plečnik Award in 1988, the G.B. Piranesi Award in 1992, and in 2005 the DETAIL Magazine Award for Best Architecture in Eastern Europe, and the ZAPS Golden Pencil for his work.

In the construction of large-sized wooden buildings in Slovenia, we are hampered more on the one hand, by prejudices and, on the other, by stringent regulations that do not support the faster development of modern construction with industrially treated timber structures than by engineering knowledge and experience. The permitted height of the construction is already restricted. It is important, however, that the chain of industrial woodworking and production as well as the technology of modern wood preservation, is slowly renewing and developing. Nevertheless, we

are mostly still tied to the import of glued timber structures and fasteners. Therefore, there is a lack of political support from the country and municipalities as well as systemic incentives for faster breakthroughs in timber construction. Thus, every larger or more demanding wooden facility in our country is still a unique, experimental construction, which helps us gain valuable experience and encourages us to look for new opportunities and new solutions. Especially public buildings and wooden structures are a kind of research project in our country, which is the result of special circumstances.

Therefore, there is a lack of political support from the country and municipalities as well as systemic incentives for faster breakthroughs in timber construction.

Of course nowadays, modern architecture and engineering are facing new challenges, such as climate change, energy conservation and the use of renewable resources. The growing environmental crisis reminds us that construction has caused the greatest and most direct impact on environmental risk due to the massive use of raw materials, energy and capital, which resulted in pollution and degradation. Timber construction, which, in addition to its exceptionally useful and aesthetic properties and where wood is primarily a renewable resource, is, therefore, the only alternative for the sustainable transformation of cities. Sustainable means planning and managing cities in a sustainable way, using methods and resources based on natural systems. This is also a way of sustainable forest management, which is at the same time an economic resource, a cultural asset, an ecological system, a conservation space and a biochemical factory. The purpose of sustainable resource management is to strike a lasting balance in nature, although we use it for our own needs.



B. Eng. Arch. Eva Prelovšek Niemelä, a researcher at ImmoRenewCoE

WE NEED A BIGGER PICTURE

Eva Prelovšek Niemelä is a researcher at ImmoRenew CoE Centre of Excellence and an architect. She received her education in architecture at the University of Technology and the Academy of Fine Arts in Vienna. She completed her master's degree in architecture in Ljubljana at the Faculty of Architecture. Since 2005, she has worked as a freelance architect in her studio Ateje Prelovšek, during which time she realised several objects and exhibitions at the National Gallery in Ljubljana and other galleries around Slovenia, Austria, the Czech Republic, Brazil, Macedonia and Japan.

In 2015–2017, she was the editor-in-chief of the HIŠE architectural magazine and curator and moderator of the events at Design City.

With the recent global climate strike following the general debate of the 74th session of the UN General Assembly, a clear message emerged that the time for change is here and now. The solutions are not easy and so far only those that have brought rapid economic success have survived. We developed partial solutions that answered only a fraction of the environmental problems. If we needed more insulation for the increased energy efficiency of the houses, we produced more

and consequently sold more. We have reduced energy consumption for building heating, but at the same time, we have increased the production of insulation, which at the same time has increased energy consumption in the industry and created large quantities of non-recyclable materials. Instead of partial solutions, we need a bigger picture, a big picture or a view on the whole. What brings undoubted environmental benefits and greenhouse gas reduction opportunities?

Wood has been cascading after being used in construction, allowing multiple levels of reuse. At the same time, a new tree will be already growing during its use.

We quickly find that there are not enough comprehensive studies to clearly show us the benefits of different types of construction on the environment. We know a lot about energy-efficient houses, smart technologies, insulation of materials and energy consumption during operation; we know a little less about maintenance, especially of new building materials, appliances and technologies that we incorporate into buildings; much less we know about their recycling and reuse. We must admit that we are still a long way from looking at the whole or understanding the entire life cycle of

buildings. Let's look at a comparison of the use of concrete and wood for the construction of large buildings.

