



HRVATSKA KOMORA INŽENJERA GRAĐEVINARSTVA

15. Dani Hrvatske komore inženjera građevinarstva

Opatija, 2021.

PRIMJENA MODERNIH ORUĐA PRI SAKUPLJANJU, OBRADI I POHRANI PODataka OCJENE STANJA DRVENIH KONSTRUKCIJA

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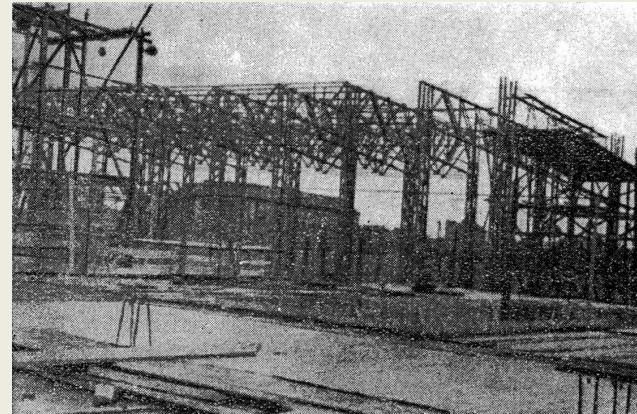
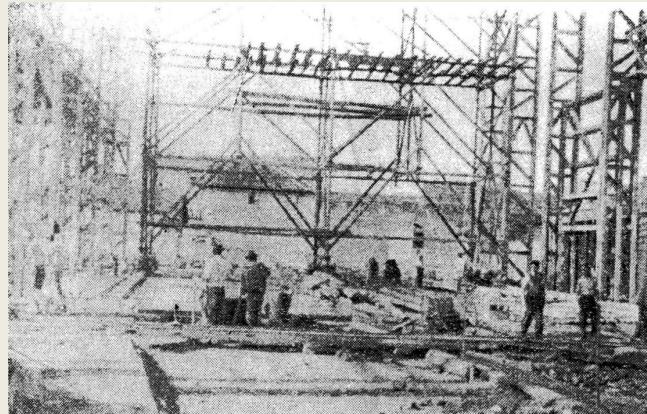
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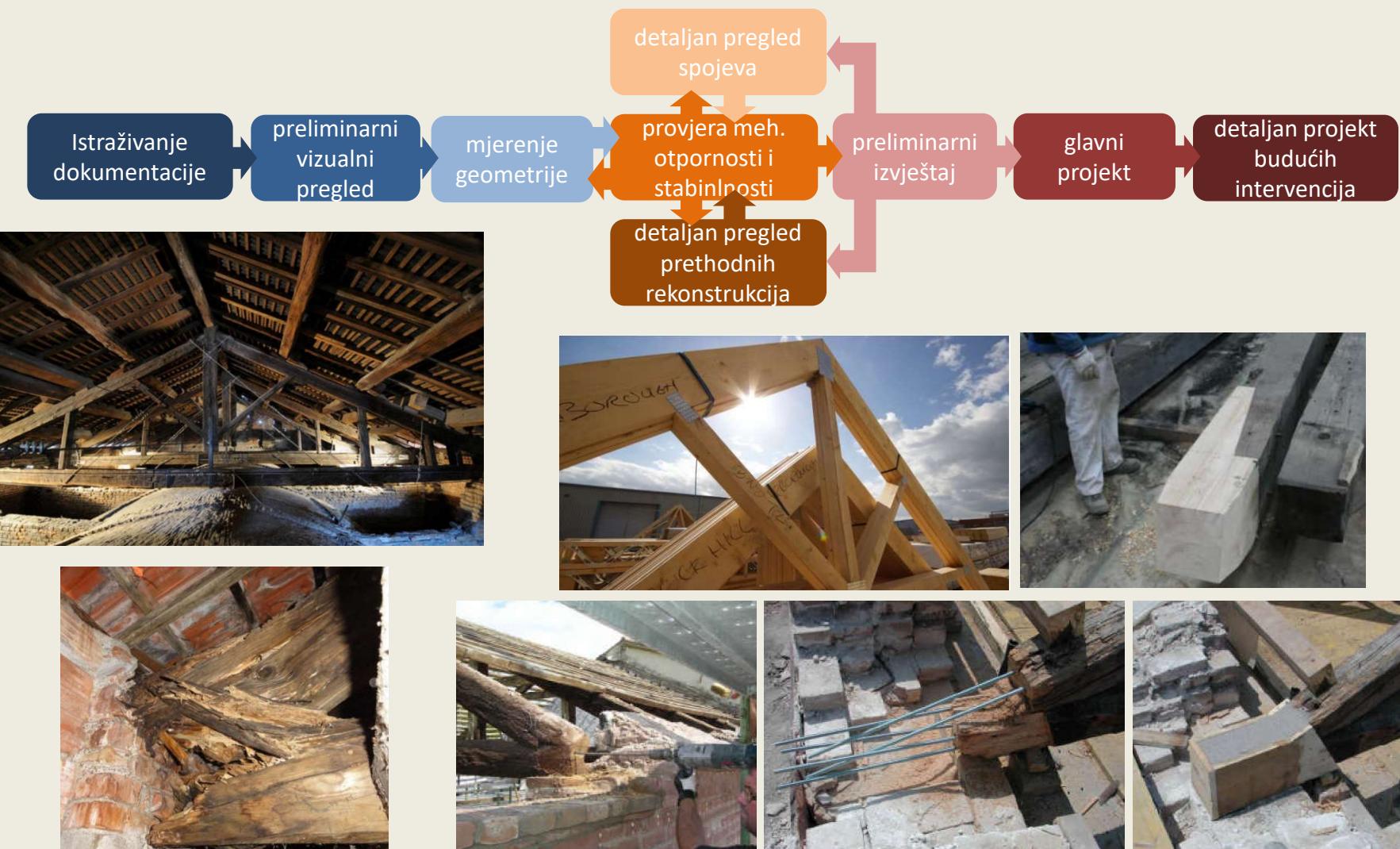
SADRŽAJ

- uvod
- suvremene metode određivanja geometrije
- ne-destruktivne metode ocjenjivanja stanja
- polu-destruktivne metode ocjenjivanja stanja
- problematika analize podataka
- pohrana i korištenje podataka

