

## MOGUĆNOST FORMIRANJA HRVATSKOG TIMA STRUKTURNIH INŽENJERA UNUTAR EUROPSKOG KAPACITETA ZA ODGOVOR NA HITNE SITUACIJE (EERC)

Stručni članak

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### Sažetak

*Trendovi pokazuju kako će inženjeri zasigurno nastaviti dobivati na značaju unutar sustava modernih sustava upravljanja u kriznim situacijama. Kada je riječ o fazi odgovora nezaobilazna je međunarodna suradnja, odnosno međunarodna pomoć, u kojoj ne postoji duga i sadržajna povijest sudjelovanja inženjera. Ipak, u posljednje vrijeme se događaju pozitivni pomaci te su započeli pokušaju standardizacije uloge i načina djelovanja timova inženjera, prije svega strukturalnih.*

*Temelje za formiranje standardiziranih timova strukturalnih inženjera njihovom identifikacijom kao jednim od timova unutar Europskog kapaciteta za odgovor na hitne situacije je postavila i Europska unija kao lider u području standardizacije međunarodne pomoći u kriznim situacijama. Ipak, postizanje brojnosti i standardizacija ovisi o inicijativama pojedinih država koje moraju preuzeti odgovornost i formirati timove strukturalnih inženjera, ali i raditi na usklađivanju strukture i postupanja s timovima drugih država.*

*Jedna od država koja potencijalno može formirati tim strukturalnih inženjera je i Hrvatska jer ima iskustva s mnogobrojnim i raznovrsnim interventnim inženjerskim aktivnostima nakon potresa u 2020. godini. Problem stvara činjenica kako su spomenute aktivnosti provedene bez sustavne pripreme na kojoj se počelo raditi tek nakon potresa.*

*Hrvatska je paralelno započela i s procesom formiranja tima strukturalnih inženjera zbog potencijalne potrebe za međunarodnim djelovanjem u bližoj budućnosti, što je dodatno potaknuo i potres u Turskoj početkom 2023. godine, ali i činjenica kako u regiji ne postoje razvijeni slični kapaciteti.*

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***Ključne riječi:*** *timovi strukturnih inženjera, upravljanje u kriznim situacijama, inženjerstvo, međunarodna pomoć, Europski kapacitet za odgovor na hitne situacije*

## **1. UVOD**

Sigurnost i sigurnosne znanosti pokrivaju mnoga područja i zahtijevaju sveobuhvatni, ali i multidisciplinarni pristup zbog raznovrsnosti tih područja. Ta činjenica posebno dolazi do izražaja u 21. stoljeću kad se fokus u području sigurnosti počinje sve više odmicati od tradicionalnih shvaćanja i ratnih djelovanja.

Fokus se počinje usmjeravati prema kriznim situacijama, uključujući one koje su rezultat pojave antropogenih ugroza, a posebno one koje su rezultat pojave prirodnih ugroza. Uzrok tome su sve češće i sve štetnije krizne situacije uzrokovane prirodnim ugrozama, a tome doprinose i klimatske promjene čiji će se utjecaj nastaviti i u budućnosti.

Sigurnost će se također u budućnosti nastaviti sve više fokusirati na preventivne aktivnosti i povećanje otpornosti zbog nedvojbenog učinka koji se može postići pravovremenim djelovanjem. Ipak, zbog same srži sigurnosti i okolnosti koje na nju utječu, operativno djelovanje, s naglaskom na fazu odgovora će uvijek zadržati svoju važnost.

Zbog te činjenice se u fazi odgovora nastavljaju pronalaziti načini daljnjeg razvoja i optimalizacije budućih aktivnosti. Jedan od pravaca je i međunarodna suradnja, odnosno pomoć, jer u katastrofama države ne mogu same odgovoriti na kriznu situaciju i potrebna im je pomoć drugih država koje su sposobne i voljne pomoći.

