



Kompozitni lagani panel s integriranom nosivom konstrukcijom

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GRAĐEVINSKI FAKULTET

FACULTY OF CIVIL ENGINEERING

Sadržaj

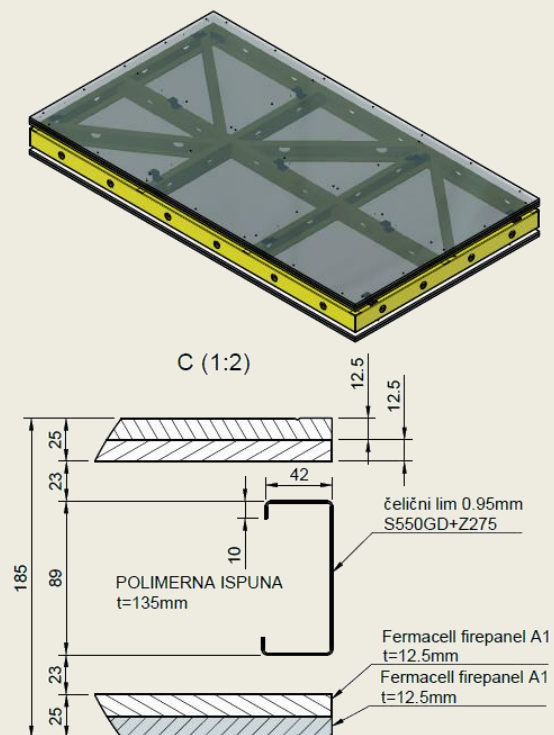
- Uvod
- Ispitivanje komponenta
 - Toplinska svojstva komponenta
 - Higroskopna svojstva komponenta
 - Ponašanje u požaru
- Požarna otpornost panela
- Akustična svojstva panela
- Toplinska svojstva panela
- Toplinski mostovi



Uvod

Kompozitni lagani panel s integriranom nosivom konstrukcijom

- Slojevi
 - 2x Firepanel ili 1x Firepanel + 2x GVP
 - Polimerna ispuna 13,5 cm
 - 2x Firepanel ili 1x Firepanel + 2x GVP

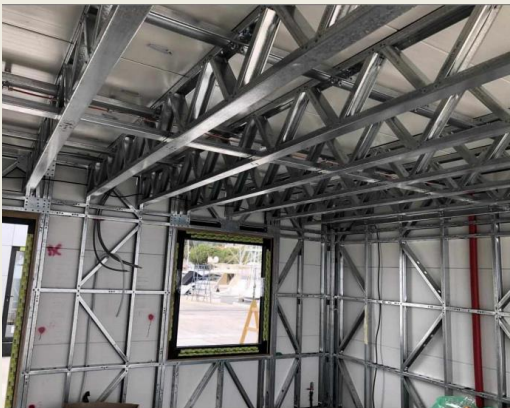


Sufinancirano sredstvima Europskog fonda za regionalni razvoj

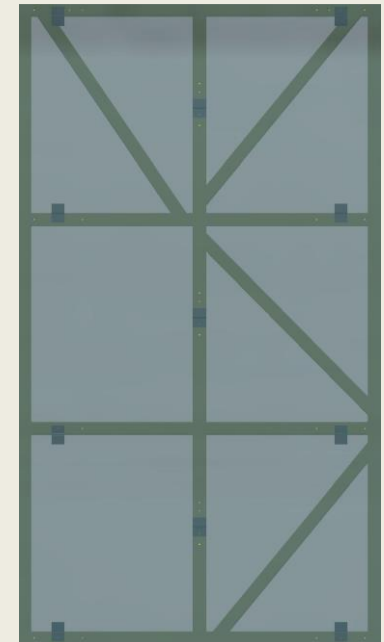
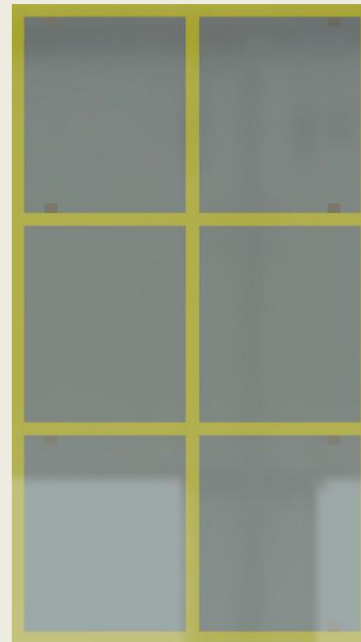


Uvod

- Prednosti
 - Problem nedostatka kvalificirane radne snage
 - Izrada panela u tvornici
 - Kontrola ulaznih materijala i sirovina
 - Nema utjecaja vremenskih neprilika
 - Kontrola kvalitete gotovog proizvoda
 - Manje građevinskog otpada
 - Brza i jednostavna ugradnja

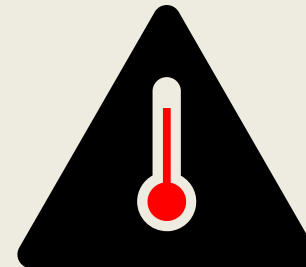


Izvor: Tehnoplast profili d.o.o.