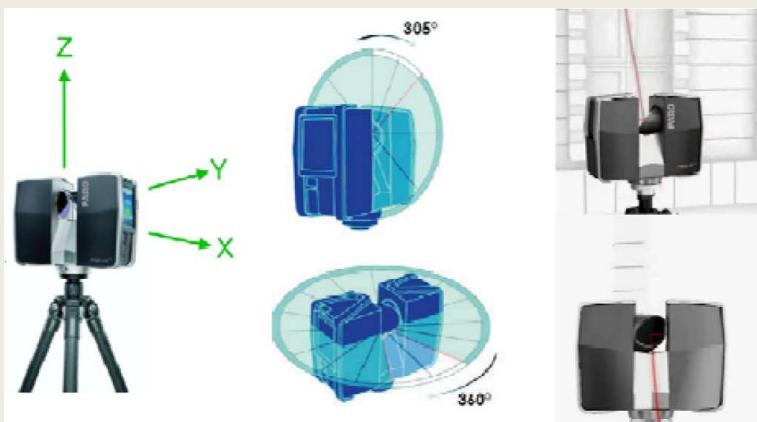
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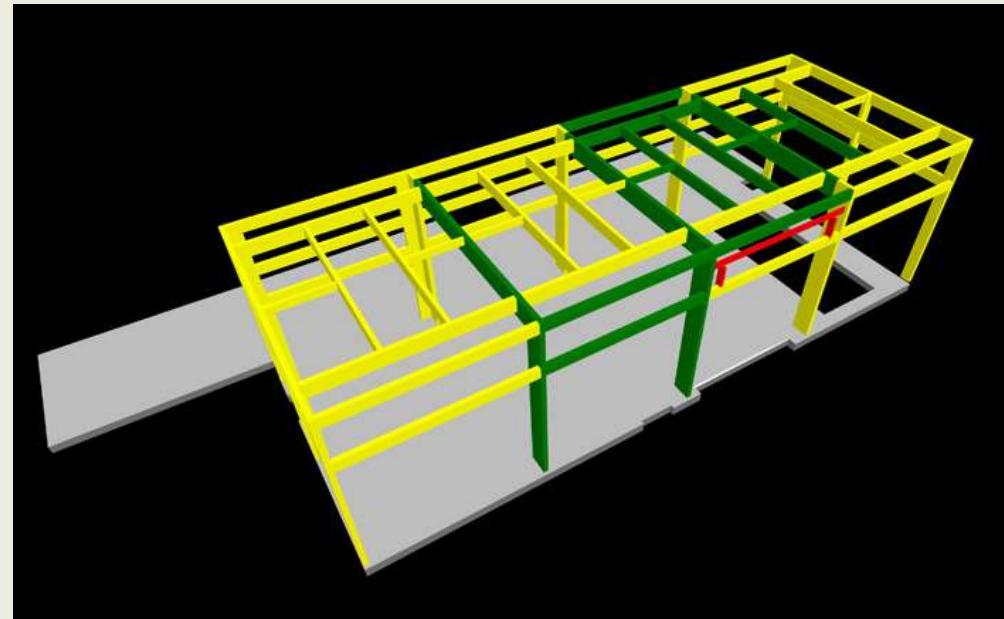
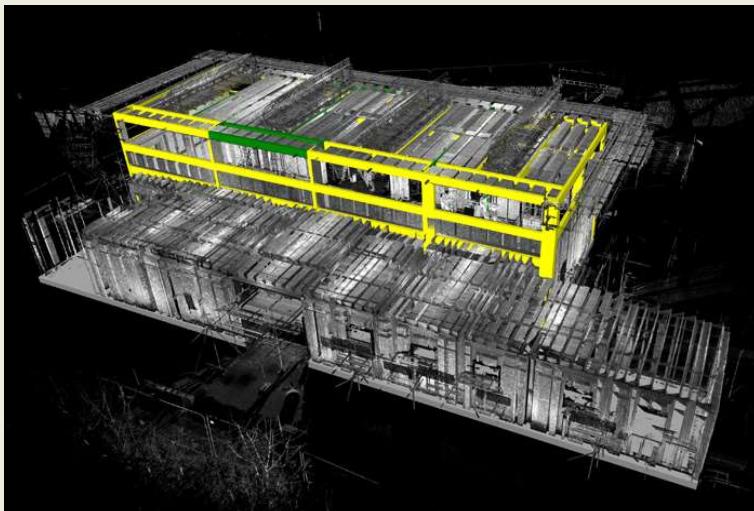
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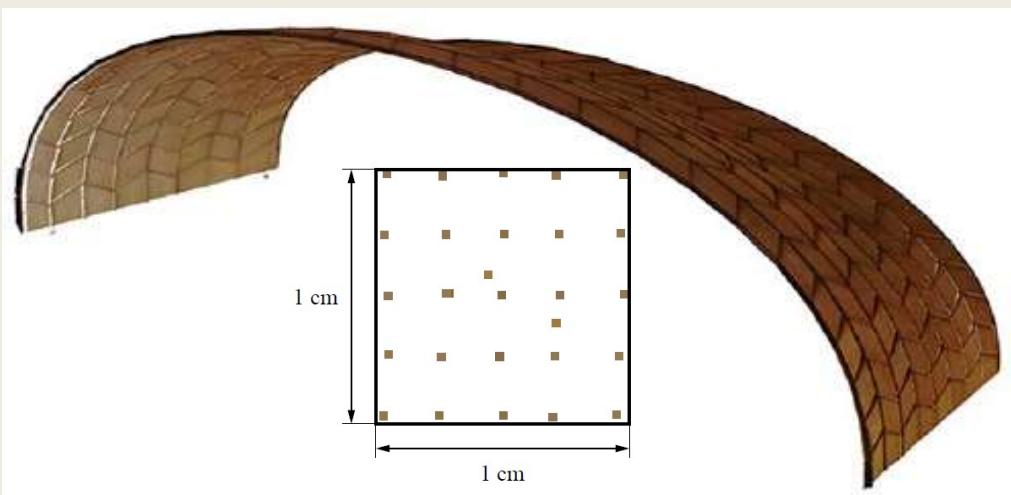
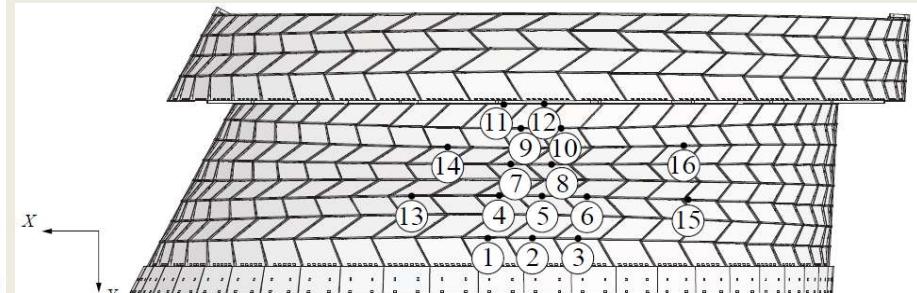
SUVREMENE METODE ODREĐIVANJA GEOMETRIJE



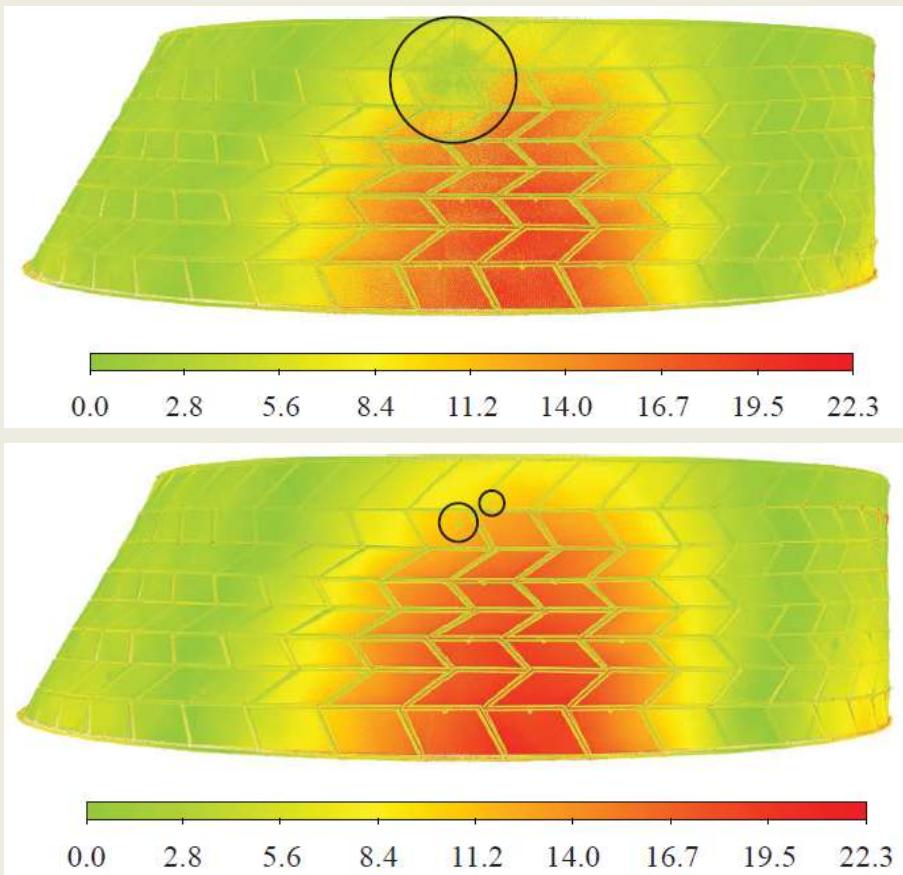
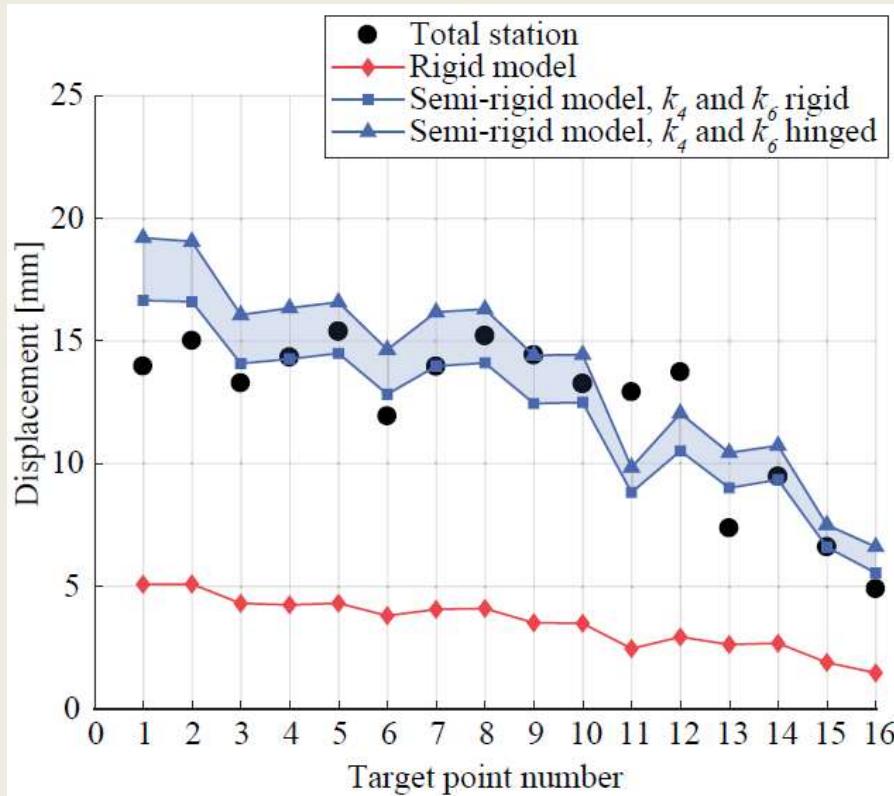
SUVREMENE METODE ODREĐIVANJA GEOMETRIJE



