

EQ in the midst of the Pandemic – Croatian Faculty of Civil Engineering view and lessons learned

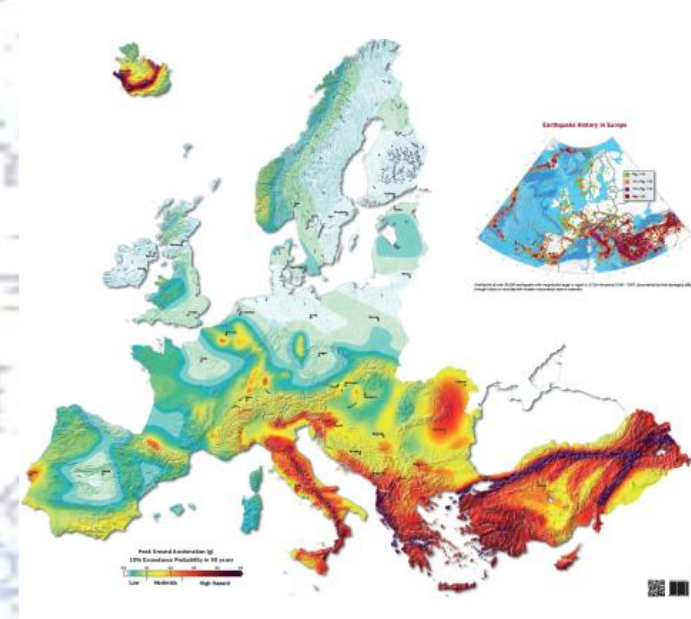
Josip Atalić
Marta Šavor Novak
Mario Uroš
Damir Lazarević
Marija Demšić
Maja Baniček
Ana Baričević
Zvonko Sigmund
Mislav Stepinac
...

UNIVERSITY OF ZAGREB
FACULTY OF CIVIL ENGINEERING

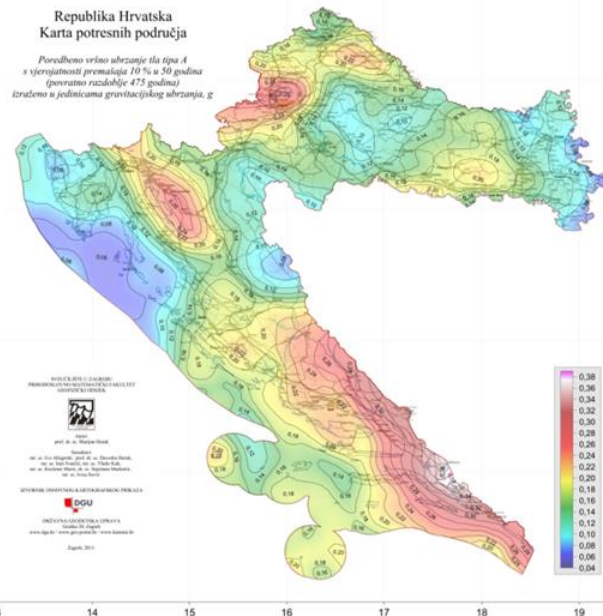
Seismic hazard ...

- South-Eastern Europe: a very earthquake-prone region
- in Croatia PGA up to 0.38g (475 years return period, bedrock)

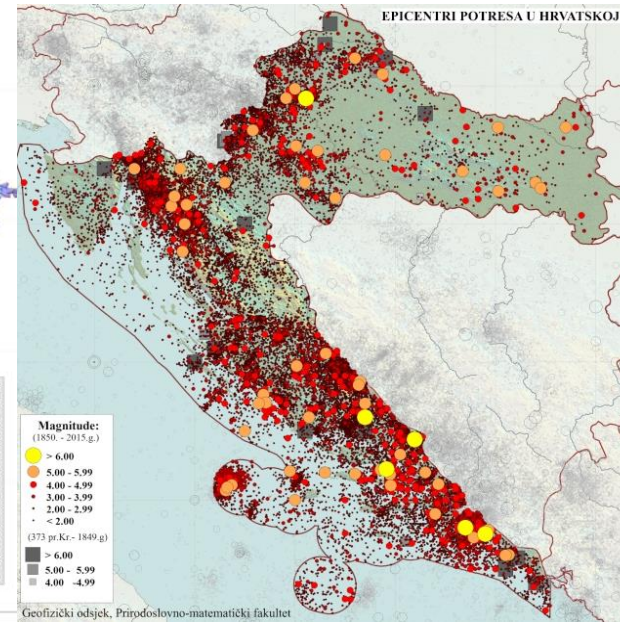
- 1667. Dubrovnik $M_L 7,1^*$
- 1880. Zagreb $M_L 6,2^*$
- 1909. Pokuplje $M_S 5,8$,
- 1942. Imotski $M_L 6,2$,
- 1962. Makarska $M_L 6,1$
- 1969. Banja Luka $M_L 6.4$,
- 1963. Skopje $M_L 6,1$,
- 1979. Crnogorsko primorje $M_w 7.0$
- 1996. Ston $M_w 6,0$



Seismic hazard map
(Giardini *et al.*, 2013)



Seismic hazard map
(Herak *et al.*, 2011)



Earthquake epicentres
(https://www.pmf.unizg.hr/geof/seizmosloska_sluzba/seizmicnost_hrvatske)



Archaeological finds suggest that Castra was the site of the largest ancient Roman settlement on the island – Cissa, which now rests at the bottom of the sea, near the cone. It probably sank as a result of a devastating earthquake that hit the area in 4th century AD. The ruins of the ancient city served as a basis for the legend of the "Atlantis of Pag" and its hidden treasure that was incorporated into the island's folk tales.



RAGUSA

strong earthquakes have occurred in the past and will occur again
 almost **30 %** of the territory and **60 %** of the population exposed to moderate/high seismic hazard
urban centers (Zagreb, Rijeka, Split, Dubrovnik) located in seismically active zones



Zagreb earthquake 1880.

post-earthquake
reconstruction of the
historic center

□ historic earthquakes: e.g. Zagreb, 1880, $M_L=6.2$



- financial losses: approximately the **half of the state's budget**
- almost **every building** was damaged
- 13% collapsed buildings
- **large emigration** (winter)

(Simović, 2000)

Zagreb, the capital of the Republic of Croatia



- **capital** city of the Republic of Croatia
- **administrative, cultural, scientific and economic center**
 - home to the Croatian Parliament, Government (all ministries) and President
 - seat of the largest Croatian companies, media, many scientific and cultural institutions, hospitals, industrial facilities and historic monuments
- important European **transport intersection**
- over **20%** of the all population (Croatian Bureau of Statistics, 2017)
- over **35%** of the country's GDP
- over **40,000** students





Zagreb: exposure and vulnerability

□ exposure and vulnerability

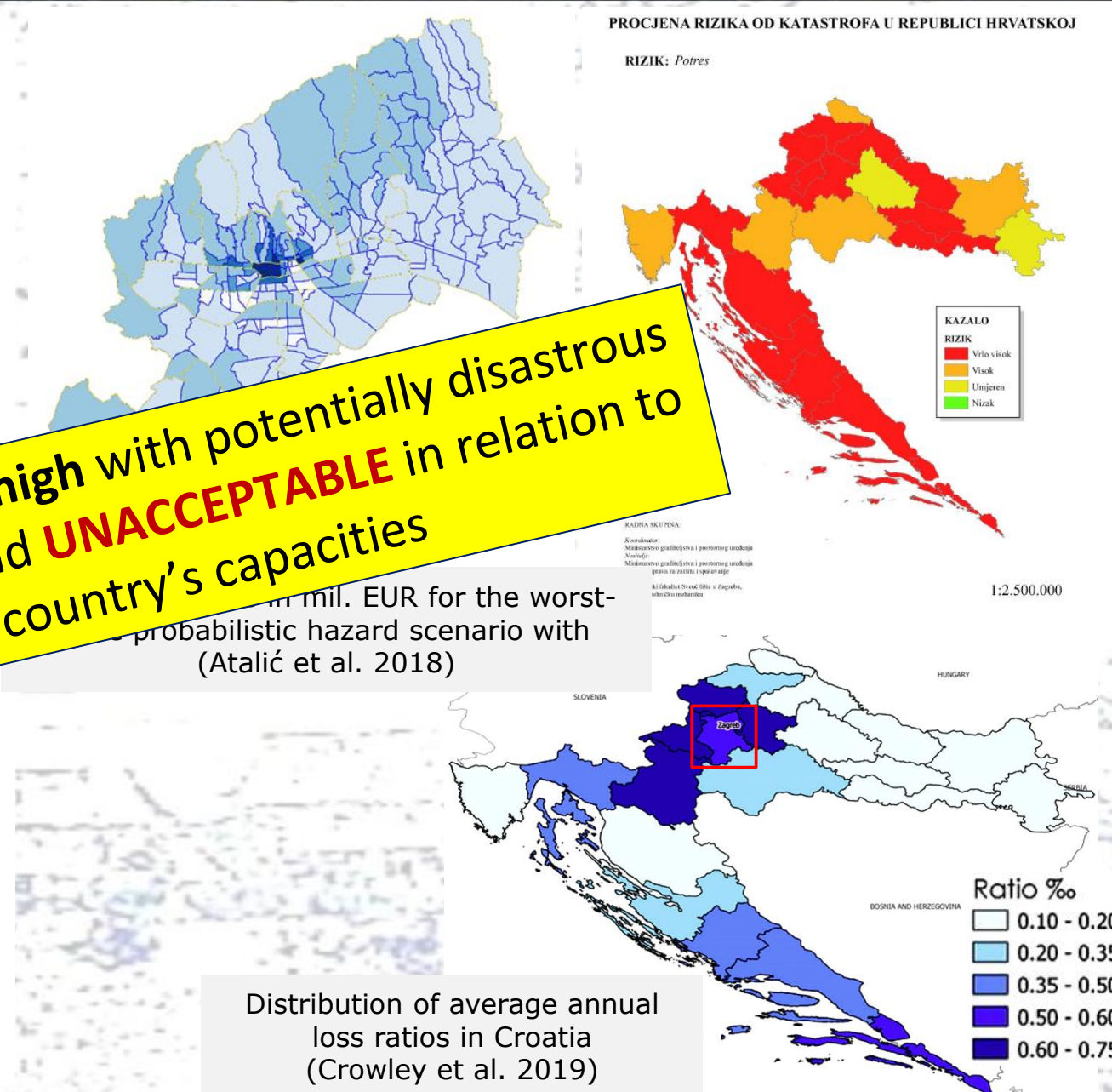
- **aged building stock**
 - **>22%** of all the habitable dwellings built before 1964 (Skopje EQ) – **NO CODE**
 - additional **41 %** before 1981 - **30-50% of EUROCODE – LOW CODE**
 - only **5%** acc. to Eurocode (gradually introduced from the beginning of the millennium, while its implementation, achieved by technical regulations, became completely obligatory in 2017)
- **poor maintainance** as in most of the region, including massive **illegal construction** and undocumented reconstructions (> 100.000 applications for legalization since 2012!)
- **Seismic risk awareness (key problem) !!!**