Praksa međunarodne pomoći u odgovoru se mnoštvo puta dokazala kroz povijest, ali su se pojavljivali i problemi vezani uz pružanje međunarodne pomoći, posebno u dijelu koji se odnosi na razumijevanje pomoći i usklađivanje u djelovanju. Iz tog razloga se dokazalo kako je potrebna standardizacija kapaciteta koji su predmet međunarodne pomoći jer je to jedini način za maksimalnu efikasnost (Giles et al., 2019).

## **2. PREGLED POSTOJEĆEG STANJA**

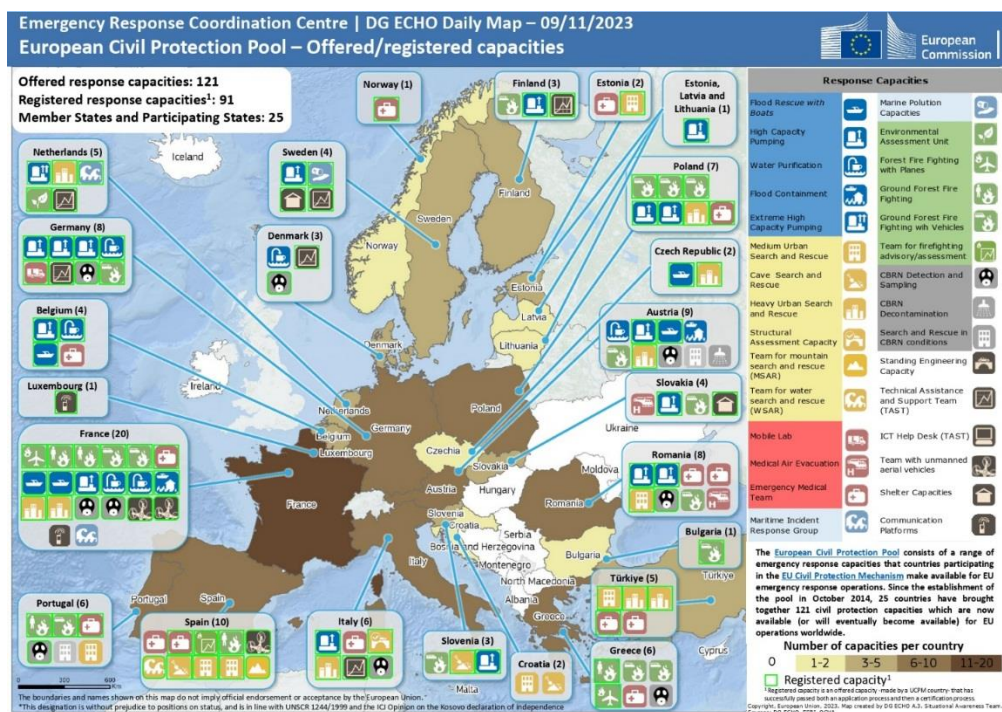
Zbog povećanja fokusa na međunarodnu pomoć i njen razvoj došlo i do sve većeg broja aktivnosti koje su usmjerene upravo prema standardizaciji kapaciteta u međunarodnoj pomoći. Prvenstveno se radi o praktičnim nastojanjima država da stvore kapacitete i procedure za međunarodnu pomoć te da iskoriste svoja, ali i iskustva i znanja drugih država (Łaźniewska, 2011). Ipak, potrebno je istaknuti kako je i sve više znanstvenih istraživanja, iako njihov broj i dalje zaostaje u odnosu na broj praktičnih aktivnosti u području prijenos znanja i iskustava vezanih uz međunarodnu suradnju.

### **Europski kapacitet za odgovor na hitne situacije**

Prijenos znanja i iskustava se odvija putem direktnih suradnji, pri čemu se ističu suradnje susjednih država ili država koje se nalaze u sličnim situacijama kada je riječ o rizicima, ali se odvija i putem posredništva međunarodnih organizacija koje su specijalizirane za koordinaciju međunarodne pomoći, pri čemu se može istaknuti Europska unija, odnosno njen mehanizam civilne zaštite (Zwęgliński, 2015).