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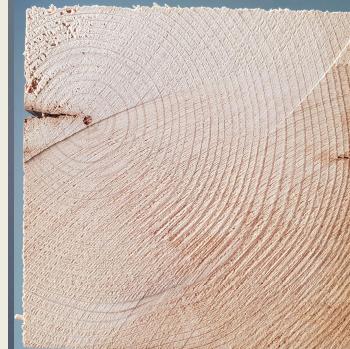
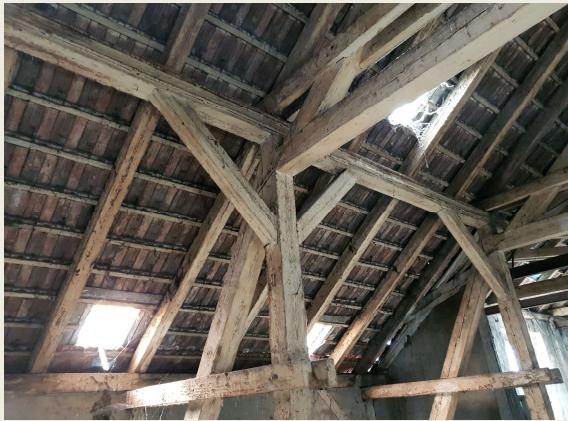


SUVREMENE METODE ODREĐIVANJA GEOMETRIJE



NE-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- vizualni pregled



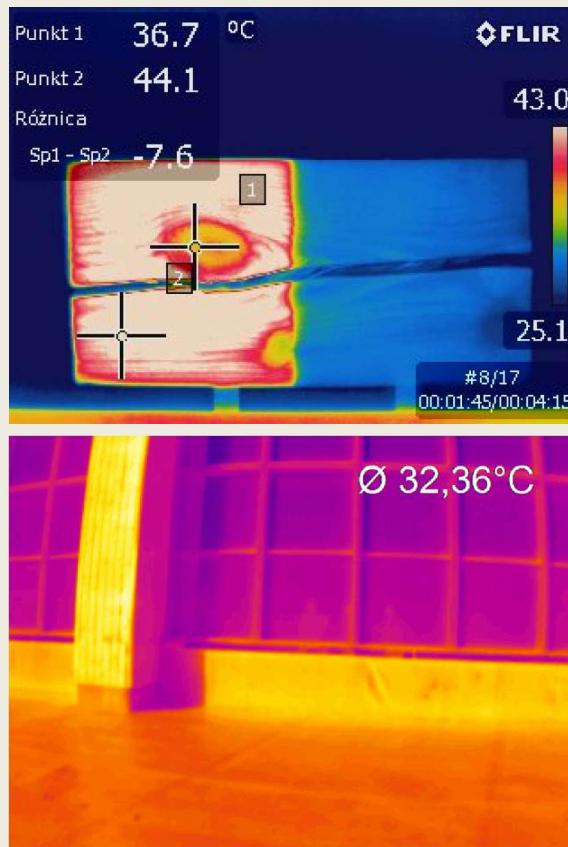
NE-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- određivanje uvjeta okoline



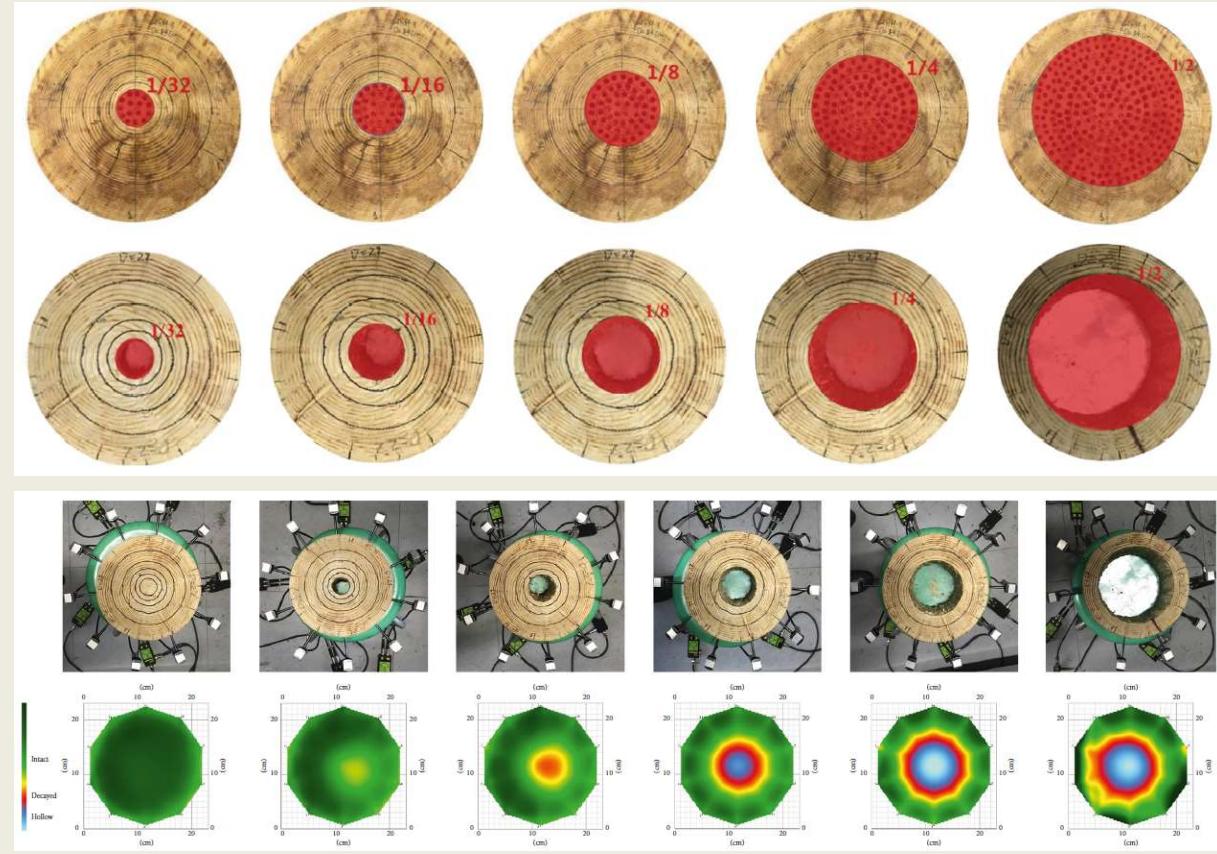
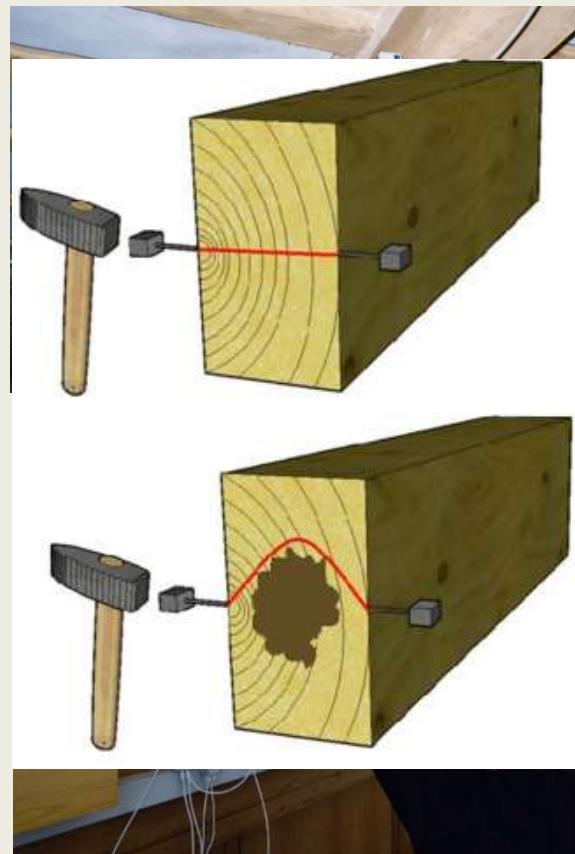
NE-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- IC termografija