National Risk Assessment in Croatia

- Risk identification (2014)
 - Top three
- Seismic risk assessment (2015)
 - Scenario for City of Zagreb (Sanja Hak)
 - Counties
- Multi-risk assessment (2015)
 - Floods, fires, ...
- Seismic risk assessment for ...
 - Very rough ...
- Assessment of risk management
 - Risk Management Plan
 - Implementing Risk Prevention and Preparedness Measures
- Updated seismic risk assessment (2018)
 - Scenario for City of Zagreb (Miroslav Nastev)
 - Big step forward

seismic risk very high with potentially disastrous consequences and **UNACCEPTABLE** in relation to the country's capacities



... mil. EUR for the worst-probabilistic hazard scenario with (Atalić et al. 2018)

Distribution of average annual loss ratios in Croatia (Crowley et al. 2019)

Zagreb earthquake 2020

M_L5.5 ZAGREB EARTHQUAKE ON MARCH 22, 2020

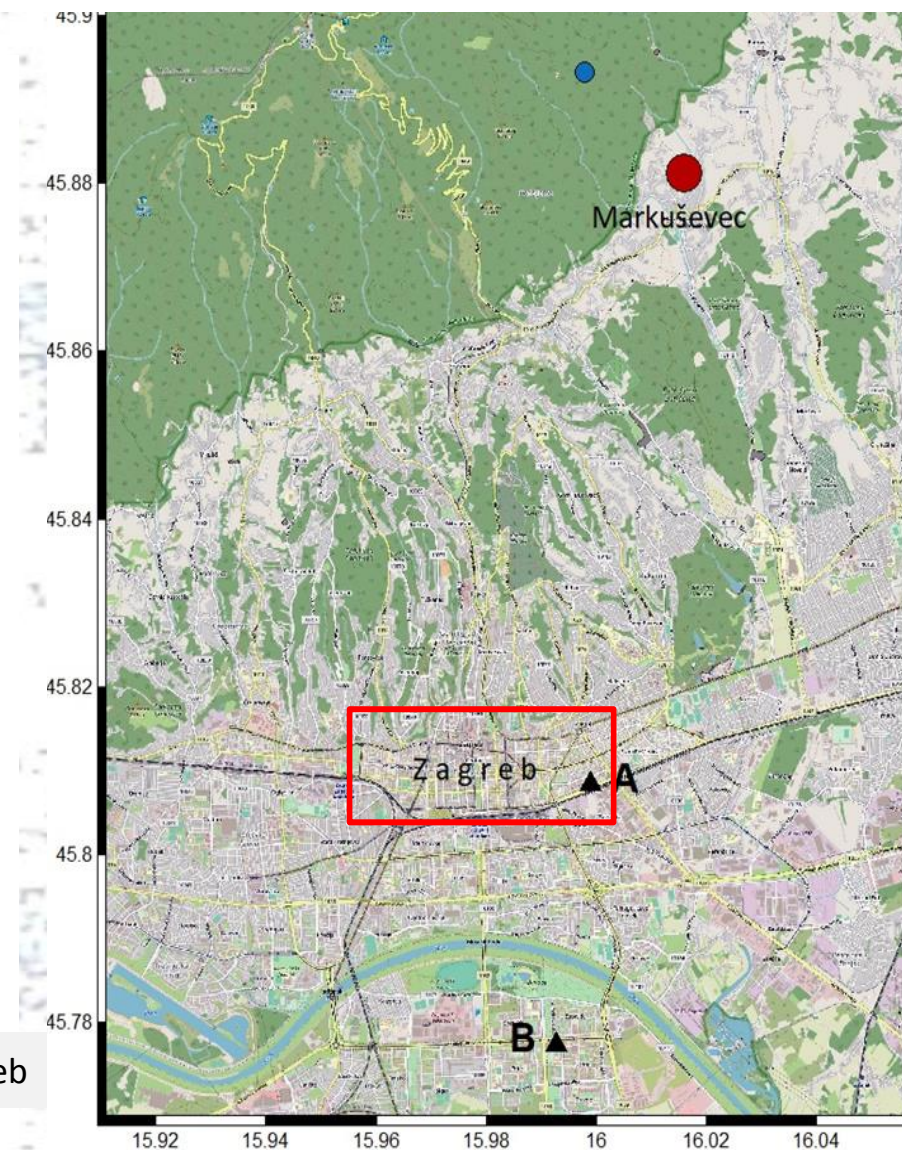
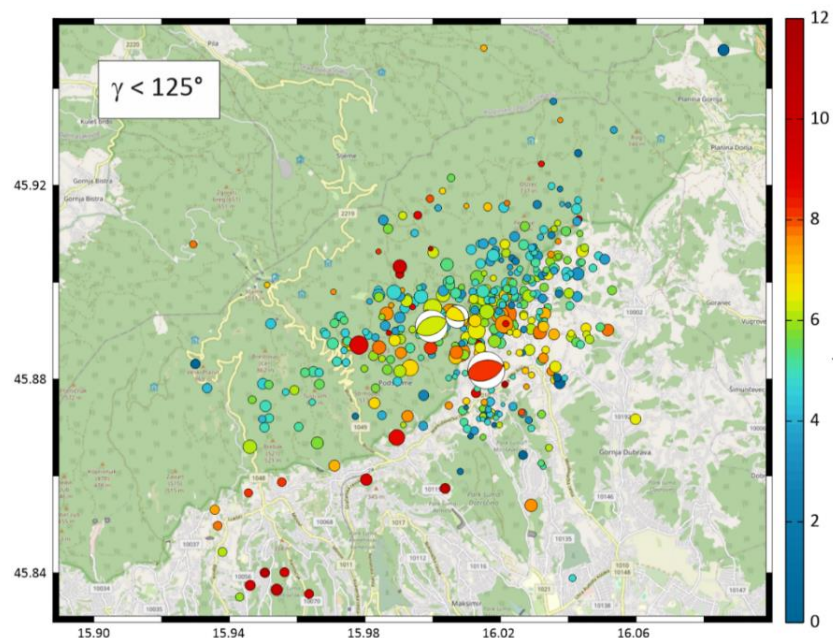
- Sunday, March 22: M_L5.5 main event 06:24 am CET and M_L4.9 aftershock 07:01 am CET
- the epicenter **7 km north** of the historical center, at a **depth of 8 km**
- seismic activity: more than 1.400 earthquakes in 45 days post-earthquake

main event:

$$a_{\max,A} = 0,22 \text{ g}$$

$$a_{\max,B} = 0,20 \text{ g}$$

estimated soil type C



source: Croatian Seismological Survey, Department of Geophysics, Faculty of Science, University of Zagreb

http://www.pmf.unizg.hr/geof/seizmoloska_sluzba/o_zagrebackom_potresu_2020

Zagreb earthquake 2020

COVID-19 lockdown

- a day before earthquake (luck)

IMPACTS

- one fatality, 26 injured
- psychological shock and panic among citizens (> 20.000 left their homes)
- widespread damage (especially to invaluable historic center)

financial losses far exceeding expectations for an event of this size which was much smaller than anticipated for the location



photos from the historic center (source: HCPI, 2020; AIR-RMLD d.o.o.; Šavor Novak et al. 2020.)