Uloga Mehanizma civilne zaštite Europske unije nije samo u povezivanju pojedinih država, primarno kroz organizaciju vježbi civilne zaštite i financiranje zajedničkih projekata iz vlastitih fondova, niti koordinacija njihovog međunarodnih djelovanja tijekom kriznih situacija putem Koordinacijskog centra za odgovor na hitne situacije (u nastavku: ERCC). Mehanizam civilne zaštite Europske unije radi i na prepoznavanju potreba za formiranjem i identifikacijom kapaciteta međunarodne pomoći koji se putem ERCC-a mogu aktivirati.

S tom svrhom je stvoren Europski kapacitet za odgovor na hitne situacije (u nastavku: EERC) kao svojevrsni bazen kapaciteta na koji su nominirani od strane država za potencijalnu međunarodnu pomoć, *Slika 1*. Vrste kapaciteta su unaprijed identificirane od strane Mehanizma civilne zaštite i dijele se na module, timove, stručnjake i opremu (DG ECHO, 2015).



*Slika 1. Europski kapacitet za odgovor na krizne situacije*  
<https://reliefweb.int/map/turkiye/european-civil-protection-pool-offeredregistered-capacities-dg-echo-daily-map-09112023>

Ključna je činjenica kako je vrlo veliki naglasak na standardizaciji kapaciteta kako bi se osiguralo njihovo razumijevanje, ali i efikasnost i interoperabilnost u samom operativnom djelovanju. Kako bi se postigla standardizacija Europska unija propisuje vrlo striktne kriterije i vrši certifikaciju svih kapaciteta (1313/2013/EU).

Osim kod razumijevanja pojedinih kapaciteta kod zatraživanja i prihvatanja pomoći tijekom kriznih situacija, striktni kriteriji znatno olakšavaju razumijevanje potrebne forme kapaciteta prilikom procesa njihovog formiranja i nominiranja u EERC, posebno kada je riječ o modulima i timovima.

Ipak, striktnost kriterija se razlikuje u odnosu radi li se o timovima ili modulima (1313/2013/EU). Moduli su prema postupku certifikacije i kriterijima zahtjevniji u odnosu na timove. Moduli i njihovi kriteriji su vrlo striktno definirani zbog svoje važnosti i učestalosti aktivacije za međunarodnu pomoć. Kriteriji i postupak certifikacije za timove su ipak fleksibilnije definirani unutar EERC-a.

Razlog tome je i činjenica kako i sama Europska unija, odnosno ERCC i EERC još uvijek pokušavaju pronaći nove timove i njihove optimalne forme. Upravo su iz tog razloga veće mogućnosti za formiranje timova i prilagođavanje njihovih formi sukladno specifičnim mogućnostima ili sklonostima. To olakšava proces formiranja timova, ali i predstavlja priliku za unaprjeđenjem generalnog standarda za kriterije tih timova u budućnosti.

### **Timovi strukturnih inženjera u Europskoj uniji**

Jedan od timova nedavno prepoznatih u EERC je tim strukturnih inženjera. Upravo su inženjeri jedno od područja koje dobivaju sve više na značaju unutar sustava upravljanja u kriznim situacijama, a posebice kada je riječ o njihovoj potencijalnoj ulozi u fazi odgovora, odnosno provedbi interventnih inženjerskih aktivnosti, a samim time i u području međunarodne pomoći.

Inženjeri mogu doprinijeti u mnoštvu različitih interventnih inženjerskih aktivnosti i ugroza, a strukturni inženjeri se posebnu ističu. Oni mogu najviše doprinijeti u dijelu sustava upravljanja kriznim situacijama koji se odnosi na građevine i njihovo stanje, pri čemu se može istaknuti krizne situacije izazvane potresima (Dolce, 2023).