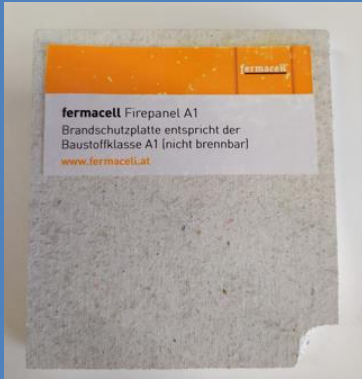


Uvod

- Izazovi
 - Požarna otpornost
 - Relativno velika količina čelika
 - U vrijednost
 - Ugradnja instalacija
 - Buka



Ispitivanje komponenta

			
	PUR pjena	Firepanel (FP)	Gips-vlaknasta ploča (GVP)
Gustoća uzorka [kg/m ³]	40 45 50 60	1200 - 1300	1200 - 1300
Ispitivanje	Specifični toplinski kapacitet		
	Toplinska vodljivost		
	Promjena mase u funkciji temperature		
	Higroskopna svojstva		

Toplinska svojstva komponenta



Promjena mase u ovisnosti o
temperaturi



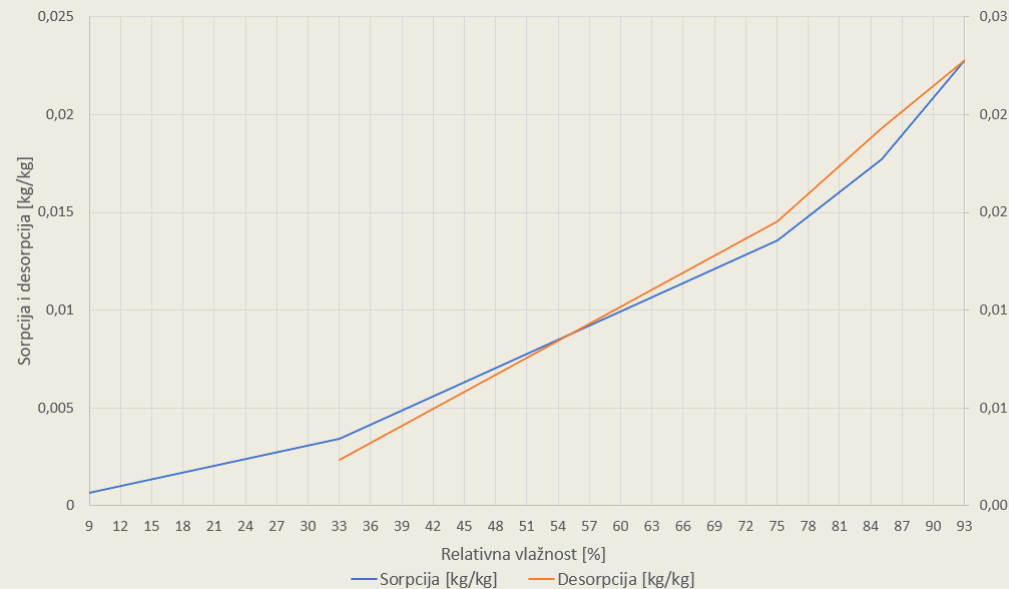
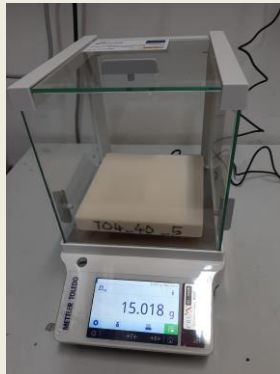
Promjena specifičnog
toplinskog kapaciteta u
ovisnosti o temperaturi



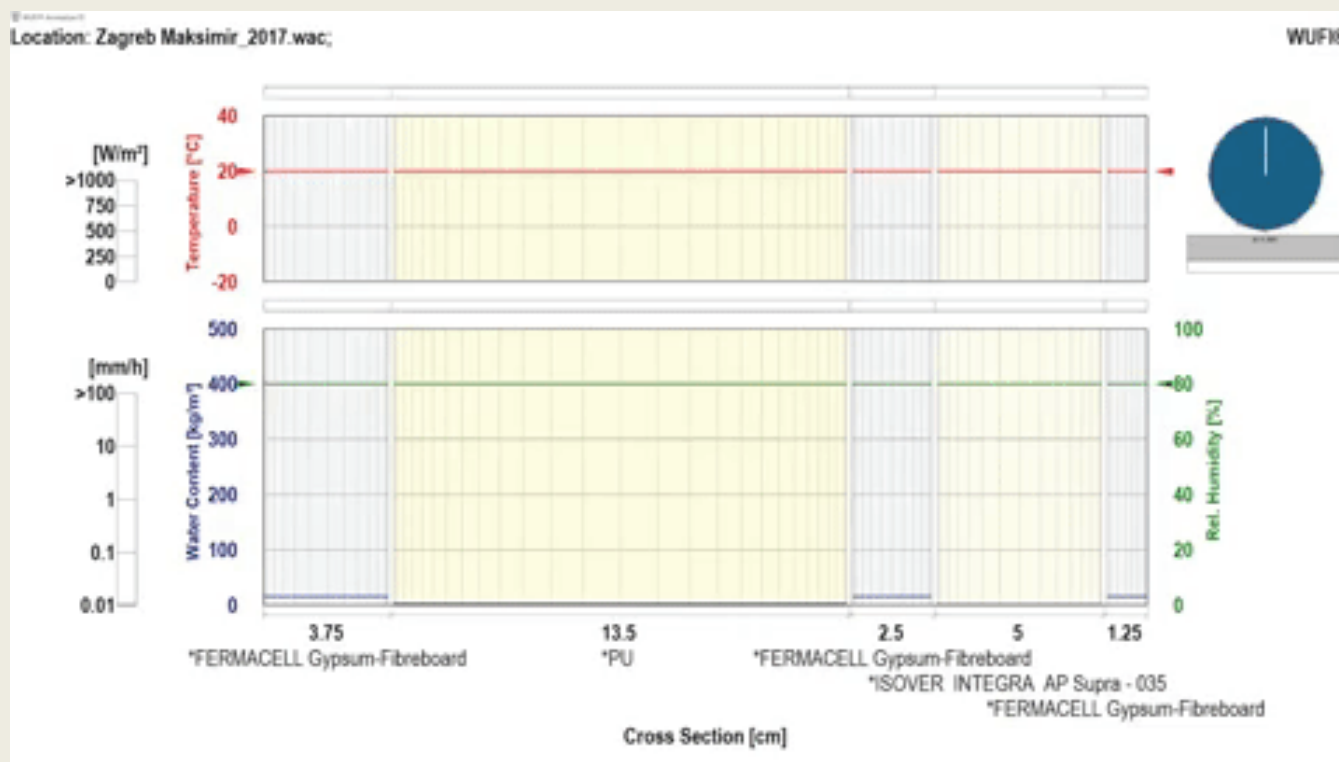
Promjena toplinske
vodljivosti u ovisnosti o
temperaturi