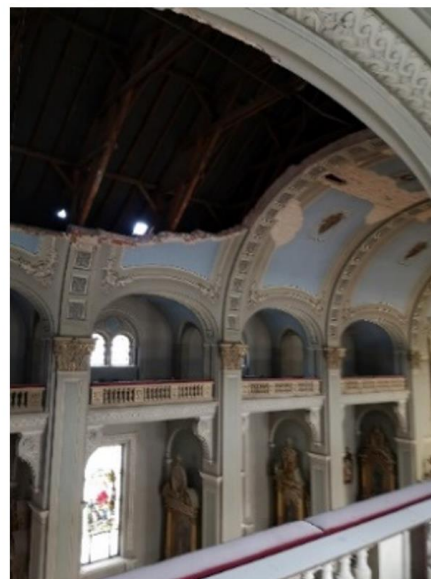
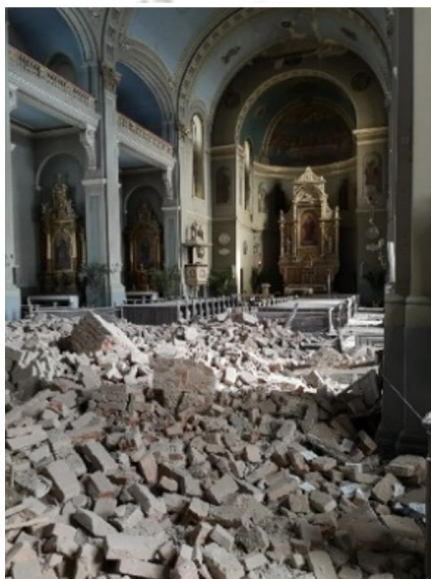
Zagreb earthquake 2020

Zagreb Cathedral and Archbishop's Palace



source:
<http://www.zg-nadbiskupija.hr/detaljno-izvjesce-o-ostecenjima-zagrebacke-katedrale>
F. Foretić
HCPI, 2020

Basilica of the Sacred Heart of Jesus



source: I. Čurić, HCPI,
2020

Zagreb earthquake 2020

□ Clinic for Women's Diseases and Obstetrics in Petrova Street



University



**160 years old building
(350 years of University)**



Zagreb earthquake 2020

URM
buildings

source:
M. Todorić, HCPI, 2020,
Šavor et al., 2020

❑ **DAMAGE:** roofs, chimneys and gable walls





Zagreb earthquake 2020

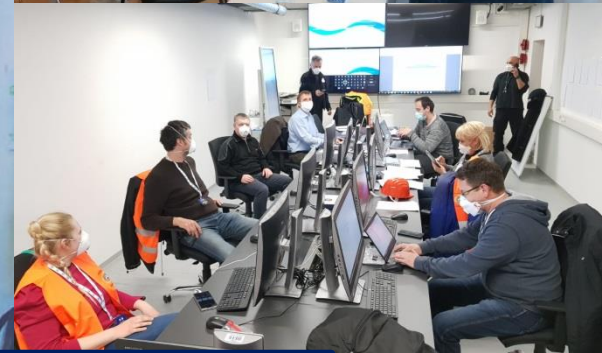


POST-EARTHQUAKE DAMAGE ASSESSMENT OF BUILDINGS

VOLUNTEERING post-earthquake building evaluation effort initiated in **collaboration between:**

- Faculty of Civil Engineering Zagreb,
- Chamber of Civil Engineers,
- City Office for Emergency Management
- Civil Protection Directorate
- ...

expert group of 25 people gathered at FCE

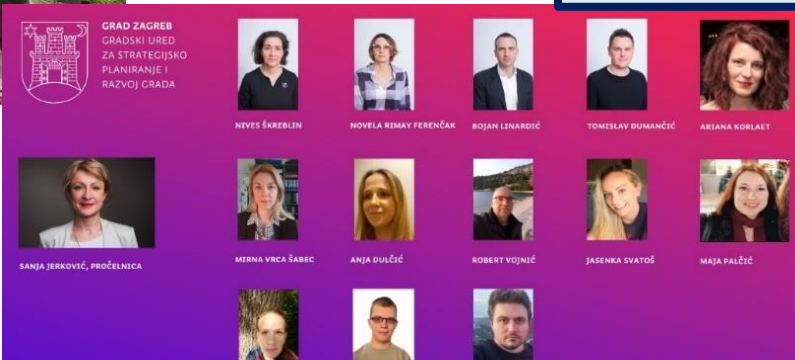


“headquarters” about 10 people

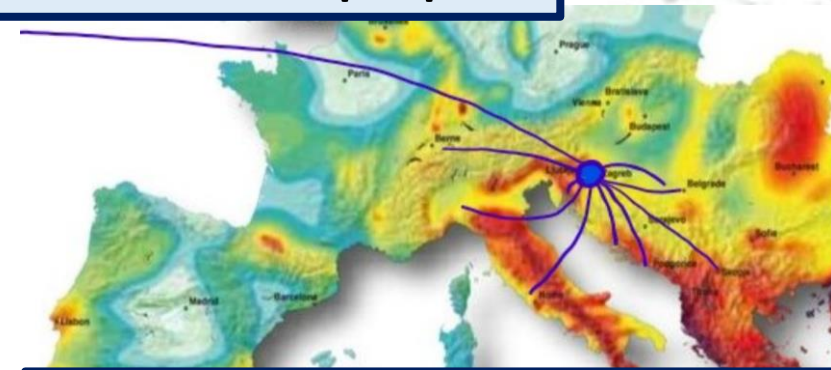


~ 500 engineers on the field
(100 - 200 daily)

+ 50 students



City/State Offices... > 20 people



consultations with > 20 people

■ Foundations

- Study on earthquake risk reduction in the City of Zagreb (OEM) , 2013-2020 (**only Zagreb**)
- EU project **Matilda** (MultiNATIonal moduLe on Damage Assessment and CounTermeasures)
- **Platform** for Disaster Risk Reduction (Ministry of interior)
- Exercises with intervention teams + **Albania mission**

Study on earthquake risk reduction



- ### Exercises
- Istra 2017
 - ZG POTRES 2018
 - Cascade'19 (Portugal)
 - Jaska 2019
 - ...



Albania



only 20 people

Education

- **improvisation** based on experience and exercises
- **adjustment** to observed damage (feedback)
- **webinars** (www.hcpi.hr) - "motivated" by COVID – 19
- **WhatsApp group** (consultations with headquarter, experienced to the younger ones, ...)
- ...

first day !!!








second day !!!



second week (webinar)

YouTube

Pretraživanje

I	NEZNATNA NEKONSTRUKTIVNA OŠTEĆENJA nema vidljivih oštećenja, manje pukotine na sekundarnim elementima ne ugrožava sigurnost korisnika zbog pada mogućih nekonstruktivskih elemenata	
II	NEZNATNA KONSTRUKTIVNA OŠTEĆENJA pukotine na zidu, oštećenja nekonstruktivnih dijelova građevine, lasaste pukotine na nosivim AB elementima, nosivost konstrukcije nije ugrožena. moguće otpadanje pojedinih dijelova nekonstruktivnih elemenata	
III	UMJERENA KONSTRUKTIVNA OŠTEĆENJA Velike i duboke pukotine na zidovima, pukotine i oštećenja stupova, nosivost djelomično smanjena, privremeno iseljenje, konstruktivna sanacija	
IV	ZNAČAJNA KONSTRUKTIVNA OŠTEĆENJA otvaraju se rupe i urušavaju se zidovi, slom oko 40% konstruktivnih komponenti, građevina je u opasnom stanju, zahtjeva iseljenje, detaljna sanacija ili rušenje	
V	SLOM CIOLOKUPNE GRAĐEVINE Veliki dio ili cijela građevina se urušila, rušenje i rekonstrukcija	

Pažljiva interpretaciju!