Buildings are complex systems, one material affects the other and the whole building (static strength, thermal insulation, sound insulation, fire resistance, the weight of the building and foundation structure, etc.). The interdependence of all the above parameters is also evident in wooden buildings. If a solid wooden wall, which we usually place in large wooden buildings, is more heat-insulating than concrete, it is at the same time, less sound-proof in the same thickness, on the other hand, however, it is lighter, and requires considerably less energy and time to produce and assemble. Wood has been cascading after being used in construction, allowing multiple levels of reuse. At the same time, a new tree will be already growing during its use. On the other hand, concrete can only be crushed and used as an aggregate or filler. The raw materials from which we produce it, cannot be recovered. Wood can be reused in several ways - for smaller structures, joinery, various wooden products and at the end of its life cycle as a fuel. Therefore, just a quick look at the life cycle of wooden buildings shows that timber structural systems create a smaller environmental footprint than other equivalent building materials.

To get things right, at InnoRenewCoE we are actively looking at the whole. We carry out life cycle analyses (LCAs, life cycle assessment) of building materials and wooden buildings. They are an objective way of proving the environmental benefits

of wooden structures of all sizes. Just looking at the whole will give satisfactory results and answers to the question of how to build in the future.

Large-sized wooden buildings are a good indicator of all the benefits of wooden construction, as they are generally used in solid cross-laminated panels, which are a very attractive material for architects. Construction is fast, quiet and clean. Architects are impressed by the level of precision that cannot be compared to dirty, relatively shallow and long-lasting concrete construction. Also, the visual sensation and the feeling of thermal comfort are much better in a wooden building. According to our Institute's research, wooden surfaces have a positive effect on the well-being and stress reduction in the work environment. Better air quality with less harmful emissions is also observed in wooden structures. Wood is a renewable natural raw material. Tree growth is accelerated in some countries by plantations of fast-growing species, which with new technologies, despite their low density and poor mechanical properties, can be used in demanding applications such as structures. With proper forest management and smart timber use according to the principles of cascading, we will always have enough timber.

If we want to make radical changes towards environmentally friendly construction, we need to accelerate the timber construction of all dimensions, while completely letting go of all fossil raw materials. This should become our common mission in the fight against climate change.



Dr. Jure Kotnik, architect and editor

WOOD CONSTRUCTION: LOWER PRICE, BETTER RESULTS.

Jure Kotnik is an architect and editor who runs his studio in Ljubljana and Paris. He works in various fields of architecture, research and design. He is the author of numerous architectural solutions that have attracted media attention. These include Container Cottage 2+, a mobile lighthouse for the Port of Paris, Kecek Kindergarten and temporary Ajda Kindergarten. Kotnik writes regularly for various magazines and is the author of many books. As the author of the first book in the field of container architecture, *Container Architecture* (LINKS, 2008), which became an international bestseller, he won the Plečnik Award in 2009. Kotnik has designed and curated the first Container Architectural Exhibition in many cities in Europe and the USA. In the last five years, he has devoted himself to the architecture of buildings for educational purposes through projects in Slovenia, France, Cyprus and Belarus. He has written two books and several articles on contemporary kindergarten design. Since 2011 he has worked as an architectural consultant for the World Bank and the Council of Europe Development Bank (CEB) in the field of optimization and design of pre-school and school facilities. In 2012 he lectured as a visiting professor at the Ecole Speciale' Architecture in Paris. In 2014, he got his PhD with a research thesis on hybrid architecture methodology. Since 2015, he has been working with Steve Jobs School to develop future learning environments. In 2018, he was awarded the Europe 40 Under 40 Award, for the most innovative young architects and designers in Europe.

Construction in wood adheres to some stereotypes, some of them more, others less true. Certainly wood construction, especially with solid wood, represents the highest standard of construction and is particularly suitable for our forest-rich environment, as the raw material is in abundance. A series of positive effects include its sustainability; wood is the only building material that has a positive carbon footprint. Recently, people have been increasingly adopting wooden construction, also because of prefabricated construction and its coincidence with modern principles and values. In constructing public buildings, this trend is slightly slower. A breakthrough was the educational facilities, especially kindergartens. Studies such as *School without Stress* (SOS, Moser, 2009) show the particular suitability of wooden construction for education. Students in classrooms built with solid wood, on average, have a lower heart rate, have an easier time to concentrate

on studies and are less stressed on average than classmates in traditional concrete construction. Wood, therefore, affects the heart, blood vessels, nervous system and improves quality of life.