Higroskopska svojstva komponenta

- Promjena mase u vremenu pri različitim vlažnostima okoliša



Higroskopna svojstva panela



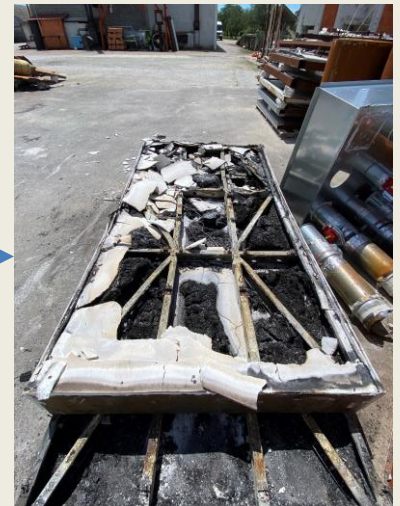
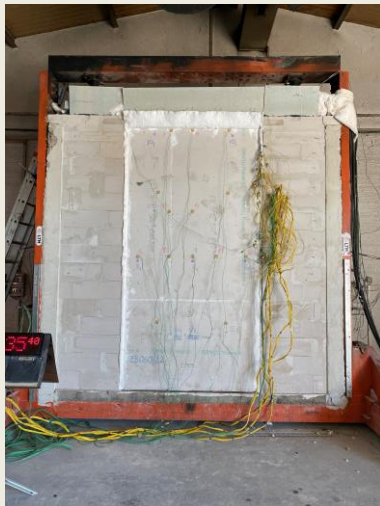
Ponašanje u požaru

- 5 uzoraka nosivog panela dimenzija 1500 x 2995 mm
- Ploče:
 - Firepanel A1 (FP)
 - Gips-vlaknasta ploča (GVP)

Uzorak	Konfiguracija	Mehaničko opterećenje
Panel 1	3FP-PUR-3FP	37,5 kN (25 kN/m')
Panel 2	FP-2GVP-PUR-2GVP-FP	22,5 kN (15 kN/m')
Panel 3	2GVP-FP-PUR-FP-2GVP	37,5 kN (25 kN/m')
Panel 4	2FP-PUR-2FP	22,5 kN (15 kN/m')
Panel 5	2FP-PUR-2FP	22,5 kN (15 kN/m')

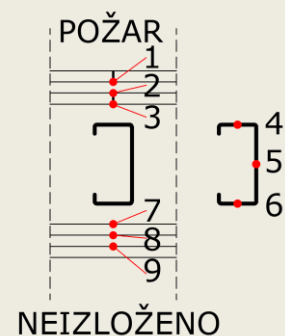
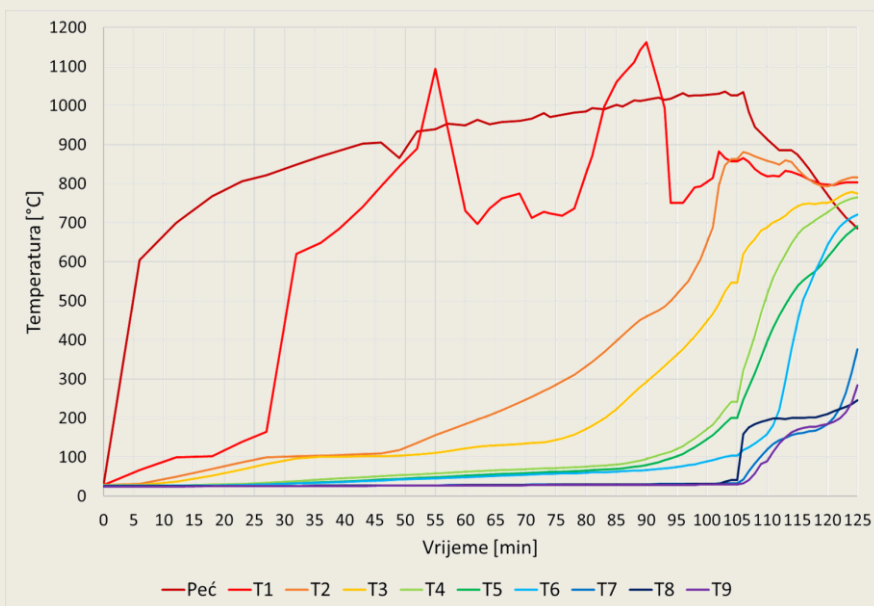
Ponašanje u požaru