←

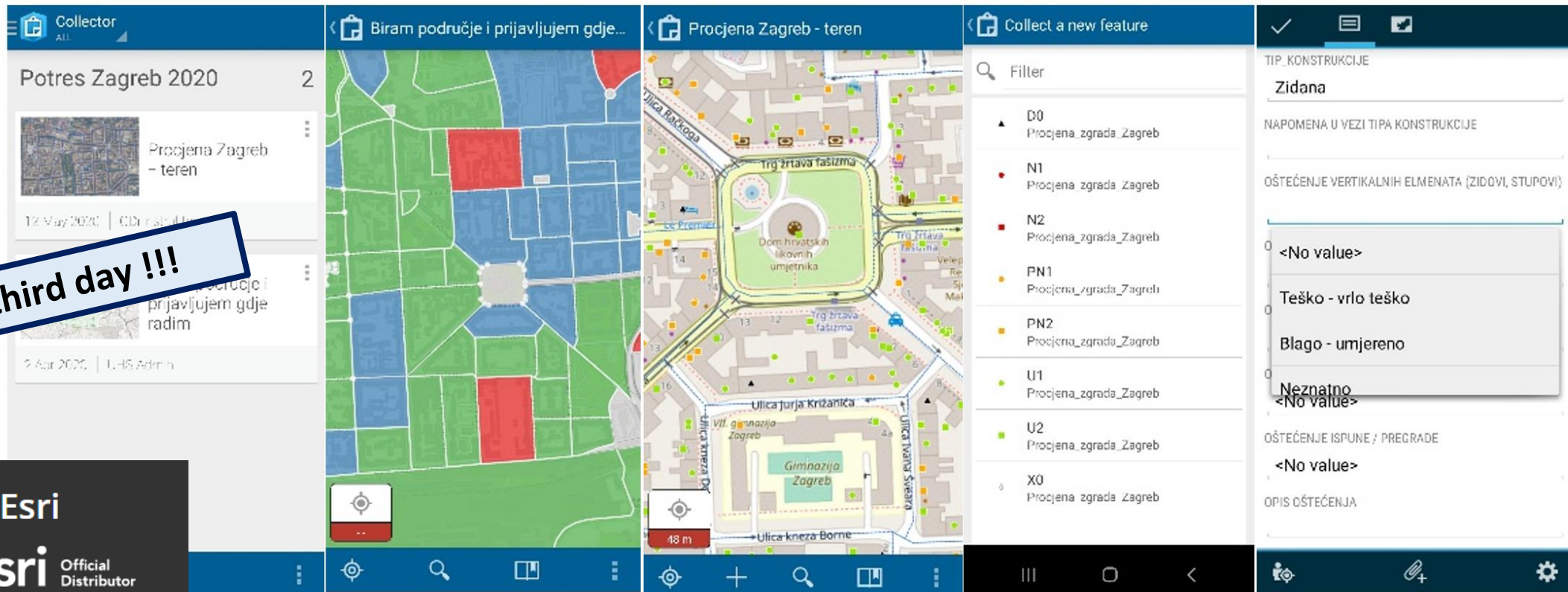
■ Equipment

- City Office of emergency management (first days) + **numerous donations** (later) !!!
- **protective equipment** (masks, disposable gloves and disinfectants for Covid-19 virus, were distributed to all first responders in the field)
- special **COVID-19 instructions** for experts (masks, distance, open the windows, limited time, ...)
- ...



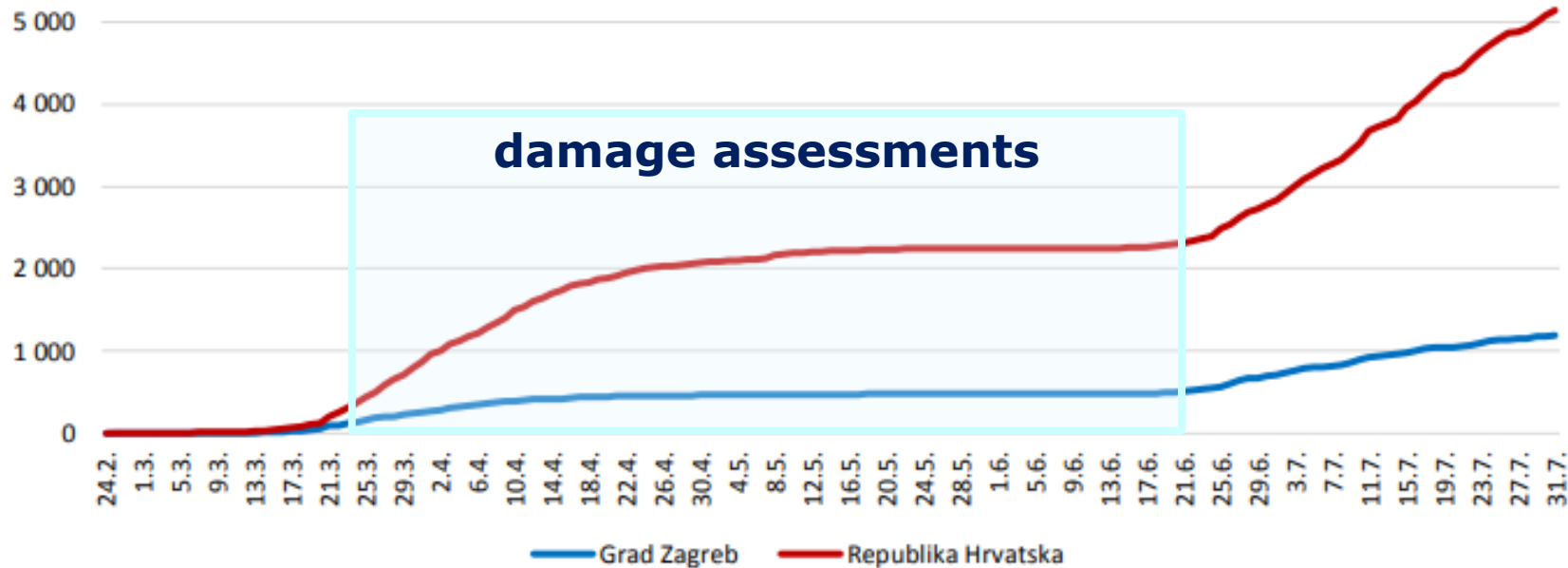
Forms

- urgent programming of the **mobile application** (Collector for ArcGIS) for field surveys
- **simplified acc. feedback from the field** (characteristic damage to gable walls, roofs and chimneys)
- "motivated" by **COVID – 19** (limiting the epidemics spread – avoiding unnecessary contacts)
- ...

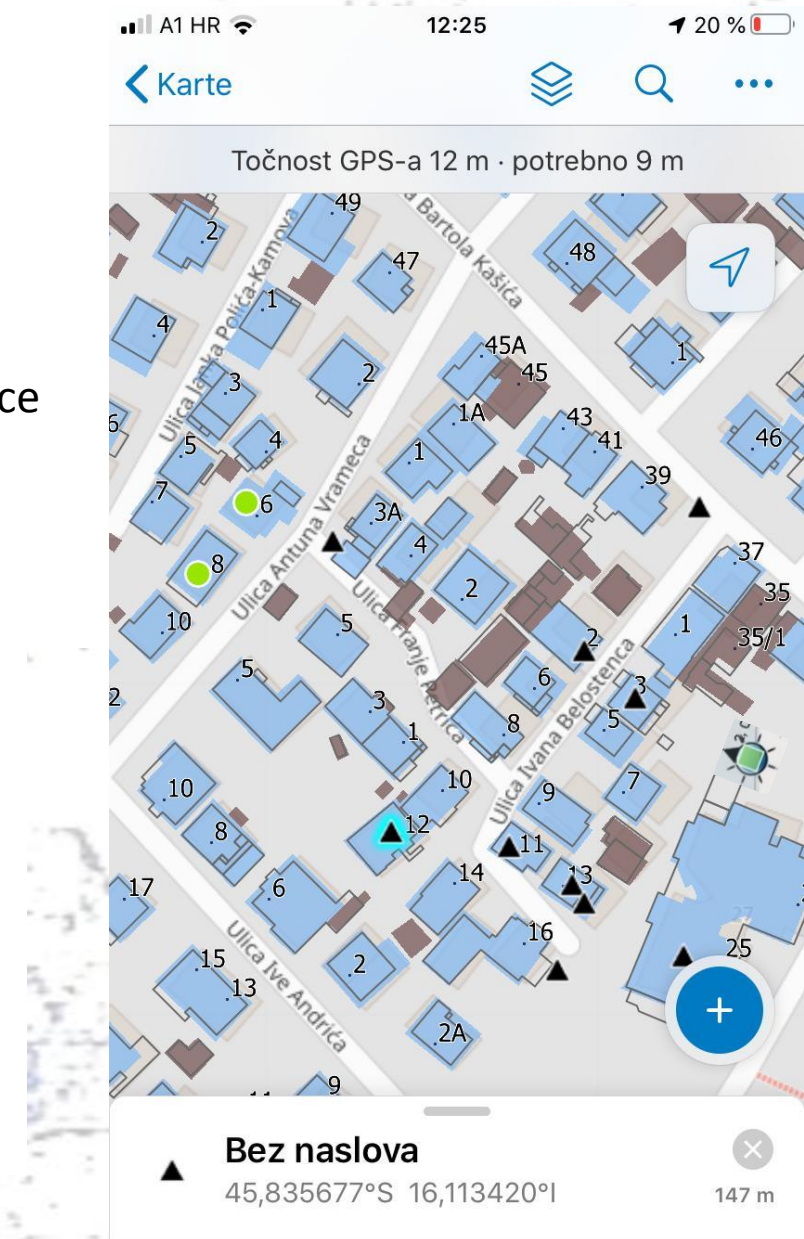


COVID-19

- after first week assessment were paused for 5 days → COVID-19
- data on the sick and self-isolated persons → COVID-19
- experienced ("older") experts were afraid of pandemic
- many engineers and specialist specialists from other parts of Croatia and neighboring countries were **unable to come to Zagreb** to provide assistance



Total number of infected people (Zagreb / Croatia)