The stereotypes that do not necessarily hold are the stereotypes of expensive wooden construction. This can be conditionally correct and especially true when the possibilities for optimal and quality design of buildings are neglected. The latter is influenced by the whole range of factors from poorly prepared project tasks to the criterion of the lowest price of project documentation to the failure of the criteria for planners and contractors. Traps also occur with unprepared clients, and the tradition of planning, constructing and using buildings right down to the legislation and its interpretation on administrative units. This spiral, highlighting only legal factors, leads to unnecessarily more expensive public buildings than those on the market, both for construction and later for maintenance.

Wood, therefore, affects the heart, blood vessels, nervous system and improves quality of life.

Some countries, including France, do things differently and choose for construction consortiums from design to implementation, where there is in everyone's interest to select the best collaborators, as responsibility for the final financial impact of the project is passed through the various stages and contractors. This kind of approach also enables the profiling of the profession and thus with each project better final results. This makes it easier to avoid the fact that a facility with the same purpose and capacity can reach multiple of the market price, which should be unacceptable for taxpayers, especially when money is wasted on walls, rather than spent on better equipment, software or users.

The end-user focus principle combined with investment optimization is also pursued through design. An example of it is a sports kindergarten in Minsk, built by the renowned Slovenian company for prefabricated construction in the Belarusian

capital in 2016. The original project of local designers was estimated at € 4.5 million. By pre-designing, we have provided not only the largest wooden public building instead of concrete but also the first public building in the country with an A + energy certification. The facility was designed with a series of innovative elements (façade's goals, hybrid sports equipment in the interior, a series of didactic corners) and the project was awarded the gold medal of the Biennale of Architecture in Minsk (2017) for a final investment price of € 2.1 million.

Another example is the kindergarten in Šmartno pri Slovenj Gradcu, built from a massive CLT structure with a wooden facade, typologically pursuing an open floor plan with connections between playgrounds and opening to common areas as extensions of playgrounds. The latter encourages meetings and communication between children of different groups and ages, as well as contact with different backgrounds and experiences. The kindergarten has 65 different play areas, for

example, a didactic staircase with a hiding place under it and is the first kindergarten in our country to have an indoor slide. It should be noted that the amount of investment, together with external arrangements and equipment, is more than three times lower than in the kindergarten of the same capacity built in the capital, and lower than all comparable investments in recent years across the country, at € 1.45 million. It is also important to note that a lower price does not mean lower quality - on the contrary. The renowned English magazine *The Economist* placed Šmartno kindergarten due to its innovative educational environment in an article called "Better Class" (McDermott, 2017) to a kindergarten of the future place, and the Wooden Icon Award (2017) was given by a local professional public to the same. Both of these kindergartens were highlighted by the OECD as an example of best practice in educational investment. This proves that public buildings can be constructed cheaper, with better quality materials and, above all, can compete with its content on the global market.



Lenka Kavčič, architect
Director of the OPEN HOUSE of SLOVENIA architectural festival

VISION: TO BUILD

Lenka Kavčič is an architect, mentor, lecturer and advocate for architecture. She is active in the field of education and awareness-raising on quality built space in Slovenia and abroad. Her guiding principle is a sustainable, prudent and reasonably designed space that offers people the opportunity to spend quality time at home or work. She deals with innovative approaches and interventions into space and is committed to raising the standard of the culture of living. She is a registered DGNB professional and advises in the field of sustainable planning. She encourages investors, buyers and the general public to use great sustainable architectural solutions.

She gained her experience in recognized domestic and foreign institutions. From 2009 to 2013, she was Vice Dean at the College of Design. As a visiting professor at Politechnica in Milan, she has been a mentor to undergraduate students in interior design. She is the founder of the aFRONT institute, which has been organizing and running the largest Open House of Slovenia architectural festival and the largest online portal of contemporary Slovenia architecture www.odprtehiselovenije.org, for a decade. Open House of Slovenia or OHS is part of the world's largest Open House Worldwide architectural festival. The OHS festival in Slovenia was awarded the highest Slovenian award in the field of architecture, the Plečnik Medal.

She has also received the Plečnik Medal for her work, i.e. the Playful Architecture project, which deals with the education of children on architecture, and a gold medal at BIO 16 International Biennial of Industrial Design. With her work, she follows a mission, which is advocating for raise in space culture and enforcement of the highest standards in architecture as space is primarily for people. She firmly believes that only through collaboration we can preserve and create a better place for our future.