- Ispitivanje provedeno prema normama:
 - HRN EN 1363-1:2020 Ispitivanje otpornosti na požar – 1.dio: Opći zahtjevi (EN 1363-1:2020)
 - HRN EN 1365-1:2012 + Ispr.1:2013 Ispitivanja otpornosti na požar nosivih elemenata - 1. dio: Zidovi (EN 1365-1:2012/AC:2013)
 - HRN EN 1365-1:2012 Ispitivanja otpornosti na požar nosivih elemenata – 1. dio: Zidovi (EN 1365-1:2012)



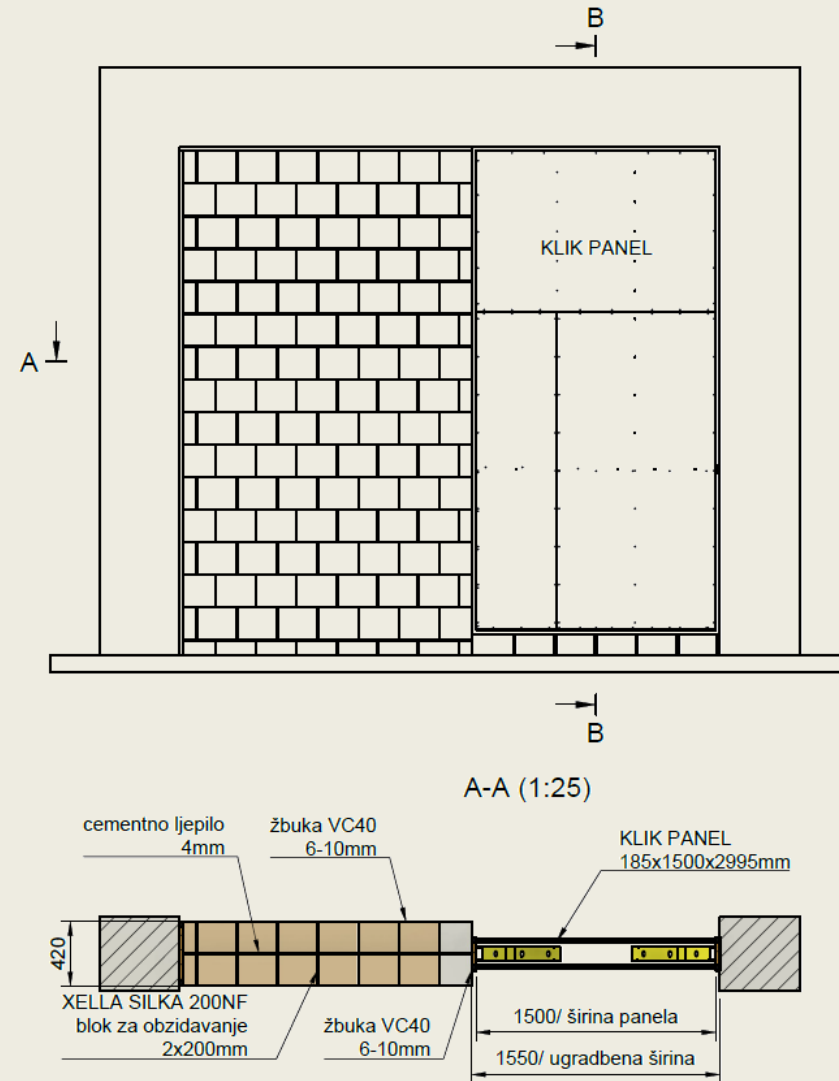
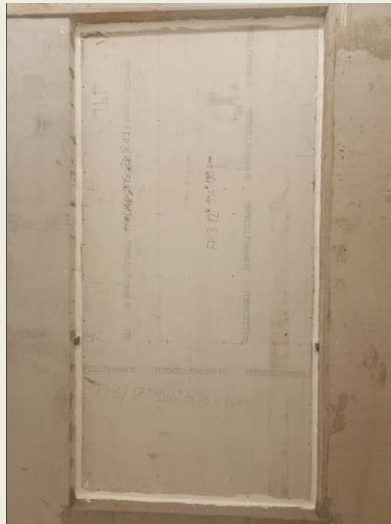
Ponašanje u požaru

Uzorak	Konfiguracija	Prekid ispitivanja
Panel 1	3FP-PUR-3FP	107. minuta
Panel 2	FP-2GV-PUR-2GV-FP	108. minuta
Panel 3	2GV-FP-PUR-FP-2GV	96. minuta
Panel 4	2FP-PUR-2FP	67. minuta
Panel 5	2FP-PUR-2FP	50. minuta