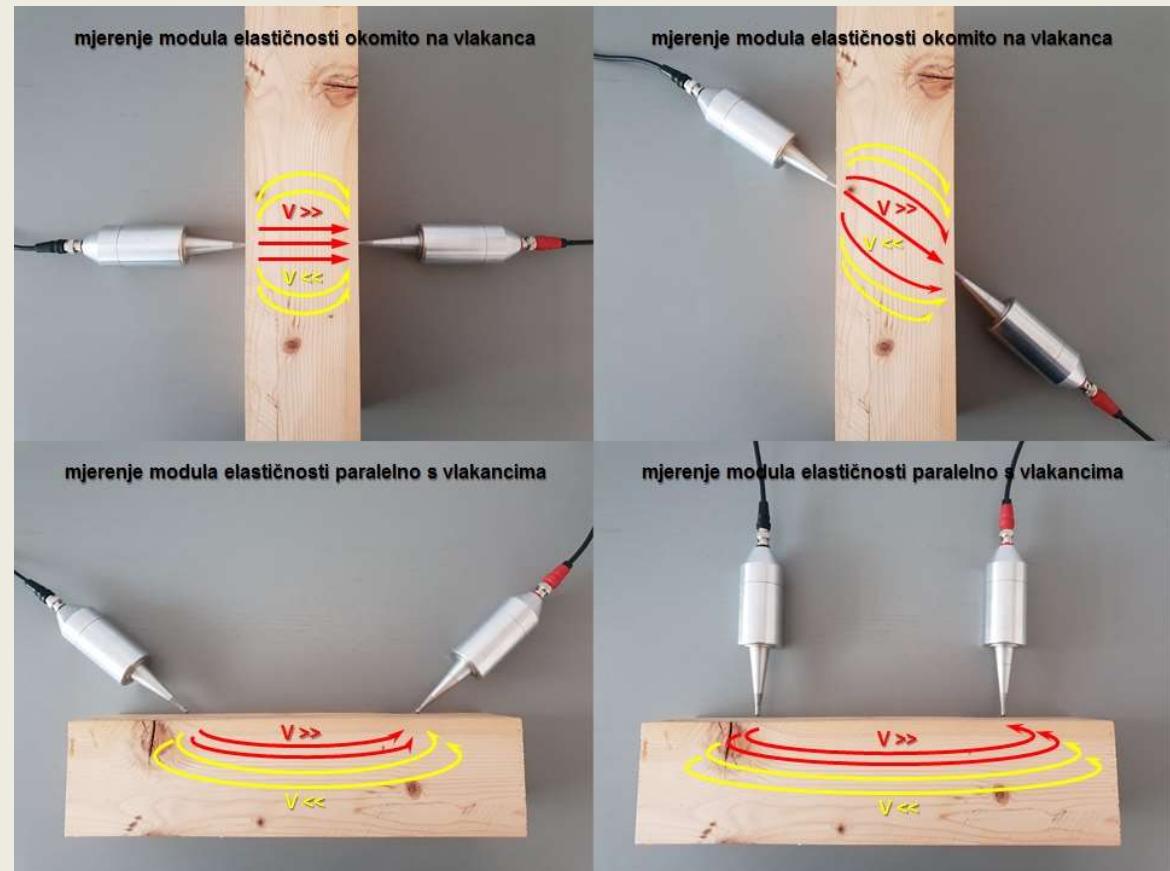
NE-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- mjerenja principima perkusije i zvučnih valova



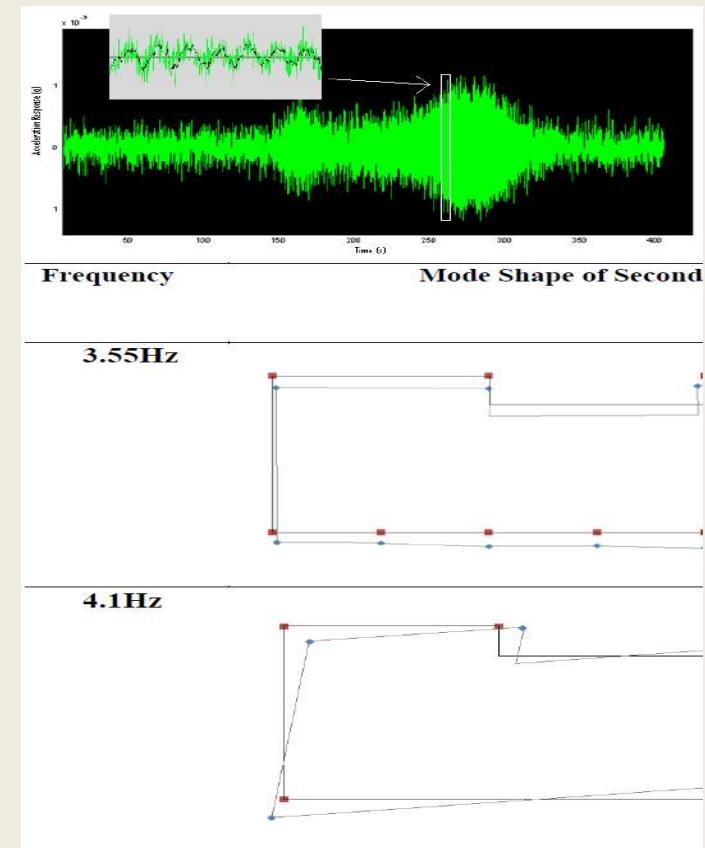
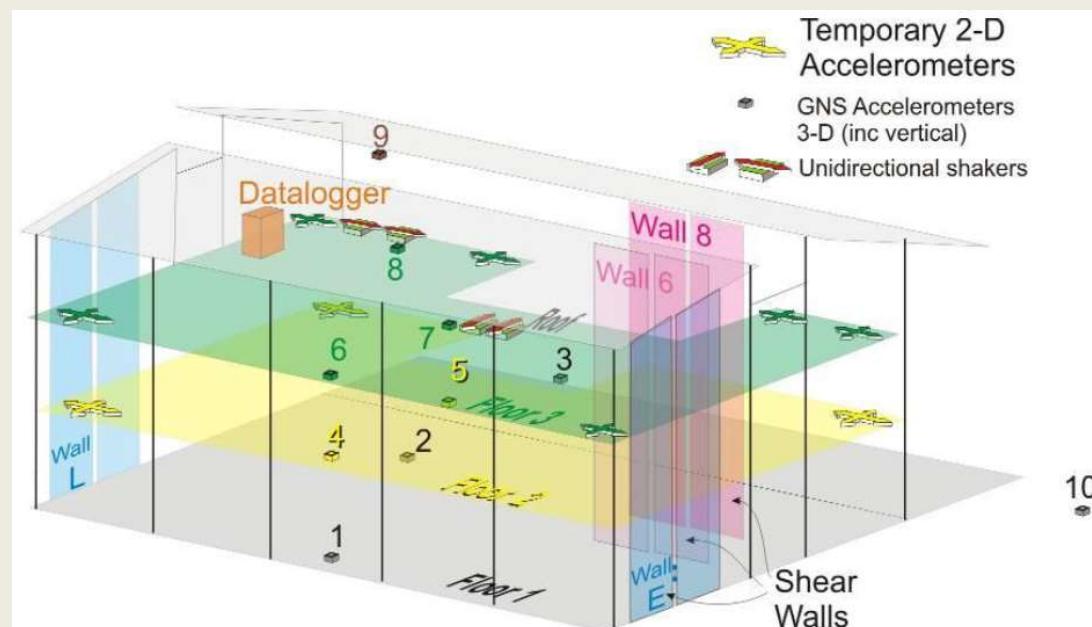
NE-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- mjerjenje modula elastičnosti ultrazvukom