Uz sve navedeno i sama Europska unija je imala prethodno iskustva s potrebom i slanjem strukturnih inženjera kao međunarodne pomoći tijekom kriznih situacija, i kao dio timova civilne zaštite Europske unije (u nastavku: EUCPT) i kao dio timova specijaliziranih timova za procjene (Goretti, 2017). Najbolji primjer je potres u Albaniji 2019. godine kad je, na zahtjev Albanije, putem ERCC-a, kao dio EUCPT poslano oko 185 strukturnih inženjera iz 18 zemalja

koji su pomogli lokalnim inženjerima u pregledima oštećenja i uporabljivosti građevina, Slika 2 (Macabuag, 2022).



*Slika 2. EUCPT nakon potresa u Albaniji*

Izvor: <https://th.bing.com/th/id/OIP.z8OkZwpXfpFruXhMT6ReTQHaE8?rs=1&pid=ImgDetMain>

Kako ne bi ovisila o pozivanju strukturalnih inženjera kao pojedinih stručnjaka ili spontano оформljenih i ponuđenih specijaliziranih timova putem ERCC-a, Europska unija je poduzela daljnje mjere i identificirala tim strukturalnih inženjera kao jedan od kapaciteta unutar EERC-a. Na taj način osiguravši lakši pronalazak i organizaciju pri slanju strukturalnih inženjera kao međunarodne pomoći, ali ujedno i osiguravši lakšu implementaciju u timove, aktivnosti i sustav zemlje primateljice pomoći.

Kao što je to ranije spomenuto timovi doprinose razumijevanju i efikasnosti, ali i dalje ne predstavljaju potpunu striktnost u kriterijima kao što je slučaj kod modula. I timovi strukturalnih inženjera su kao kapacitet su još uvijek poprilično fleksibilni, odnosno tek trebaju biti razvijeni i formirani sukladno optimalnim potrebama i mogućnostima, nakon usuglašavanja i dokazivanja forme će početi striktnije definiranje kriterija kako bi se osigurala standardizacija sukladno optimalnoj formi.

U cijelom procesu je inicijativu preuzela Italija što je očekivano jer već duži period imaju sustavno razvijeno sudjelovanje inženjera u sustavu upravljanja u kriznim situacijama (Dolce 2023). Također, već su imali značajna iskustva s uključivanjem inženjera u krizne situacije na svom području, a njihovi inženjeri

su pružali i međunarodnu pomoć, između ostalog i kao dio tima koji je ERCC uputio 2019. godine u Albaniju (Macabuag, 2022).

Uz to, Italija je u proteklim godinama organizirala edukacije inženjera iz za drugih država za provedbu interventnih inženjerskih aktivnosti. Potrebno je istaknuti projekt MultinATIonaL module on Damage Assessment and countermeasures (u nastavku: MATILDA). MATILDA je provedena od 2014. do 2017. godine kao nastavak prethodnog projekta Dr. House koji je bio u nacionalnim okvirima, dok se u MATILDA-i proširio na inženjere iz Slovenije i Hrvatske DG ECHO, 2014).

Upravo zbog svega navedenog je Italija preuzela inicijativu i prva prijavila tim strukturalnih inženjera u EERC, a do danas je to ostao jedini prijavljeni tim strukturalnih inženjera. Problematično je što nema dostupnih informacija o talijanskom timu strukturalnih inženjera i njegovoj strukturi i mogućnostima, već samo postoji informacija o njegovom postojanju i certifikaciji unutar EERC-a.

Nedvojbeno je kako je potrebno još formiranih i certificiranih timova strukturalnih inženjera unutar EERC-a. To se dokazuje što se vidi tijekom mnogi kriznih događaja većih razmjera (i izvan Europske unije), posebno kada je riječ o onima nastalim pojavom potresima, najbolji primjer potres u Turskoj 2023. godine.