Without a doubt, I can say that no one in Slovenia would not be able to say something positive and uplifting about wood.

Let's just name them: it has several very useful and measurable properties, the use of wood and wood products significantly contributes to reducing CO₂ emissions and increasing CO₂ sinks, it represents a renewable energy source, wooden products can be durable, can be recycled or reused. It is a very useful material of low weight and high load-bearing capacity, with excellent strength and insulation properties. And last but not least, it is possible to make most of the things we use in our everyday lives out of wood.

Wooden buildings allow for healthy living conditions - wood smells good, does not emit harmful substances and does not cause allergies, regulates humidity in the rooms and is antistatic. By using wood, we mitigate climate change and indirectly care for our forests. With the intelligently increased use of wood in our daily lives, we could create a sustainable living space and ensure shared prosperity. And it would be nice for us.

In principle, we all agree on the benefits and necessities of using wood. The green and sustainable orientation of our economy are supported by the country. With visions, laws, regulations, action plans, guidelines, etc. To utilize its economic potential, Slovenian wood must be processed into high value-added products in Slovenia and then successfully sold. Only in this way do the set out strategic orientations make sense and will contribute to domestic economic development, and consequently to economic and social prosperity. But that is still not a priority.

Despite the abundant domestic supply of logs, we are still importing high value-added wooden products to Slovenia. Mainly because we still do not have a high-tech wood processing centre at home. The Action Plan also states that Slovenia urgently needs it or needs a couple or more of them. But from strategy to realization, there is always a point that sticks in the craw. Such centres turn natural raw material into a high-tech product. It is interesting for engineers, statics, architects, investors and new owners as well as from an economic point of view.

The Decree on Green Public Procurement stipulates the mandatory use of at least 30% of the wood and wood products that are installed in the building (without interior equipment) in terms of the volume of all materials used. That is why we no longer have (public) buildings built of wood.

We have kindergartens, several gyms, major sports facilities, school wooden extensions, lookout towers and observatories, a range of interesting single-family homes and exemplary multi-dwelling residential buildings. However, we do not have public buildings that use wood as a traditional building material in a modern, contemporary way - such buildings that would demonstrate the country's sustainable orientation and concern for our environment, people and culture.

But in the field of architectural design and construction of important public buildings, it is not the worst that they are not made of wood. It may be more worrying that we do not have them at all - such modern, sustainable, attractive, beautiful, spacious and useful enough buildings. The city of Ljubljana does not yet have the developed character of the capital, with appropriate buildings for state protocols, ministries, administrative buildings, faculties, museums, scientific centres, the National Library and others. While some of the projects already exist, they are put on hold. These are, in addition to National University Library II and Slovenian Nati-

Why are we building
so little or almost no
public buildings?
Why don't we use wood?

onal Theatre Drama Ljubljana, the Ljubljana Passenger Centre, the Courthouse, the Natural History Museum of Slovenia, the Academy of Arts, the Ministry on Dunajska cesta, etc.

We also do not have a Slovenian "Proles" Centre. Even the effectiveness of the Austrian role model "Proholz", which by raising awareness of the ecological, economic and technological advantages of wood as a building material and encouraging its greater use, advocates to the increase the volume of timber construction with good examples and expert information, does not convince us of its necessity.



Assist. Prof. Iztok Šušteršič, BSc Eng.
Research Group Leader on Sustainable Building with Renewable Materials at InnoRenew CoE

DESIGNING HIGHER WOODEN BUILDINGS

Dr. Iztok Šušteršič is the research group leader in sustainable building with renewable materials at the centre of excellence InnoRenew CoE and an assistant professor at the University of Primorska. Before he was working in both academic research at the University of Ljubljana, as well as in private engineering practice CBD d.o.o. So far, he has led over 200 building projects and worked on or coordinated 10 national and international research projects dealing with timber and hybrid timber structures, new adhesives and seismic analysis. With his colleagues from the design office he received awards for special achievements in timber building design. Dr. Šušteršič is specialised in seismic design of taller timber buildings and seismic retrofitting of existing buildings. In general, he tries to build his research work around more complex problems originating from the engineering sector, as well as developing new optimised building products with greater benefit for the users and a lower impact on the environment. He is active in the preparation of new Eurocode standards, member of several COST actions and head of timber structures in the Strategic research-innovation partnerships. He is the author or co-author of over 30 publications, two national and one European patent.