NE-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- eksperimentalna modalna analiza



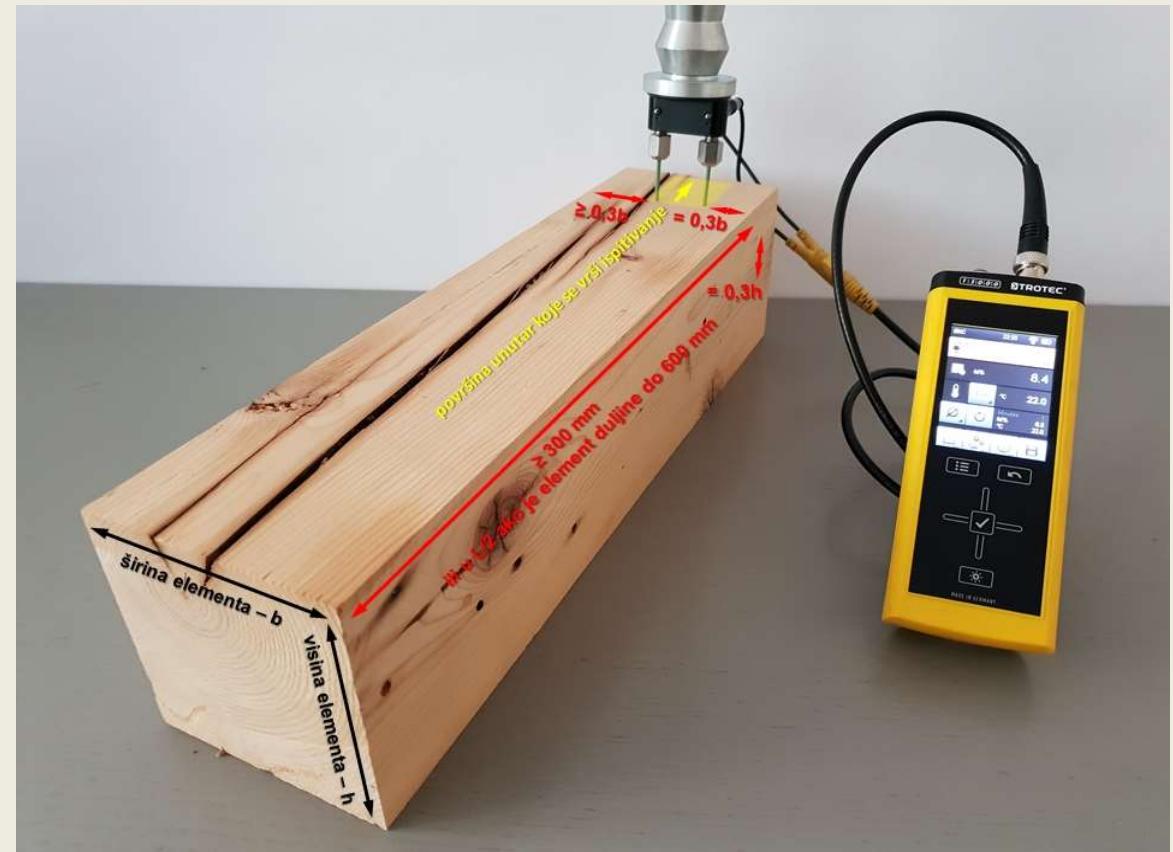
POLU-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- mjerjenje gustoće



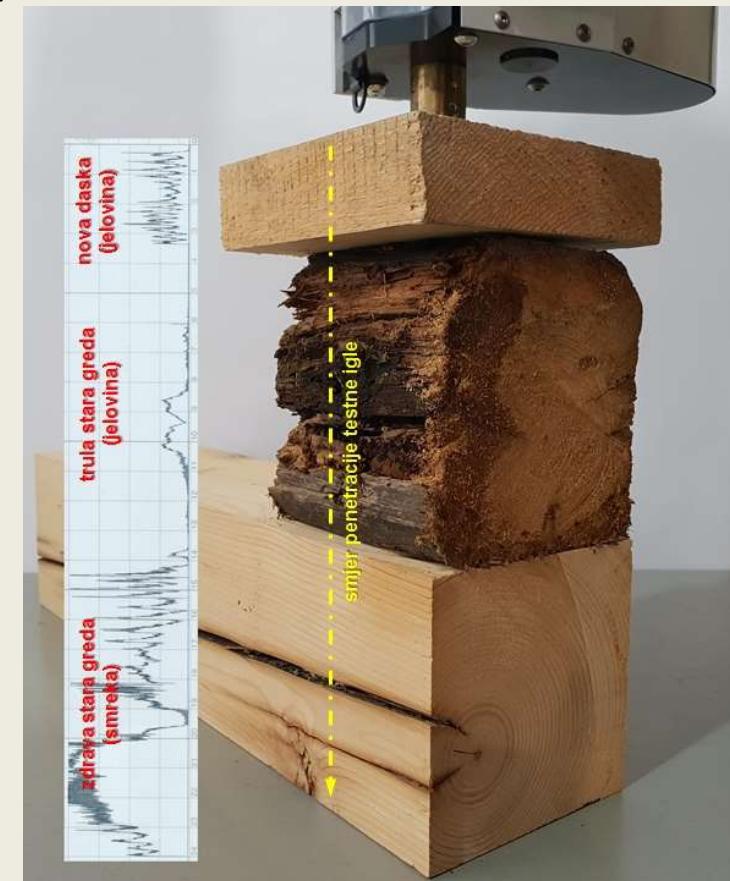
POLU-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- mjerjenje vlage



POLU-DESTRUKTIVNE METODE ODREĐIVANJA STANJA

- određivanje stanja stanja presjeka



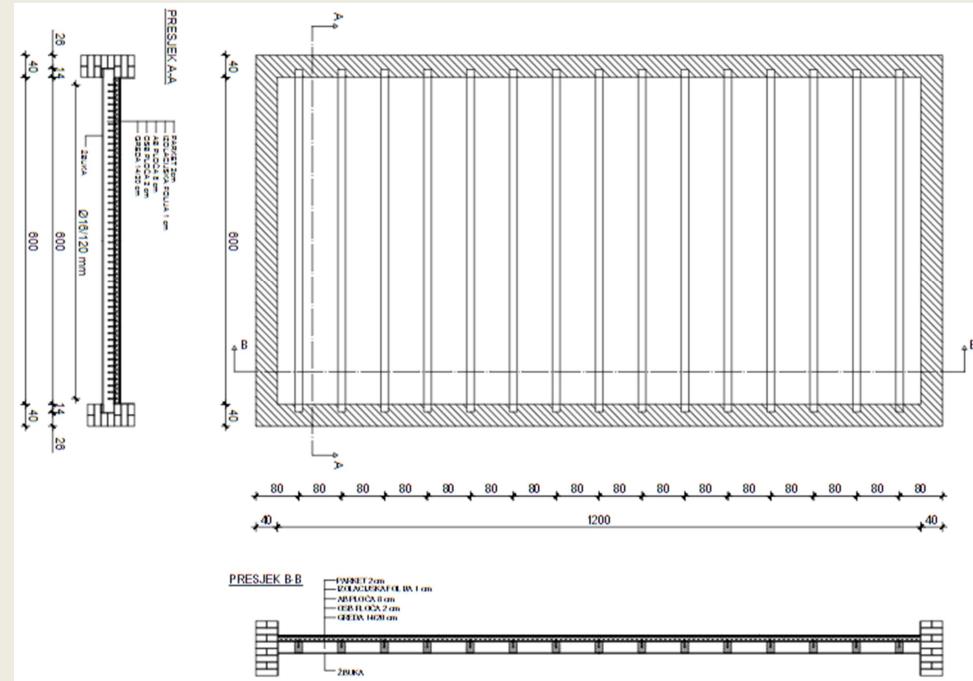
PROBLEMATIKA ANALIZE PODATAKA

- mapiranje te procjena važnosti pukotina, kao i općeg stanja konstrukcije



PROBLEMATIKA ANALIZE PODATAKA

- utjecaj trajnih deformacija



- Za ukupni progib mora biti zadovoljen sljedeći uvjet:

$$u_{inst}^{Gk,j} + u_{inst}^{Qk,j} \leq \frac{L}{200}$$

$$13,61 + 11,11 = 24,7 < \frac{6000}{200}$$

- Za ukupni progib mora biti zadovoljen sljedeći uvjet:

$$u_{inst}^{Gk,j} + u_{inst}^{Qk,j} \leq \frac{L}{200}$$

$$15,31 + 12,5 = 27,81 < \frac{6000}{200}$$

- Za ukupni progib mora biti zadovoljen sljedeći uvjet:

$$u_{inst}^{Gk,j} + u_{inst}^{Qk,j} \leq \frac{L}{200}$$

$$53,81 \text{ mm} < \frac{6000}{200} = 30 \text{ mm} \rightarrow \text{Ne zadovoljava!}$$