Svakako talijanski tim strukturalnih inženjera treba služiti kao referentan prilikom formiranja drugih timova strukturalnih inženjera, posebno ako se misle nominirati za certifikaciju u EERC-u. Ipak, sama forma koju je Italija predložila je fleksibilna i može se prilagoditi mogućnostima drugih država odnosno timova, a moguće je pronaći i unaprjeđenja za sve buduće timove strukturalnih inženjera, što će posebno doći do izražaja povećanjem broja timova i njihovim usklađivanjem i uvježbavanjem, a potencijalno i suradnjom tijekom kriznih događaja.

Pridruživanje inicijativi formiranja timova strukturalnih inženjera i njihovog nominiranja za certifikaciju u EERC od strane drugih država treba se bazirati na državama koje imaju već imaju iskustva i postojeće preduvjete za stvaranje timova strukturalnih inženjera.

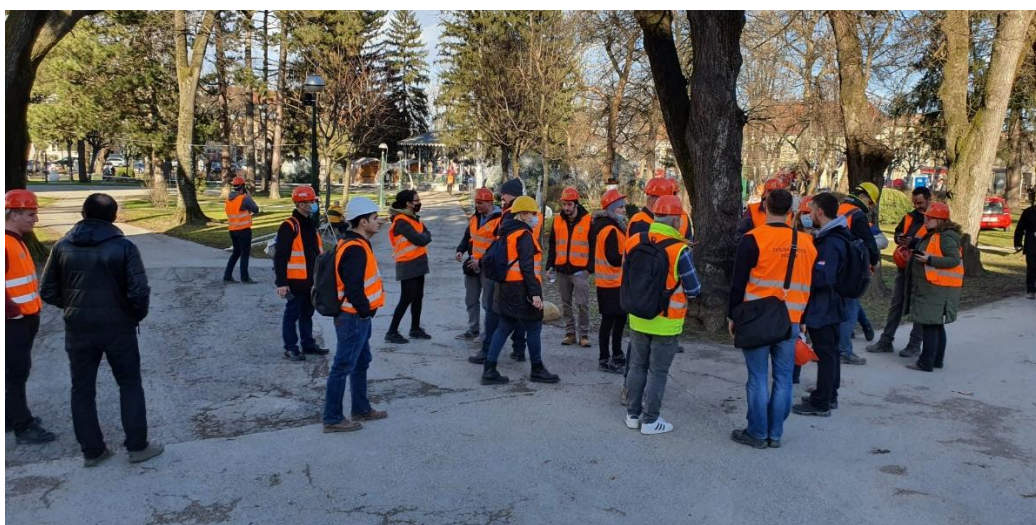
### **3. POTENCIJAL ZA FORMIRANJE HRVATSKOG TIMA STRUKTURNIH INŽENJERA U HRVATSKOJ**

Hrvatska posjeduje iznimna nedavna iskustva s interventnim inženjerskim aktivnostima unutar sustava civilne zaštite. Iskustva su stečena nakon potresa u Hrvatskoj u 2020. godini, točnije u ožujku u Zagrebu, a nakon toga i prosincu i u Petrinji.

Prethodno nije postojao organiziran i pripremljen sustav za uključivanje inženjera u fazu odgovora tijekom kriznih situacija, ali je zbog značajne potrebe je sustav (struktura, procedure, metodologije i dr.), uz značajnu razinu improvizacije, stvoren u vrlo kratkom vremenu pod nazivom Hrvatski centar za potresno inženjerstvo.

Iako Hrvatski centar za potresno inženjerstvo nije formalno postojao kao organizacija, već samo kao neformalna platforma koja je djelovala kao dio Ureda za Hitne situacije Grada Zagreba i kasnije Ravnateljstva civilne zaštite Republike Hrvatske (u nastavku: RCZ), bio je ključan jer je postao centralno tijelo koje je omogućilo uključivanje inženjera, a samim time i provođenje interventnih inženjerskih aktivnosti.

Mnogobrojni inženjeri, kojih je ukupno bilo oko dvije tisuće, su bili organizirani u timove s ciljem izvršavanja pojedinih interventnih inženjerskih aktivnosti, Slika 3. Specijalizacije pojedinih inženjera su bile raznovrsne, a najvažniju ulogu su imali strukturalni inženjeri.