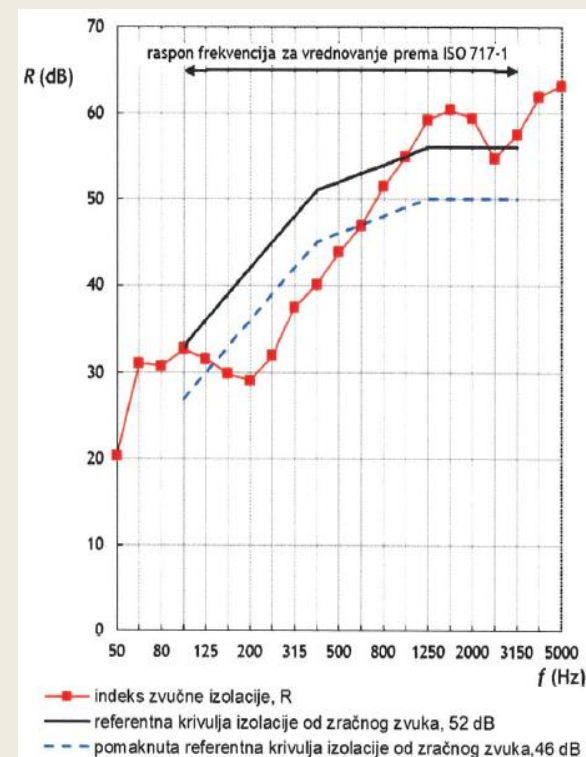
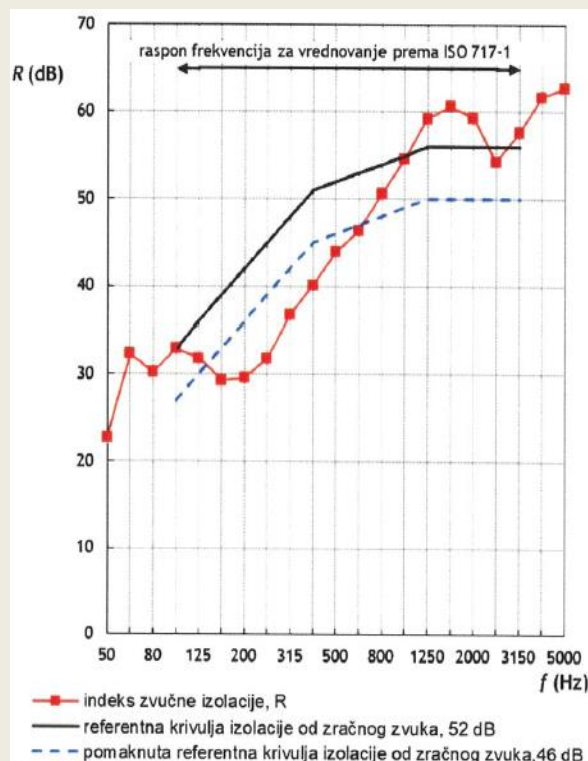
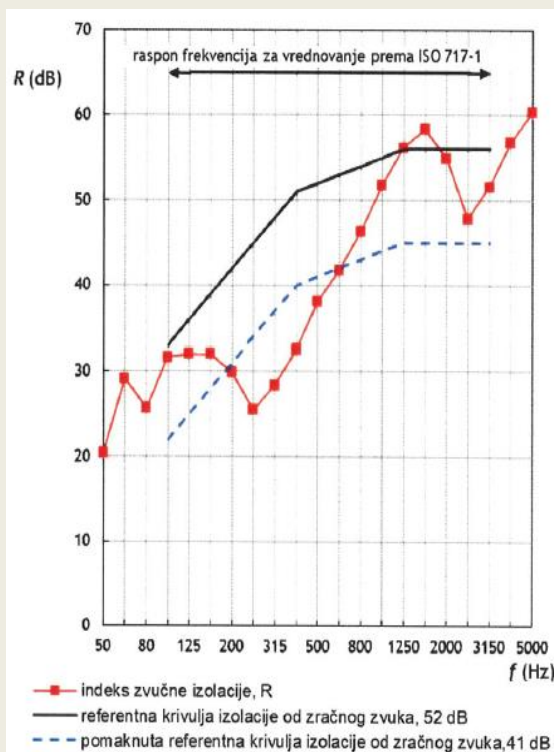
Akustična svojstva

- Ispitani cijeli paneli
- Laboratorijsko mjerenje zvučne izolacije građevnih dijelova zgrade
 - HRN EN ISO 10140-1:2016
 - HRN EN ISO 10140-2:2010