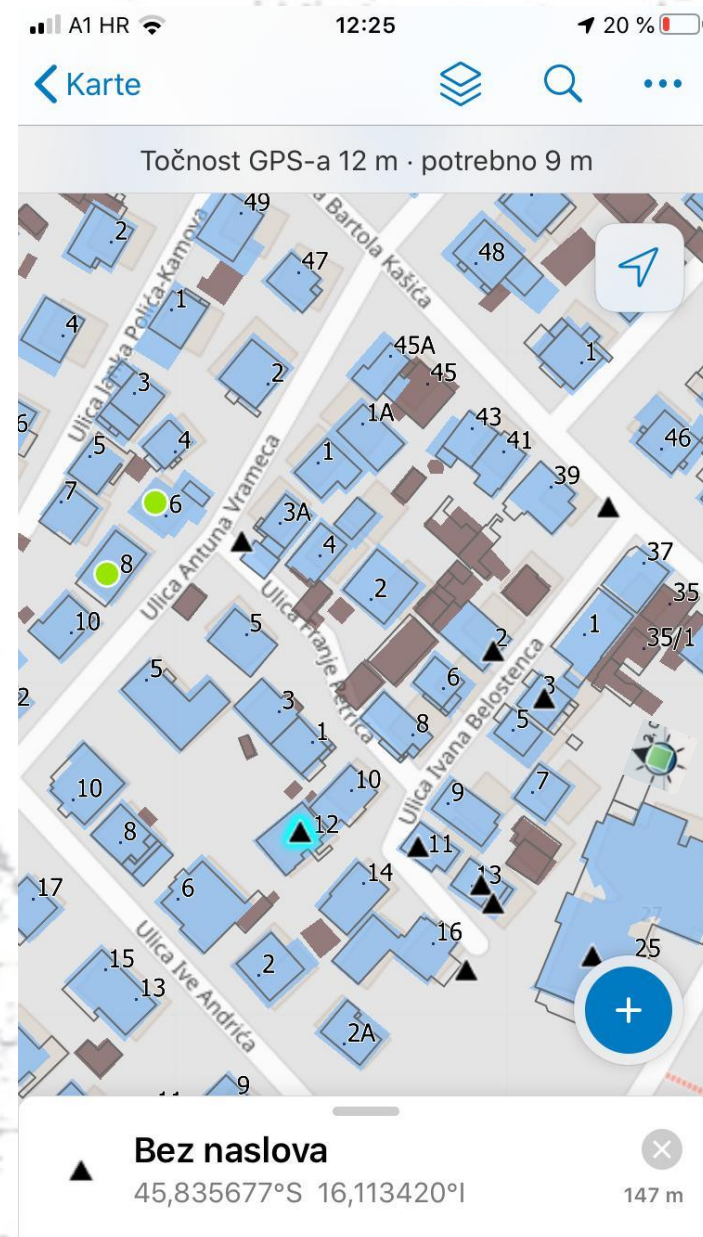
COVID-19

- after first week assessment were paused for 5 days → COVID-19
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- experienced ("older") experts were afraid of pandemic
- many engineers and specialist specialists from other neighboring countries were unable to come
- 150 experts were serologically + (active – 2%)

analyses can't connect the engineers with spread of pandemic

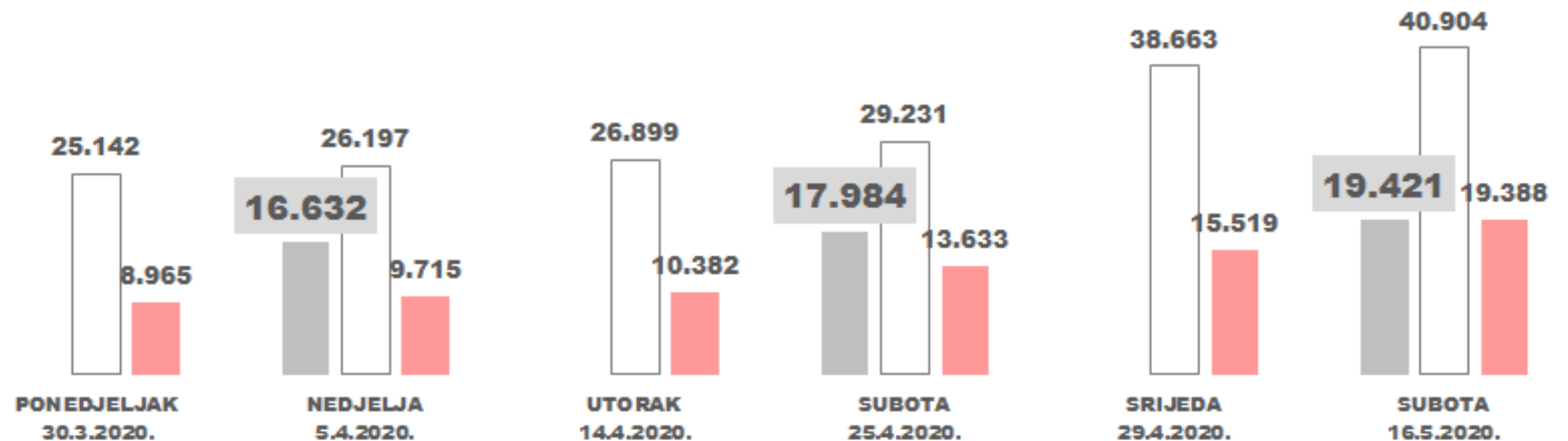


Newly infected (Zagreb / Croatia)



■ Unexpected difficulties:

- double-reported inspection requests
- reaction of residents (not familiar with the methods of inspections)
- residents choosed to **stay home** even when the building was red-tagged
- conflicting and confusing information reported by the **media**
- **shortage of protective equipment on the market**
- **closed borders** and a ban on movement outside the place of residence
- enabling **linkages** with all relevant institutions taking part in the post-earthquake activities
- **adaptations of the GIS based** database to various needs (**only database for a long time**)
- ...



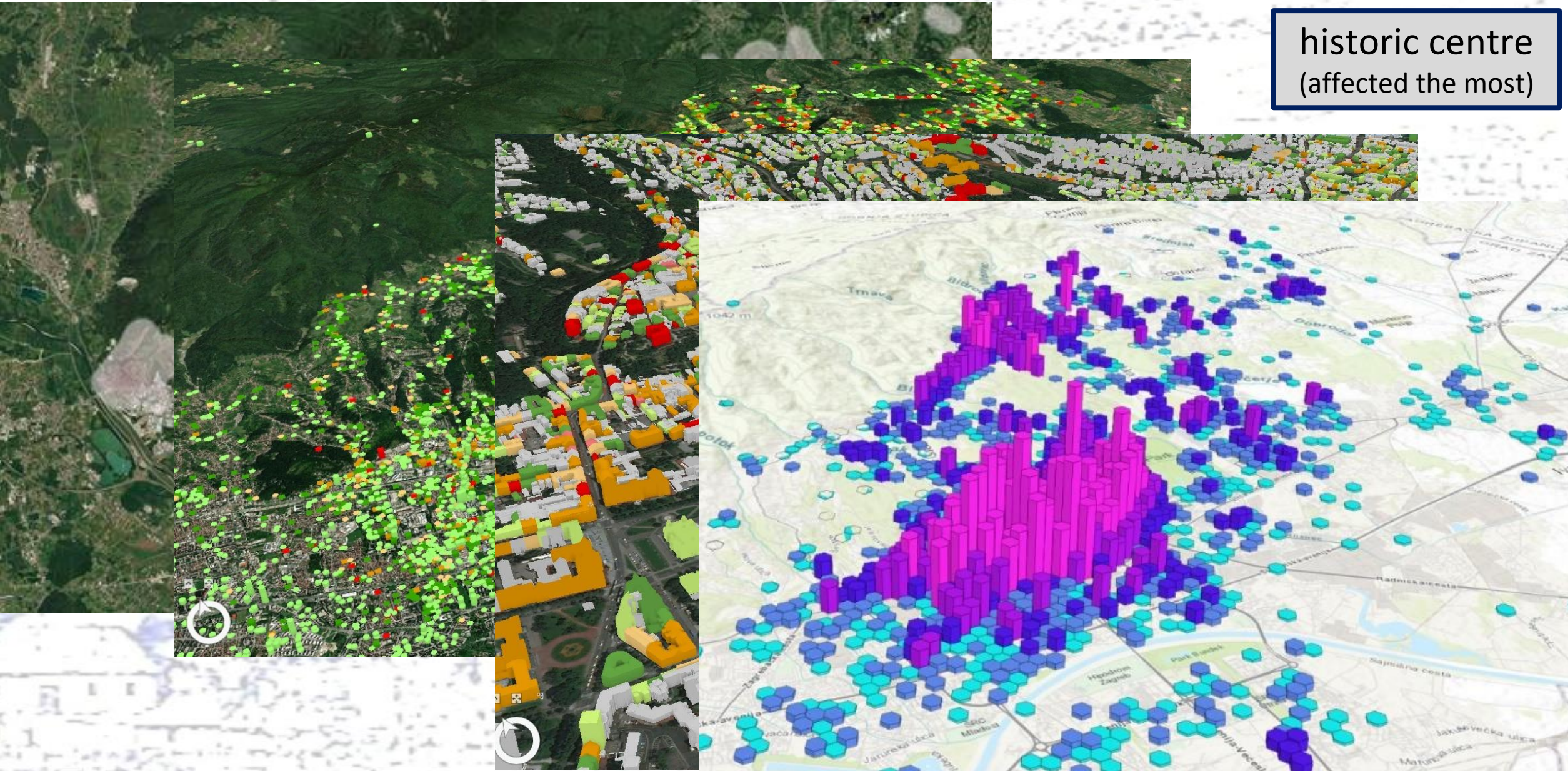


POST-EARTHQUAKE DAMAGE ASSESSMENT OF BUILDINGS



POST-EARTHQUAKE DAMAGE ASSESSMENT OF BUILDINGS

historic centre
(affected the most)