*Slika 3. Inženjeri nakon potresa u Petrinji 2020. godine*

Izvor: Zbirka HCPI-IS

Razlog je činjenica kako su upravo najvažnije i najopsežnije aktivnosti zahtijevala znanja strukturalnih inženjera, a te aktivnosti obuhvaćaju: preglede oštećenja i uporabljivosti građevina (kritična infrastruktura, zgrade, prometnice), preglede vezane uz hitne procedure (sigurnosni koridori, hitna uklanjanja, hitne mjere tehničke zaštite), sudjelovanje u timovima za spašavanje iz ruševina kao stručna podrška (spašavanje imovine).

Osim navedenih, provodile su se i druge interventne inženjerske aktivnosti koje nisu obuhvaćala strukturalne inženjere a to su prije svega pregledi geotehničkih ugroza i uspostavljanje hitnih građevina/infrastrukture. Važno je istaknuti kako je većina aktivnosti provedena u korištenje modernih tehnologija i alata, prije svega ArcGIS-a što je bilo posebno značajno kod pregleda oštećenja i uporabljivosti građevina.

Obzirom da su potresi dokazali nedvojbenu potrebnu za interventnim inženjerskim aktivnostima, a sve aktivnosti i cijeli izgrađeni sustav su početno bili rezultat improvizacije i djelovanja neformalne platforme, unutar sustava civilne zaštite se javila inicijativa za formalizacijom platforme koja će nastaviti svoje djelovanje i nakon krizne situacije.

Inicijativa je naknadno, krajem 2021. godine rezultirala formiranjem udruge Hrvatski centar za potresno inženjerstvo – Interventna služba (u nastavku: HCPI-IS). HCPI-IS je preuzeo provedbu svih interventnih inženjerskih aktivnosti i započeo je s implementacijom u sustav civilne zaštite Hrvatske.

Implementacija i uspostavljanje redovnog i sustavnog funkcioniranja HCPI-IS stvaraju preduvjete za stratešku i sustavnu organizaciju sudjelovanja inženjera u sustavu civilne zaštite, uključujući i interventne inženjerske aktivnosti. Sustavnom organizacijom bi se postigla mogućnost formiranja nacionalnih čvrsto strukturiranih timova inženjera koji bi se mogli jednostavno aktivirati i koordinirati u budućim kriznim situacijama, postizanjem sustavnosti i smanjenjem improvizacije.

HCPI-IS će nakon formiranje nacionalnih timova inženjera, uz potporu ostatka sustava civilne zaštite u Hrvatskoj, imati preduvjete i za sustavno formiranje timova inženjera za međunarodno djelovanje usklađujući nacionalne timove sa standardima koji su propisani za međunarodno djelovanje. Trenutno se u području inženjerskih timova u međunarodnom djelovanju svakako ističu spomenuti timovi strukturnih inženjera unutar EERC-a.

Osim stvaranja nacionalnih timova inženjera, HCPI-IS i Hrvatska već imaju još jedan preduvjet za stvaranje međunarodnih timova. To je činjenica kako pojedini inženjeri već imaju iskustva s međunarodnim aktivnostima, a posebno tečajevima, misijama i vježbama Europske unije koja je nadležna za certifikaciju unutar EERC-a.

Inženjeri su prolazili tečajeve za tehničke eksperte, te su bili na misijama u Albaniji i Turskoj, ali i na vježbama u Sloveniji i Portugalu. Važno je istaknuti i kako su pojedini inženjeri prošli obuku u Italiji u sklopu spomenutog projekta MATILDA u kojem su inženjeri iz Hrvatske sudjelovali u svim dijelovima obuke (Atalić et al., 2019).

Osim inženjera, Hrvatska posjeduje značajna međunarodnih iskustava u području upravljanja u kriznim situacijama. Osim što je nekoliko puta zatražila međunarodnu pomoć zbog kriznih situacija na svom teritoriju, upravo je ona i upućivala svoje kapacitete putem ERCC-a kao pomoć drugim državama.