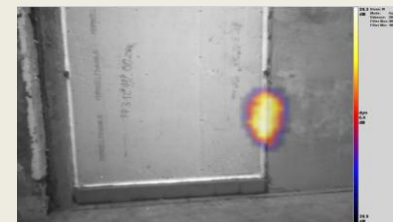
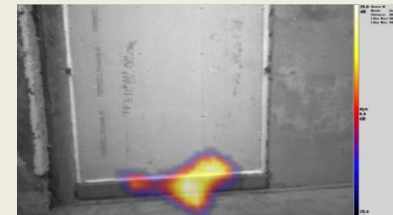
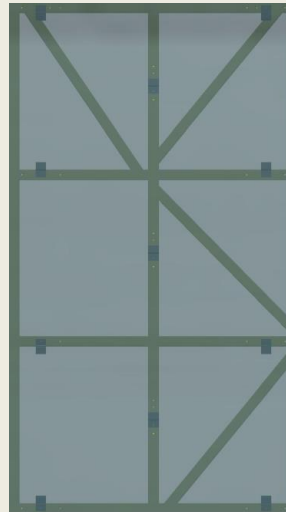
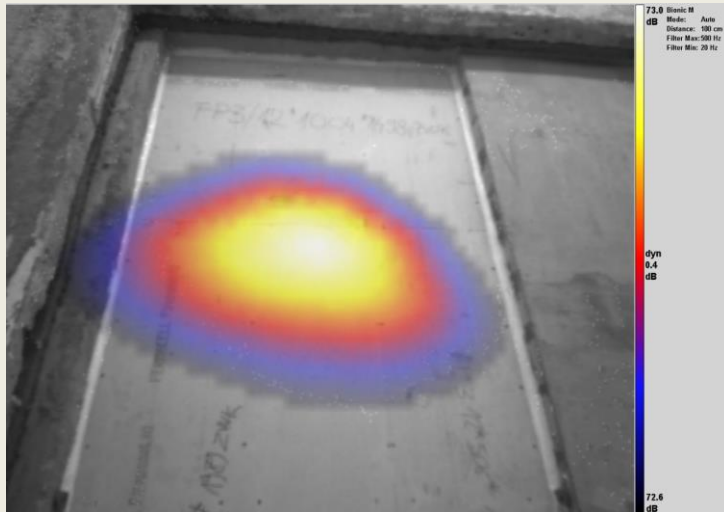
Akustična svojstva

- 2x Firepanel, obostrano
- $R_W(C; C_{tr}) = 41 \text{ (-2;-5) dB}$
- 3x Firepanel, obostrano
- $R_W(C; C_{tr}) = 46 \text{ (-2;-6) dB}$
- 2x GVP + Firepanel, obostrano
- $R_W(C; C_{tr}) = 46 \text{ (-2;-6) dB}$



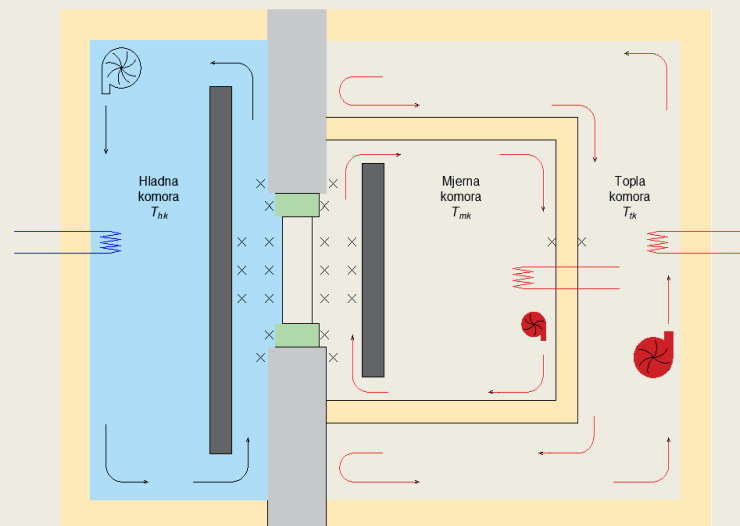
Akustična svojstva

- Akustična kamera
- Koncentrirani izvori zvuka:
 - Spoj panela i zida
 - Spoj horizontalnog, vertikalnog i dijagonalnog elementa

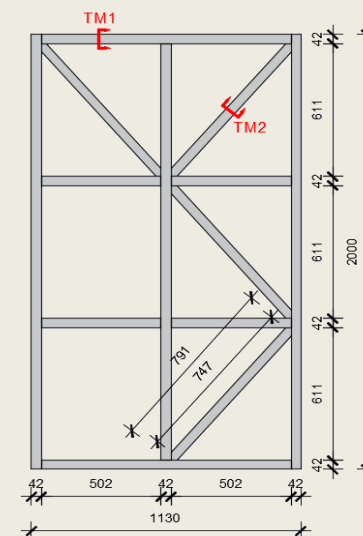


Toplinska svojstva

- Umjerena i zaštićena vruća komora
 - HRN EN ISO 8990:1998
 - Temperaturna razlika između komora
 - Stacionarni toplinski tok
- Razlika između mjerenja i 2D proračuna < 10%