POST-EARTHQUAKE DAMAGE ASSESSMENT OF BUILDINGS

www.hcpi.hr

USABLE

- U1 bez OGRANIČENJA
- U2 UPORABLJIVO s preporukom

PROVEDEN BRZI PREGLED

75,1 %

TEMPORARILY USABLE

- PN1 potreban DETALJAN PREGLED
- PN2 potrebne mjere HITNE INTERVENCIJE

PROVEDEN BRZI PREGLED

19,6 %

UNUSABLE

- N1 zbog VANJSKIH UTJECAJA
- N2 zbog OŠTEĆENJA

PROVEDEN BRZI PREGLED

5,3 %

Ukupno pregleda:

25.574

(neke zgrade su pregledane dva ili više puta)

Statistike

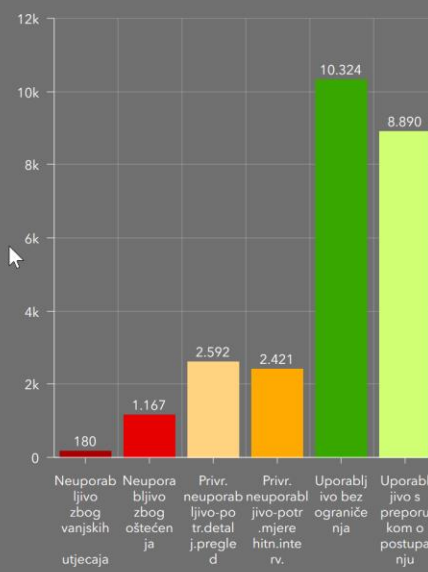
(bez novog sloja)

U novom sloju pregledano

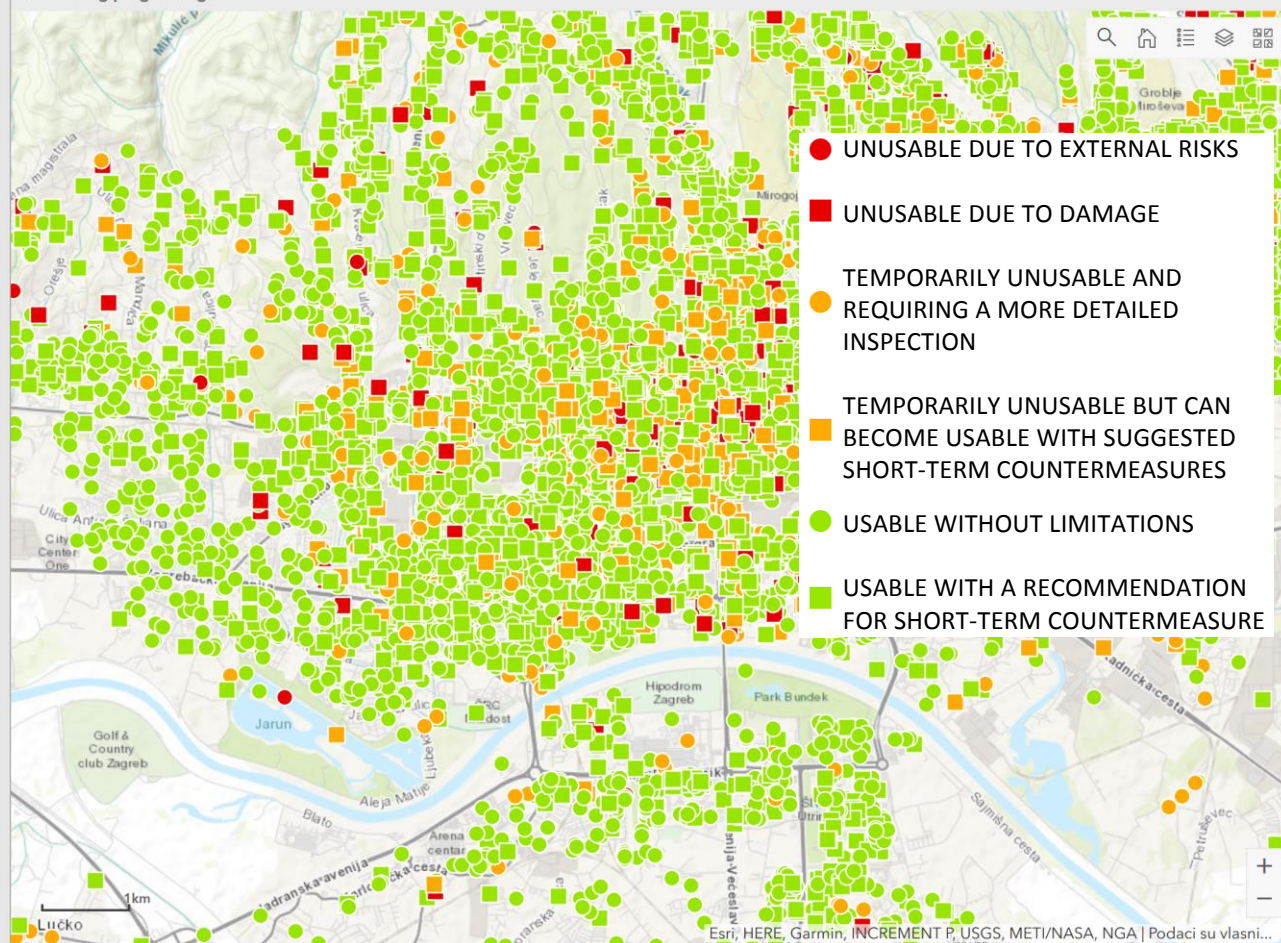
597

zgrada

Pregledi zgrada po uporabljivosti

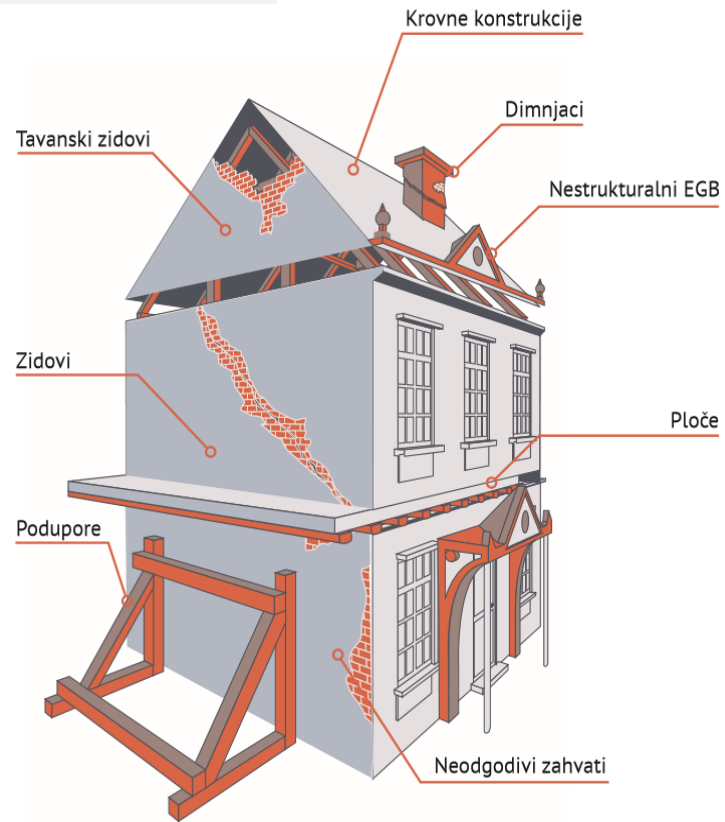
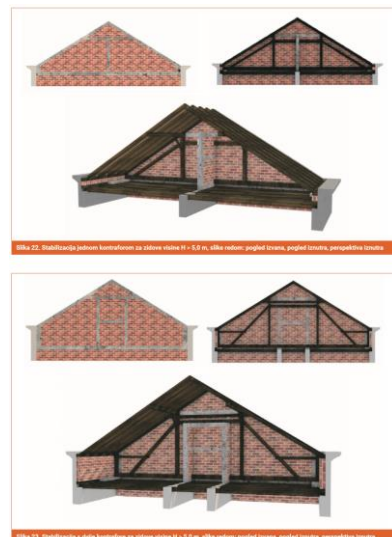
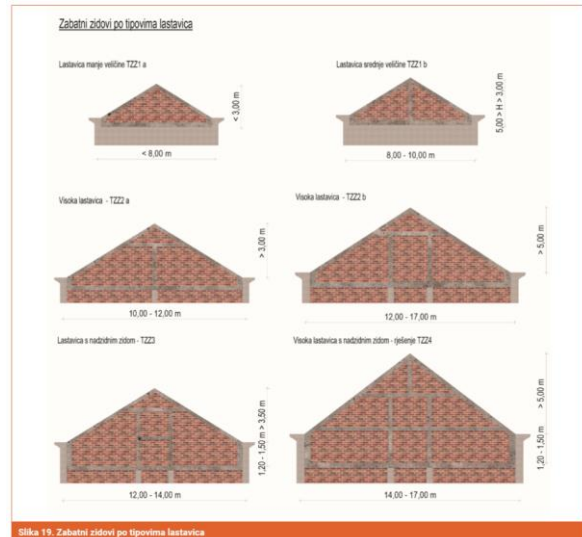
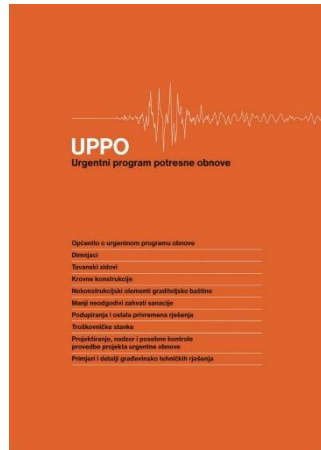
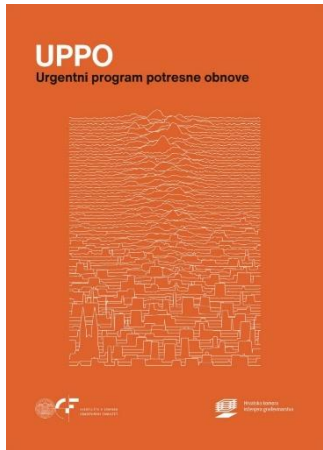