PROBLEMATIKA ANALIZE PODATAKA

- procjena materijalnih karakteristika

Sample No / Oznaka uzorka	Date / Godina
1	1800 - 1894
2	1805
3	1810 - 1891
4	1848 - 1893
5	1868 - 1883
6	1822
7	1899 - 1953
8	1924 - 1961
9	1933
10	1929 - 2000

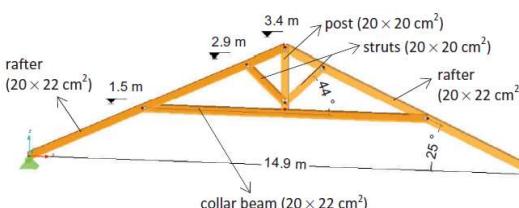
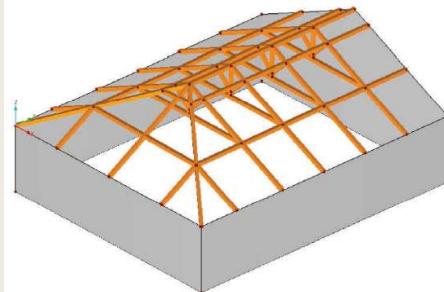
Sample No. Oznaka uzorka	Air-dry density Gustoća prosutiennog drva g/cm ³	Oven-dry density Gustoća standard- no suhog drva g/cm ³
1	0.399	0.350
2	0.394	0.348
3	0.404	0.357
4	0.406	0.358
5	0.435	0.382
6	0.437	0.383
7	0.439	0.388
8	0.442	0.389
9	0.451	0.398
10	0.459	0.404
Control (freshly cut wood) / Kontrolni uzorak (svježe oborenio drvo)	0.52	0.46

Species (Scientific name / Trade name)	Age [year]	Lignin	(Holo)cellulose	Hemicellulose	Crystallinity	Extractives	Ash	EMC	Swelling	Bending strength	Compression strength	Tensile strength	Shear strength	Young's modulus	Impact bending strength	Hardness
Softwoods:																
<i>Abies alba</i> Mill. / Silver fir	n.a.															
	300-800	↑	↓													
<i>Chamaecyparis obtusa</i> Endl. / Hinoki	300-1300	↓		↑	↑				↓	↓	~		↓	~	↓	~
	500-1600								↓		~			↑		
	1250	↓	↓	-												
	1400			-					↓							
	<1600														↓	
<i>Juniperus phoenicea</i> L. / Phoenician juniper	4100-4400	↓	↑	↓		↑										
<i>Larix decidua</i> Mill. / European larch	300-800	↑	↓			↑										
<i>Picea abies</i> [L.] Karst. / Norway spruce	60(-180?)	-	-	-		-			↓							
	100								↓							
	300									↑	↑	↑	↑			↓
	200-500	↓	↓	↓	↓											
	300-800	↑	↓			↑										
	n.a.															
	n.a.								↓							
<i>Pinus densiflora</i> Siebold et Zucc. / Japanese red pine	270			-												
	121-296														↑	
	170-500	↓		↑												

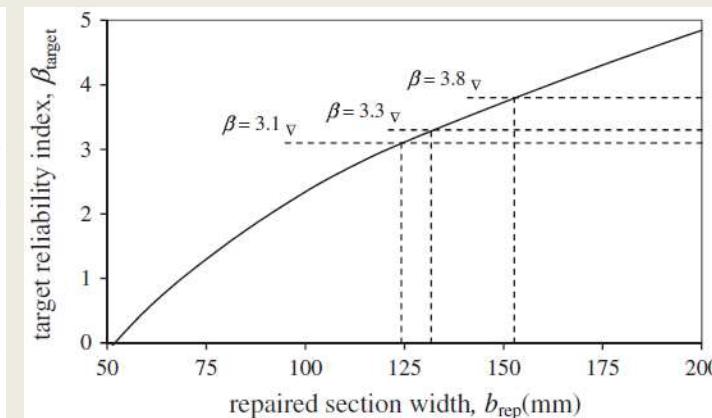
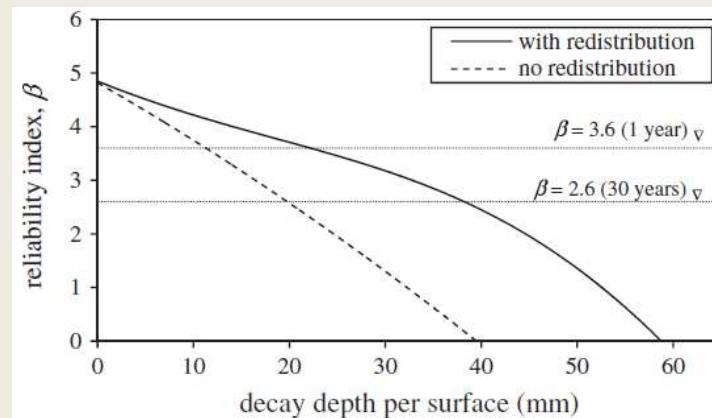


PROBLEMATIKA ANALIZE PODATAKA

- pitanje ispravne procjene pouzdanosti

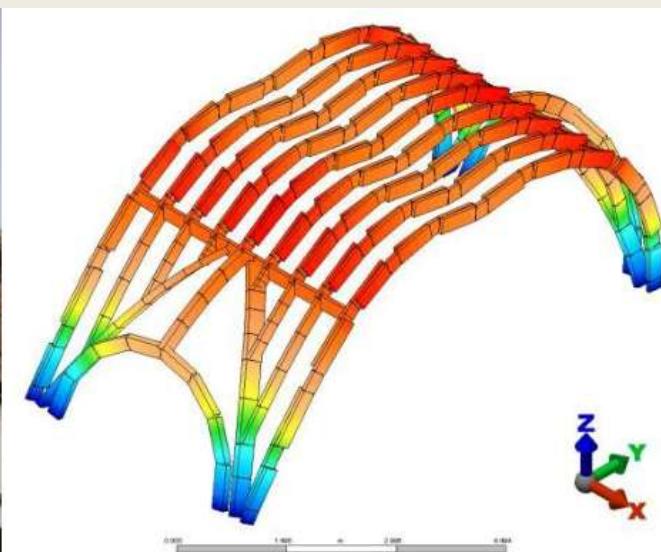
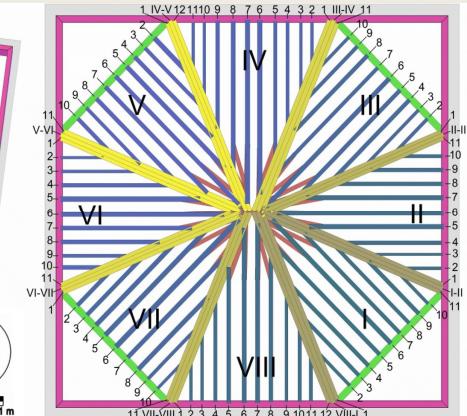


Lifetime	1 year		5 years		15 years		30 years	
A_{col} (m^2)	<500	>500	<500	>500	<500	>500	<500	>500
CC1	3.1	3.1	2.6	2.6	2.2	2.2	1.9	1.9
CC2	3.6	4.2	3.2	3.8	2.8	3.5	2.6	3.4
CC3	3.9	4.8	3.5	4.5	3.2	4.2	3.0	4.1