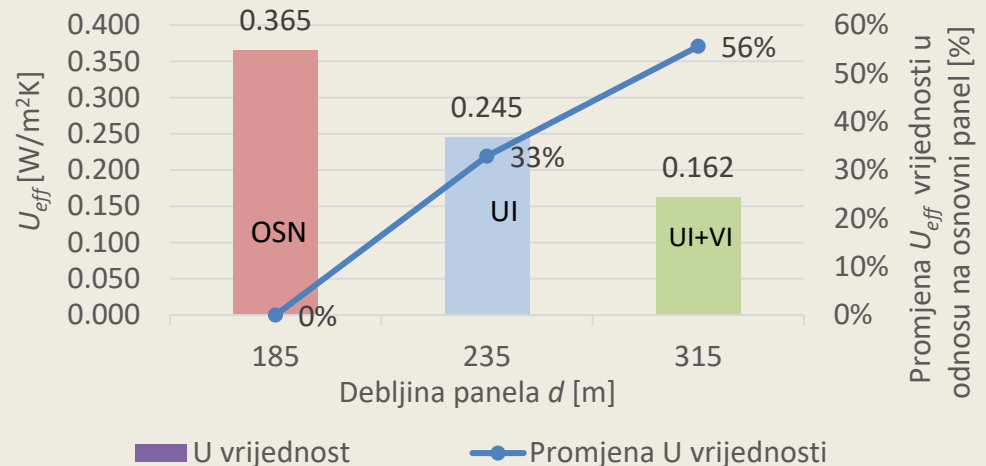


	Debljina panela [mm]	U_{eff} - mjereni [W/m ² K]	U_{eff} - proračunski [W/m ² K]
S dijagonalnim ojačanjem	185	0,395	0,391
Bez dijagonalnog ojačanja	185	0,387	0,354
S dijagonalnim ojačanjem	210	0,364	0,380
Bez dijagonalnog ojačanja	210	0,364	0,343



Toplinska svojstva

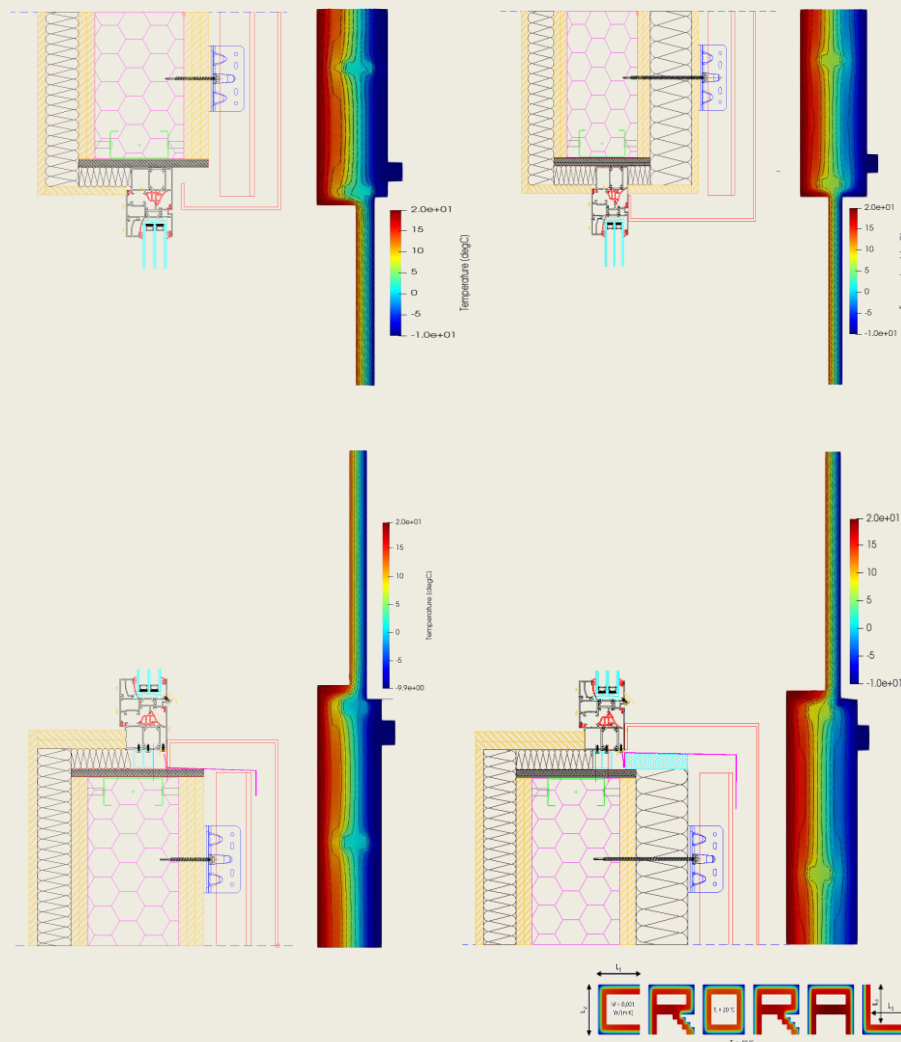
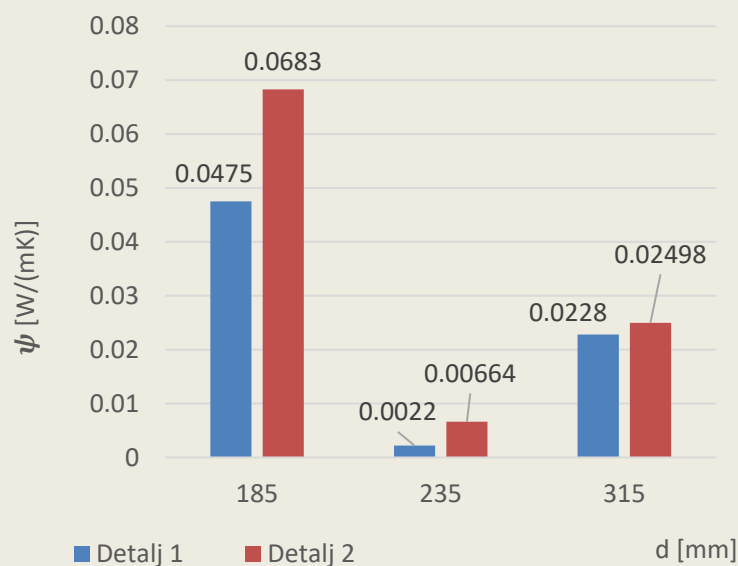
- Potreba za dodatnim toplinskom izolacijom
- Moguća rješenja
 - Instalacijski sloj MW 5 cm
 - Vanjski sloj MW 8 cm
- Učinak
 - Povećana otpornost na požar
 - Zadovoljeni zahtjevi nZEB za U -vrijednost
 - Prostor za instalacije
 - Smanjen utjecaj toplinskih mostova
 - Bolja zrakonepropusnost
 - Bolja akustična svojstva