Karta brzog pregleda zgrada

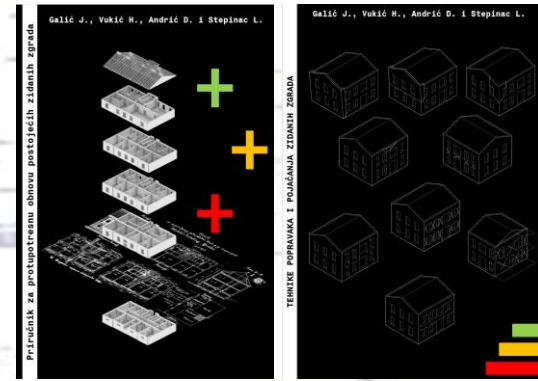


URGENT PROGRAM OF POST-EARTHQUAKE RECONSTRUCTION: manual

www.hcpi.hr/UPPO/



“live” version
(continuous updating)



expert group of 23 people

Other activities

HRVATSKI CENTAR ZA SEIZMIČNO INŽENJERSTVO

stranica inicirana potrebama građevinskih stručnjaka

Home O nama VOLONTERI

Obavijesti iz institucija Info seizmologije

Andrew Charleson: **Retrofitting: improving the seismic performance of masonry buildings.**

Željko Uhlir: **Zakon o obnovi zgrada oštećenih potresom na području Grada Zagreba, Krapinsko-zagorske županije i Zagrebačke županije.**

Mihaela Skurić: **40 godina iskustva iz obnove Dubrovnika.**

Domagoj Damjanović, Joško Krolo i Ivan Duvnjak: **Metode i rezultati ispitivanja zidanih građevina**

Iva Dasović, Marijan Herak, Ines Ivančić i Snježan Prevotnik: **O potresima i seizmologiji – što bi jedan inženjer trebao znati.**

Miroslav Nastev: **Ocjena seizmickog rizika od potresa u urbanim sredinama**

Seismic Resistance and Retrofitting of Unreinforced Masonry Buildings

OBNOVA GRADA ZAGREBA NAKON POTRESA

Ciklus predavanja: znanjem za Zagreb (i Hrvatsku)

Novosti u skladu sa smjernicama Eurokoda 8

Modeliranje nelinearnog odgovora povijesnih zidanih građevina pomoću Equivalent frame modela sa naglaskom na nizeve zgrada

Igor Tomić
 Earthquake Engineering and Structural Dynamics Laboratory (EESD)
 Ecole Polytechnique Fédérale de Lausanne (EPFL)
 Studeni, 2020.

Shake Zagreb with Knowledge

1st Croatian Conference on Earthquake Engineering
 22-23 March 2021
 Zagreb, Croatia

education after earthquake

Savjetovanje 4: OBNOVA ZAGREBA NAKON POTRESA - Zagreb od Splita POTRESNO INŽENJERSTVO (projektiranje, proračuni, izvođenje, eksperimenti, rizici...)

23.11. (ponedjeljak)

Vrijeme	Naslov	Voditelji
08:30-08:40	Pozdrav, najava i vođenje Programa.	Boris Trogrlič, FGAG u Splitu Nina Dražin Lovrec, HIG Josip Atalić, GF Zagreb
08:40-09:00	Uvod.	Ante Mihanović, FGAG u Splitu
1. blok, 09:00-12:00		
09:00-09:45	Iskustva i eksperimentalna istraživanja u vezi seizmičke sanacije zidanih zgrada	Miha Tomažević, Zavod za gradbeništvo Slovenije, Oddelek za konstrukcije
09:45-10:30	Primer projekta sanacije objekta oštećenog eksplozijom	Alen Harapin, FGAG u Splitu
10:30-11:15	Nelinearne numeričke simulacije i eksperimentalna istraživanja statičkog i dinamičkog ponašanja zidanih konstrukcija	Goran Balovec i Nikola Grgić, FGAG u Splitu
11:15-11:30	Tehnološki postupci ojačanja konstrukcija - osvrt	Berislav Borovina i Miljenko Vučić, SPEGRA d.o.o. Split
2. blok, 12:00-15:00		
12:00-12:30	Primeri posljedica djelovanja potresa na objekte kulturne baštine	Blaž Gotovac, Nives Kurbaša, FGAG u Splitu
12:30-13:00	Procjena potresne ranjivosti i nosivosti zgrada kao preduvjet sprječavanja, upravljanja i prevladavanja potresnog rizika u povijesnim gradskim sredinama	Željana Nikolić, FGAG u Splitu
13:00-13:30	Praktični primjeri seizmičkog ojačanja opsežnog zida čeličnim okvirima i mrežama stakloplastike GFRP u mortu na zgradama grada Zagreba	Nikola Miletić, KAP 4 d.o.o. Zagreb / SIGMA PROJEKT d.o.o. Split
13:30-14:00	Primjena FEM/DEM metode u potresnom inženjerstvu	Hrvoje Smejlović, FGAG u Splitu
14:00-14:30	New generation of masonry solutions	Andreas Jäger, Tomislav Franko WIENERBERGER Austrija/Hrvatska
14:30-	Rasprava/zaključci	

31.3.2020.: Mapei webinar: Konstrukcijska ojačanja

31.3.2020.: Baldinistudio webinar: Seizmička analiza zgrada

6.5.2020. Webinar: Sanacije u potresu oštećenih dimnjaka primjenom suvremenih rješenja - proizvođača Skoberne

13.5.2020. Webinar: Sanacija karakterističnih oštećenja građevina nastalih djelovanjem potresa, primjenom suvremenih rješenja proizvođača SIKA

19.5.2020. Webinar: Provedba i tumačenje uputstva za sanaciju dimnjaka, ugradnju novih bojlera te ostalih oštećenja namijenjeno vlasnicima zgrada i upraviteljima

20.5.2020.: Mapei sustavi i rješenja za sanaciju nakon potresa - webinar

3.6.2020. Panel rasprava o Prijedlogu Zakona o obnovi zgrada oštećenih potresom u Zagrebu i okolici

KONFERENCIJA Poslovni dnevnik
 18.00 - 18.30
 Pozdravni govori

28.7.2020.: Potres - metode proračuna Mapei webinar

Webinar obrađuje metode proračuna potresa. Svoja iskustva prenijeli su međunarodni stručnjaci dr. Gabriele Guerrini, Davide Seni i Luca Albertario.

STRUČNA ONLINE KONFERENCIJA:
 POTRES I ODRŽIVA GRADNJA
 TEHNIČKI ASPEKTI

PROGRAM
 zoom
 1.7.2020.
 10.00 - 13.30

SVUČILIŠTE U SPLITU, FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
<http://gradst.unist.hr>

Hrvatska komora inženjera građevinarstva

u sklopu aktivnosti Stručnog usavršavanja AF-a organizira stručni

analize otpornosti postojećih zgrada

6. velika dvorana 81, 14.07.2020. godine s početkom u 14 sati.