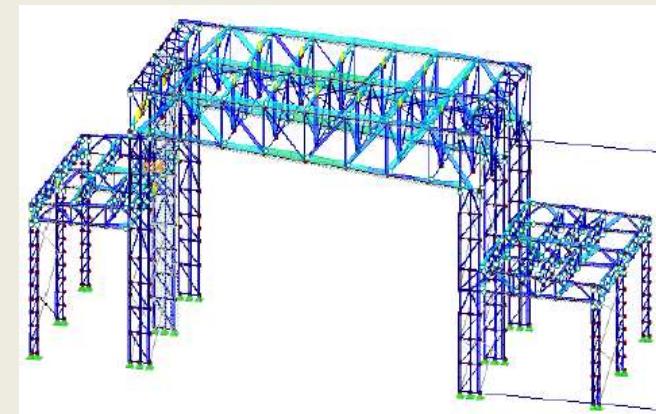
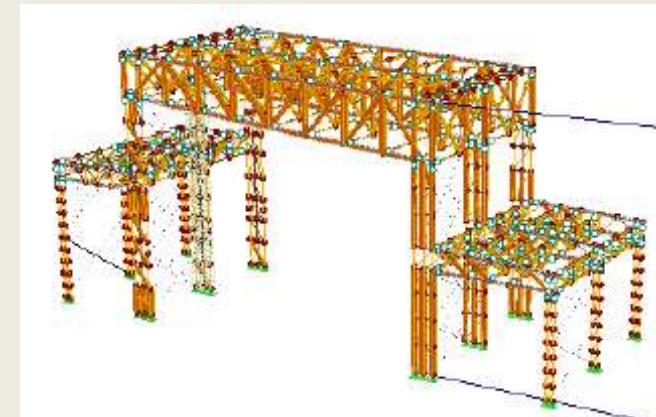
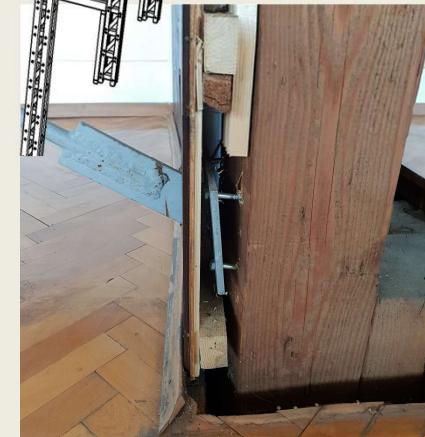
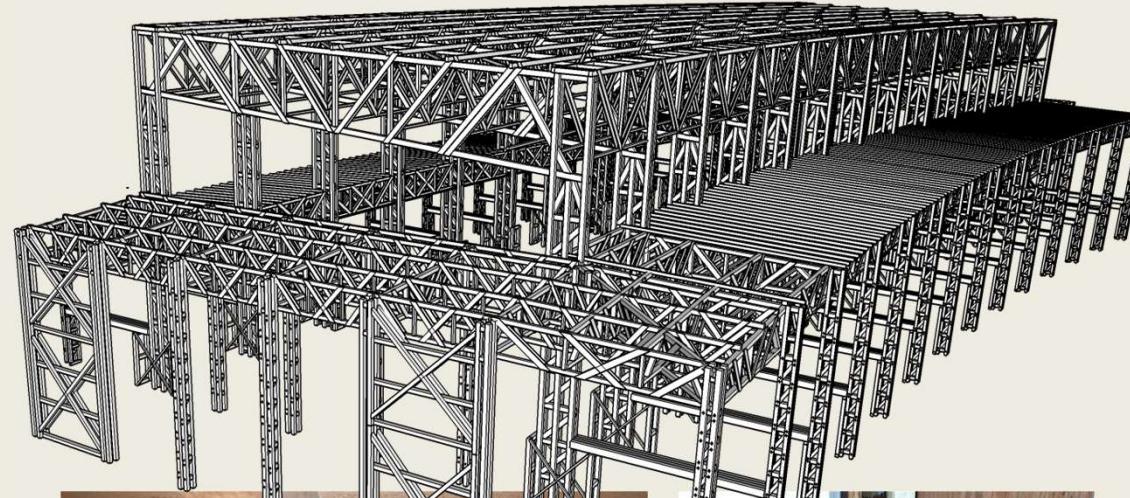
PROBLEMATIKA ANALIZE PODATAKA

- numerički modeli



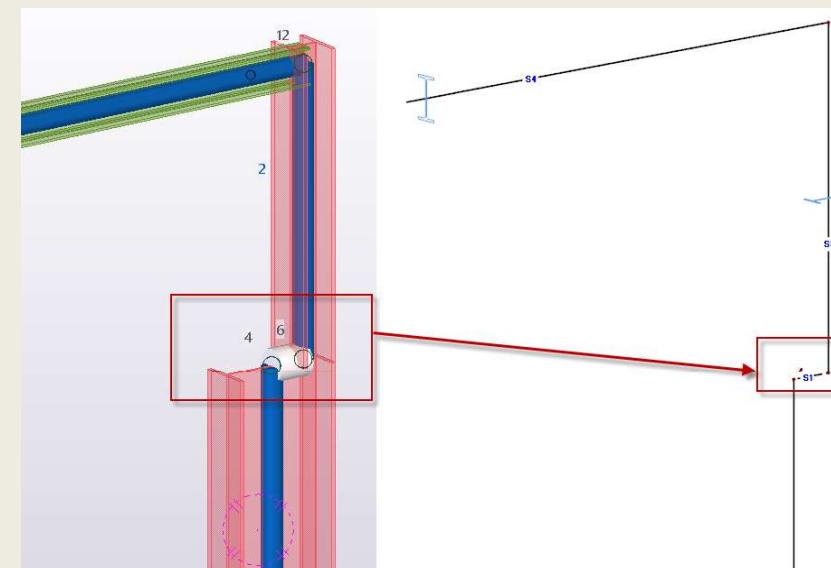
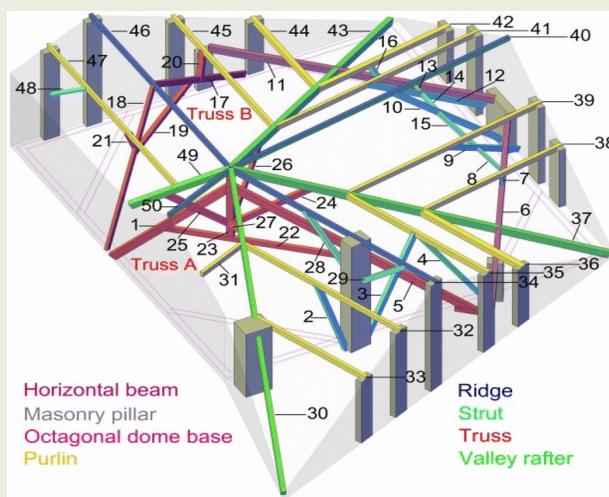
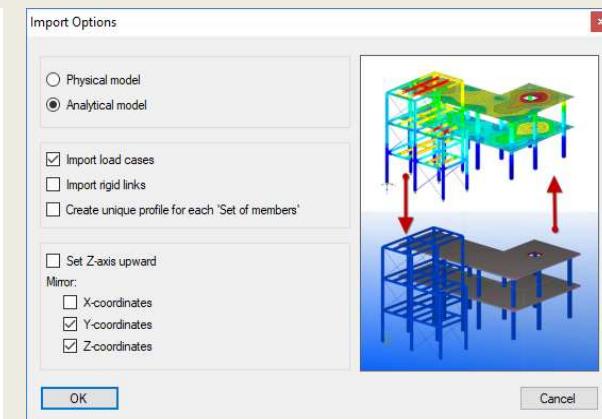
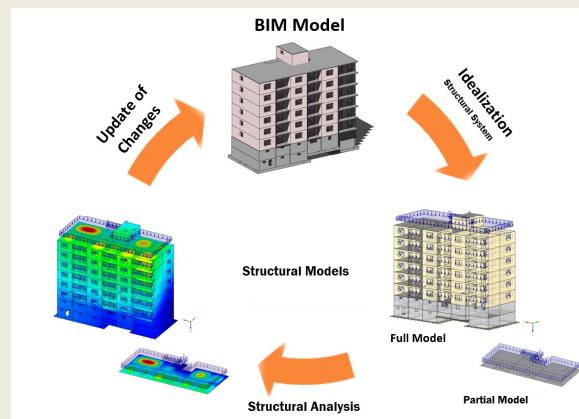
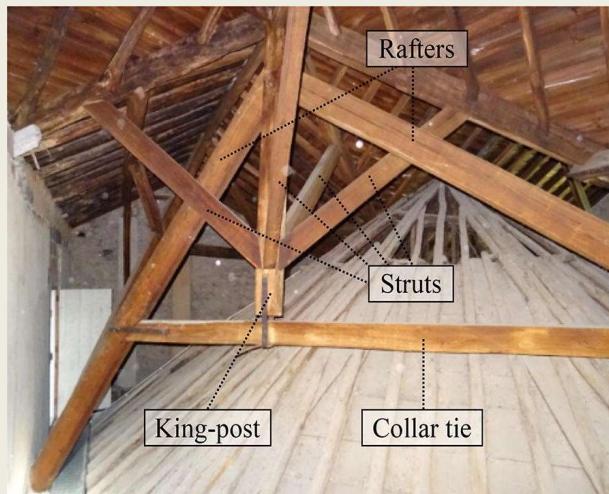
PROBLEMATIKA ANALIZE PODATAKA