Toplinski mostovi

KLICK **PANEL**

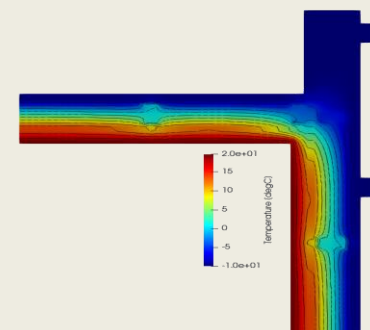
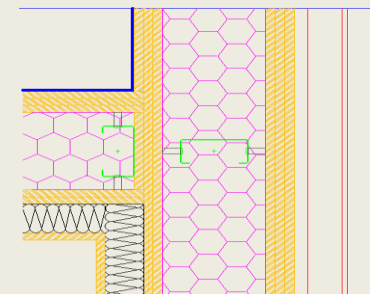
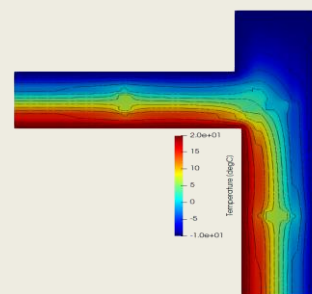
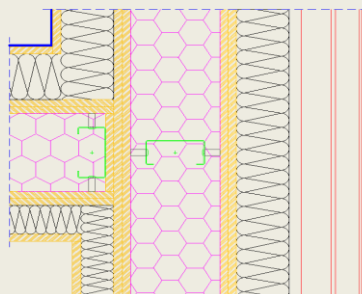
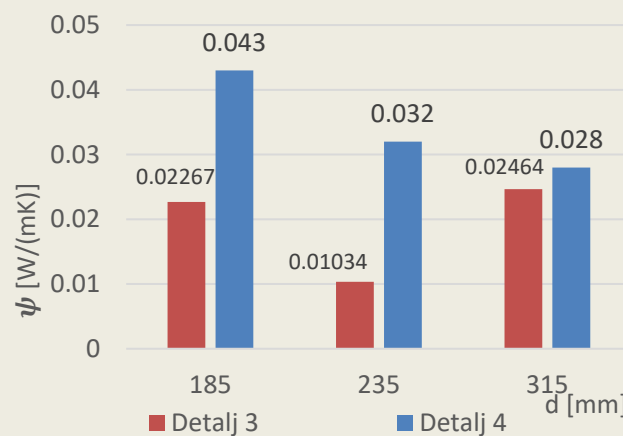
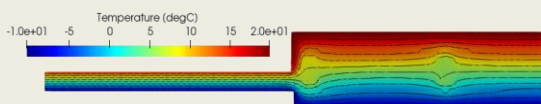
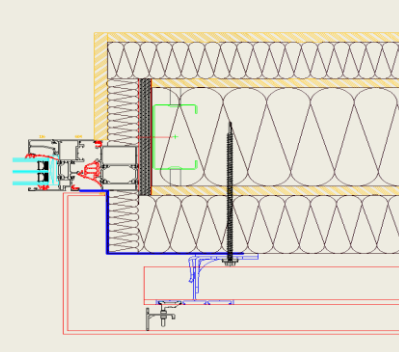
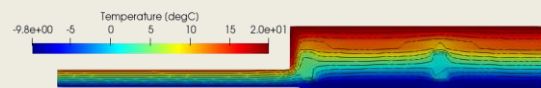
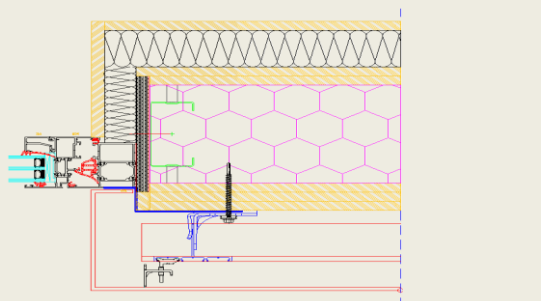
Kompozitni lagani panel s integriranom nosivom konstrukcijom



Toplinski mostovi

KLICK **PANEL**

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Hvala na pažnji!



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Sufinancirano sredstvima Europskog fonda za regionalni razvoj