prosinac



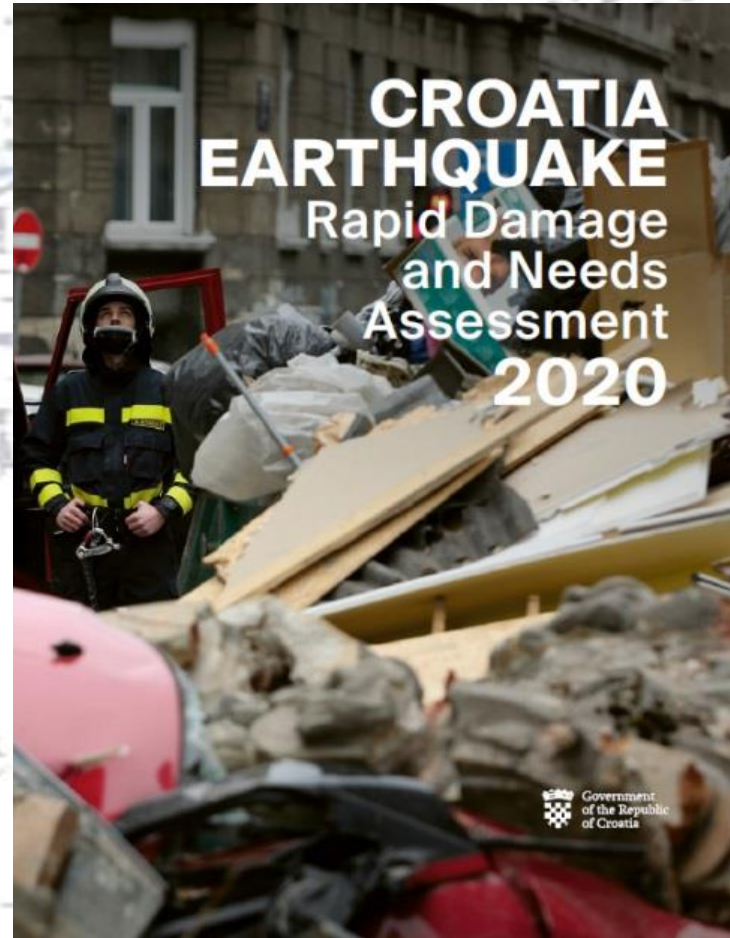
Other activities



**ZAKON O OBNOVI ZGRADA OŠTEĆENIH
 POTRESOM NA PODRUČJU GRADA ZAGREBA I
 OKOLICE**
 Preliminarna procjena troškova

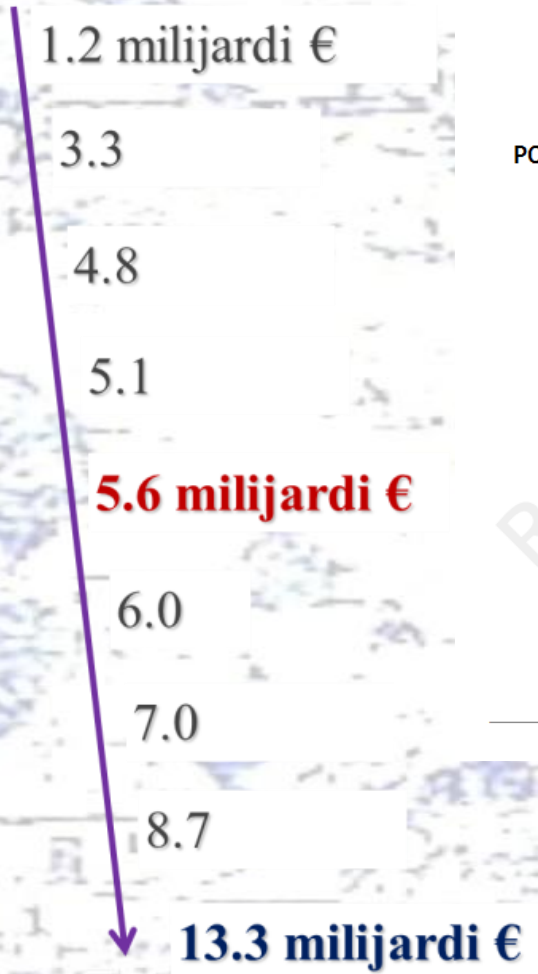
Zagreb, travanj 2020.

Umnožavanje ovog Elaborata nije dozvoljeno bez pisanog odobrenja Voditelja projekta.



> 7.1 milijardi €
 > 12.3 milijardi €

> 11.0 milijardi €
 > 17.5 milijardi €



New laws

MINISTARSTVO GRADITELJSTVA I PROSTORNOGA UREĐENJA

1448

Na temelju članka 17. stavka 2. Zakona o gradnji («Narodne novine», broj 153/13, 20/17, 39/19 i 125/19) ministar graditeljstva i prostornoga uređenja donosi

TEHNIČKI PROPIS

O IZMJENI I DOPUNAMA TEHNIČKOG PROPISA ZA GRAĐEVINSKE KONSTRUKCIJE

Članak 1.

U Tehničkom propisu za građevinske konstrukcije («Narodne novine», broj 17/17) u članku 4. iza podstavka 2. dodaje se podstavak 3. koji glasi: »Prilog III. – Razine obnove potresom oštećenih konstrukcija zgrada u odnosu na mehaničku otpornost i stabilnost.«

Članak 2.

Naslov poglavlja V. mijenja se i glasi: »V. REKONSTRUKCIJA, OBNOVA GRAĐEVINSKIH KONSTRUKCIJA ZGRADA NAKON POTRESA I UKLANJANJE GRAĐEVINSKE KONSTRUKCIJE«

Članak 3.

Iza članka 24. dodaje se članak 24.a i naslov iznad njega koji glase:

»Obnova građevinskih konstrukcija zgrada nakon potresa

Članak 24.a

(1) Obnova potresom oštećenih građevinskih konstrukcija zgrada obuhvaća popravak i pojačanja konstrukcijskih i/ili nekonstrukcijskih elemenata s razinom obnove koja je primjerena opasnosti područja, oštećenju zgrada i potresnom riziku zgrade, a vezano za potresnu oštećljivost zgrade i njezinu namjenu.

(2) Razine obnove građevinskih konstrukcija zgrade nakon potresa za određena područja propisane su u Prilogu III. ovoga Propisa.

(3) Obnovom građevinske konstrukcije zgrade u skladu s Prilogom III. ovoga Propisa ne smije se nepovoljno utjecati na ispunjavanje ostalih temeljnih zahtjeva u odnosu na razinu na kojoj su bili ispunjeni prije potresa.

(4) Obnova se provodi na razinu potresne otpornosti prema Prilogu III. ovoga Propisa ili na razinu potresne otpornosti koja je bila propisana u trenutku kada je zgrada izgrađena, s time da je mjerodavan stroži kriterij potresne otpornosti.«

Članak 4.

Ovaj Propis stupa na snagu prvoga dana od dana objave u »Narodnim novinama«.

Klasa: 360-01/20-04/6

Urbroj: 531-01-20-27

Zagreb, 26. lipnja 2020.

Ministar

Predrag Štromar, v. r.

HRVATSKI SABOR

1915

Na temelju članka 89. Ustava Republike Hrvatske, donosim

ODLUKU

O PROGLAŠENJU ZAKONA O OBNOVI ZGRADA OŠTEĆENIH POTRESOM NA PODRUČJU GRADA ZAGREBA, KRAPINSKO-ZAGORSKE ŽUPANIJE I ZAGREBAČKE ŽUPANIJE

Proglašavam Zakon o obnovi zgrada oštećenih potresom na području Grada Zagreba, Krapinsko-zagorske županije i zagrebačke županije, koji je Hrvatski sabor donio na sjednici 11. rujna 2020.

Klasa: 011-01/20-01/88

Urbroj: 71-06-01/1-20-2

Zagreb, 15. rujna 2020.

Predsjednik
Republike Hrvatske
Zoran Milanović, v. r.

ZAKON

O OBNOVI ZGRADA OŠTEĆENIH POTRESOM NA PODRUČJU GRADA ZAGREBA, KRAPINSKO-ZAGORSKE ŽUPANIJE I ZAGREBAČKE ŽUPANIJE

New regulations

New ...

NN 119/2020 (30.10.2020.), Odluka o donošenju Prvog programa mjera obnove zgrada oštećenih potresom na području Grada Zagreba, Krapinsko-zagorske županije i Zagrebačke županije

VLADA REPUBLIKE HRVATSKE

2309

Na temelju članka 11. stavka 3. Zakona o obnovi zgrada oštećenih potresom na području Grada Zagreba, Krapinsko-zagorske županije i Zagrebačke županije («Narodne novine», broj 102/20), Vlada Republike Hrvatske je na sjednici održanoj 29. listopada 2020. donijela

ODLUKU

O DONOŠENJU PRVOG PROGRAMA MJERA OBNOVE ZGRADA OŠTEĆENIH POTRESOM NA PODRUČJU GRADA ZAGREBA, KRAPINSKO-ZAGORSKE ŽUPANIJE I ZAGREBAČKE ŽUPANIJE

I.

Donosi se Prvi program mjera obnove zgrada oštećenih potresom na području Grada Zagreba, Krapinsko-zagorske županije i Zagrebačke županije.

Prvi program iz stavka I. ove točke sastavni je dio ove Odluke.

II.

Zadužuje se Ministarstvo prostornoga uređenja, graditeljstva i državne imovine da o donošenju ove Odluke izvijesti nositelje provedbe Prvog programa mjera iz točke I. stavka I. ove Odluke.

III.

Ova Odluka stupa na snagu prvoga dana od dana objave u »Narodnim novinama«.

Klasa: 022-03/20-04/294

Urbroj: 50301-05/20-20-2

Zagreb, 29. listopada 2020.

Predsjednik
mr. sc. Andrej Plenković, v. r.



Lessons learned

- ❑ small "slap" (lesson) for Croatia
- ❑ **key** is continuous raising/maintaining of **seismic risk awareness**
 - citizens, media, profession, politics, ...
 - procedures (prepare all in advance)
 - continuous work ("fight"), investments, ...
 - energy efficiency (together?)
 - ...
- ❑ **preparedness** (knowledge transfer, education, exercises, ...)
 - minimum preparedness for **COVID-19** (used to improvisation?)
- ❑ deal with the "sins" of the past in advance
- ❑ **PLATFORM FOR EARTHQUAKE ENGINEERING !!!**
 - connecting all – our best hope
- ❑ COVID-19 /seismic risk awareness (new EQ, other city?)



THANK YOU FOR YOUR ATTENTION!

Josip Atalić atalic@grad.hr

www.grad.hr/crocee



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