- numerički modeli



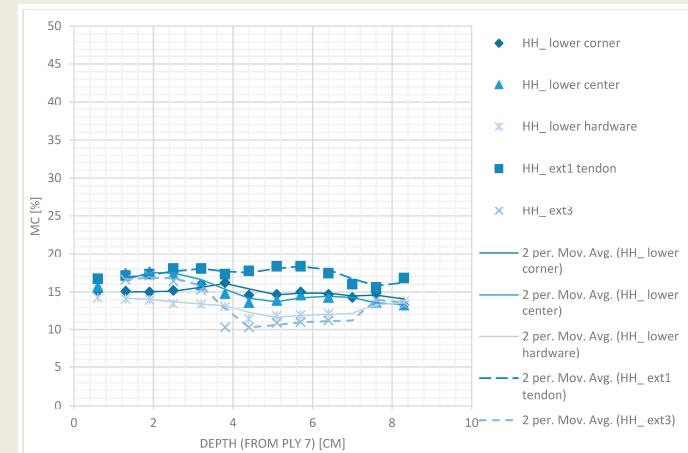
PROBLEMATIKA ANALIZE PODATAKA

- numerički modeli



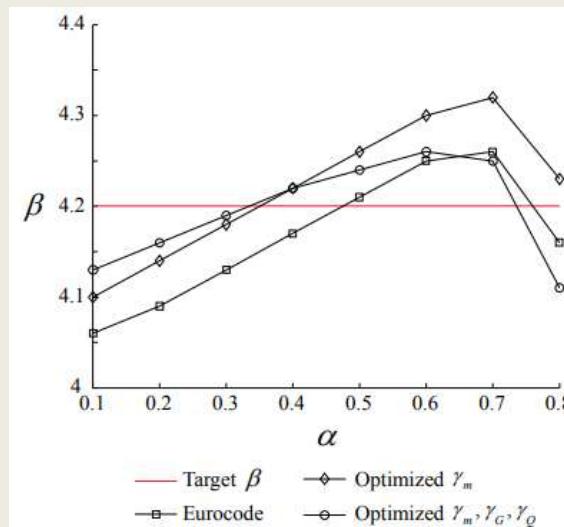
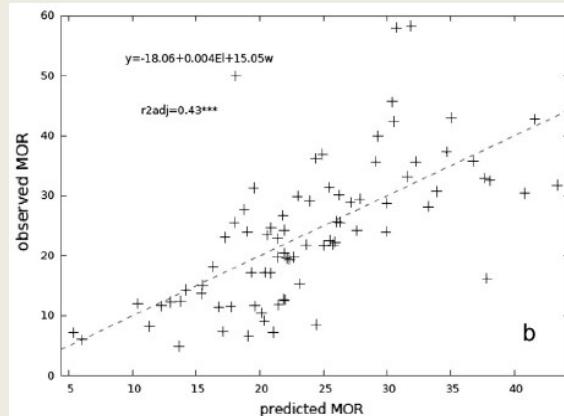
PROBLEMATIKA ANALIZE PODATAKA

- monitoring



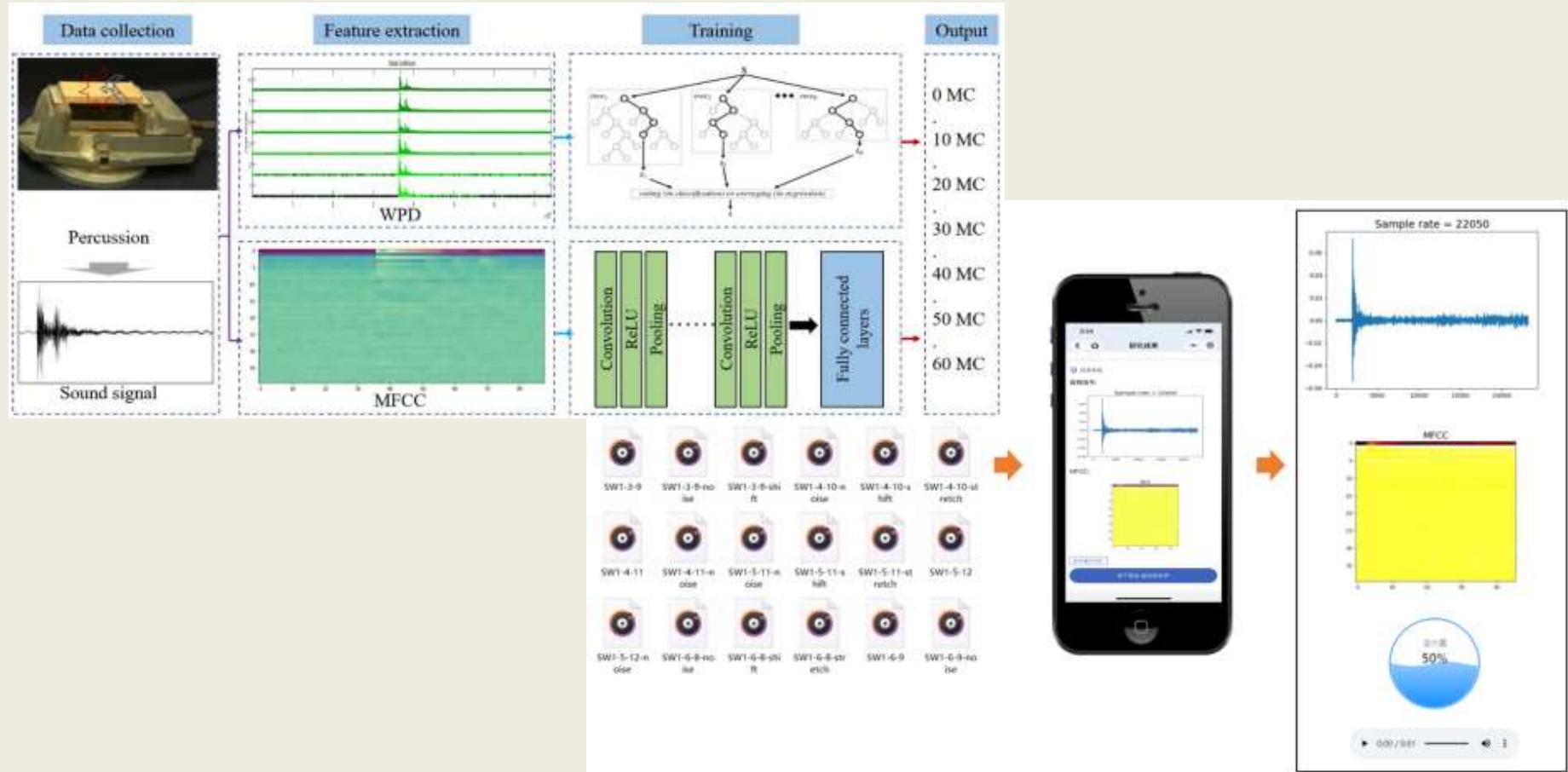
POHRANA I KORIŠTENJE PODATAKA

- virtualne baze



POHRANA I KORIŠTENJE PODATAKA

- neuralne mreže i umjetna inteligencija





PRIMJENA MODERNIH ORUĐA PRI SAKUPLJANJU, OBRAĐI I POHRANI PODATAKA OCJENE STANJA DRVENIH KONSTRUKCIJA

Hvala na pažnji!