The trend of tall wooden buildings has been present in the world for a long time. Records are falling almost year after year, with an average of one additional storey added to a wooden structure each year. The StadthausMurrayGrove in London was erected in 2008, with 8 of them. The tallest clean wooden building in the world (not a hybrid with reinforced concrete core) is currently Mjøstårnet in Norway, measuring more than 85 m in height (about the same as the new concrete hotel at the Bavarian Palace in Ljubljana) and having 18 storeys. The teams of experts in charge of the new recorders are in principle really well versed in this specific area of timber construction and all the specialities that lie with it. However, sometimes there are dilemmas, as certain topics are simply not yet sufficiently explored (say wind damping), which is why more conservative approaches are used at the time. On the other hand, nowadays, the new 8-storey wooden buildings in the world find almost no place in the newspaper. They have become commonplace - at least in Central, Western and Northern Europe.

For 6 to 10-storey buildings we use the term "mid-rise", i.e. medium-high, which represent the largest share of the housing construction market. Due to their popularity and potential in the market, but having poor coverage in building standards, these buildings may become problematic in the future if undertaken by inexperienced design teams. Designing wooden structures is more challenging than designing reinforced concrete or steel buildings. Compared to other materials, wood is a distinctly orthotropic material. This means that its behaviour varies in different directions and depends on the direction of the load - much more so than, for example, concrete, where the greatest difference is in the behaviour in tension or pressure. For wood, the orientation of the fibres (parallel or perpendicular) is also important as well as in which direction the fibres are acting shear forces, in addition to

The situation we are in, I do not really understand. Why are we building so little or almost no public buildings? Why don't we use wood?

The built buildings would have an incredibly positive effect in an instant. They would be attractive; everyone could visit them and see for themselves, feel and recognize the essence. Such buildings would communicate very clearly and easily what we have been writing, talking about and convincing for years the already convinced people. To know, want and be able to be a modern, progressive, sustainable and green country that, with its natural wealth, acts in the spirit of a good master, respects values, cares for people and enables them to live a cultural life. Even in quality public architecture.

the difference in pressure and tension. However, these are just the basics. What is important is what kind of engineered wood we build (solid, glued, veneers, panels) and how the elements are interconnected. These connecting elements dictate not only the load-carrying capacity but also the rigidity of the structure, which is very important in the case of its dynamic analysis, especially its response to earthquakes and wind. When fire and acoustic requirements are added to the equation, design becomes even more challenging.

For many concrete structures, designers can work more independently. Static covers the requirements of vertical and horizontal loads. Due to their large mass, the sound insulation requirements of concrete walls and slabs are not problematic. The fire resistance is solved by the appropriate thickness of the concrete cover layer. However, user satisfaction is somewhat irrelevant in concrete structures - concrete is a cold material that is not particularly touch-friendly. On the contrary, the wood is warm and proven to contribute to a healthy living environment. Facility users, therefore, want visible wooden surfaces. The latter, however, influences fire design, which, especially in larger buildings, requires more massive cross-sections of load-bearing elements and determines the choice of fire zones. At the same time, it also affects the sound insulation where the architect must choose the appropriate layer compositions to provide the required sound insulation. Additional acoustic measures - insulating washers for cross-laminated walls and insulating angles, which are increasingly used in multi-dwelling wooden structures, changing the horizontal rigidity of the vertical supports of the elements (walls), which in turn affects the design of wind and earthquake loads. Especially with the latter, we must ensure continuity of the load current in height, which is not easy in the case of poor architectural designs. We should also not forget the breakages of the structure due to mechanical installations, which are often a problematic chapter in all types of construction.

The above-cited could dissuade anyone from building taller wooden construction, which is not my intention. I hope, however, that there will be less weak wood constructions built on this account. All the problems described above are solvable, but they require an expert team that is well-versed in wooden construction and draws its knowledge beyond standards. In addition to the technical engineers, the role of the architect who draws the first lines of the building sets its concept and thus paves the way for the rest of the team is extremely important. And precisely the original design of the facility is a major challenge. The refinement of the initial concept is more important in wooden structures than in others. It enables quality and cheaper wooden construction - not only its design but also its execution.

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