Nedavni primjer je MUSAR tim koji je jedini formiran i certificiran kapacitet Hrvatske u EERC-u, a koji je putem ERCC-a upućen i operativno je djelovao nakon potresa u Turskoj 2023. godine. Važno je istaknuti kako MUSAR tim, osim certifikacije u EERC-u, redovno sudjeluje na europskim vježbama.

Iako je samo MUSAR trenutno nominiran, Hrvatska je trenutno u fazi pripreme i nominiranja drugih timova za certifikaciju u EERC koji su također prethodno prolazili europske vježbe, ali su i bili upućeni kao međunarodna pomoć drugim državama u prošlosti, pri čemu se mogu istaknuti gašenje požara korištenjem zrakoplova i spašavanje iz vode korištenjem plovila.

Osim međunarodne pomoći u fazi odgovora na krizne situacije, Hrvatska, a prije svega RCZ kao centralno tijelo nadležno za upravljanje u kriznim situacijama ima značajno iskustvo s procedurama i projektima Europske unije što znatno olakšava sve aktivnosti koje su dio sustava Europske unije, točnije Mehanizma civilne zaštite Europske unije.

Potrebno je istaknuti i kako su RCZ, ali i ostatak sustava civilne zaštite vrlo aktivni i u regiji kroz zajedničke projekte, ali i vježbe i međunarodnu suradnju u kriznim situacijama, Slika 4. Upravo regija može imati najviše koristi od hrvatskog tima strukturalnih inženjera unutar EERC-a, jer će se formirati vrlo organiziran i sposoban tim koji će se moći aktivirati i pomoći vrlo brzo preko ERCC, ali i bilateralno. Također, iz istog razloga regija može imati i koristi od drugih dijelova interventnog inženjersko djelovanja HCPI-IS.



*Slika 4. Terenska vježba EU CZ BiH – BANJA LUKA 2021*

Izvor: <https://civilna-zastita.gov.hr/userdocsimages//CIVILNA%20ZA%20C5%A0TITA/Vijesti/Terenska%20vje%C5%BEba%20EU%20CZ%20BiH%20naslovna.jpg?width=750&height=500>

HCPI-IS i Hrvatska mogu imati izniman pozitivan utjecaj i na regiju i u vrijeme između kriznih situacija jer svojim razvojem i razvojem spomenutih kapaciteta mogu služiti kao primjer i centar izvrsnosti, odnosno prenositelj znanja u okruženju, kao što je to primjerice bio spomenuti projekt MATILDA za prijenos znanja od strane Italije. To je posebno naglašeno jer je činjenica kako u regiji u većoj mjeri ne postoje razvijeni slični kapaciteti.

Dodatna je prednost je činjenica kako su zemlje u regiji u vrlo sličnom položaju, ne samo zbog geografskih preduvjeta koji se odnose na postojanje i rasprostranjenost pojedinih ugroza i geografskih obilježja, već i na vrlo slične karakteristike građevina, ali i vrlo sličan jezik što je može imati veliki utjecaj kod međunarodne suradnje, posebno u dijelu koji se odnosi na timove strukturalnih inženjera.

#### **4. POČETNI KORACI FORMIRANJA HRVATSKOG TIMA STRUKTURNIH INŽENJERA**

U veljači 2023. godine dogodio se snažan potres u Turskoj koji je rezultirao katastrofom i zatražena je međunarodna pomoć, između ostalog i preko EERC-

a. Hrvatska je putem ERCC-a ponudila MUSAR tim koji Turska prihvatila i isti je upućen u Tursku gdje je djelovao nekoliko dana. U sastavu MUSAR tima su kao stručna podrška bila i dva inženjera HCPI-IS.

Tim strukturnih inženjera je za vrijeme boravka MUSAR tima bio ponuđen Turskoj bilateralno od strane Hrvatske, iako nije formalno nominiran u ERCC-u i nije certificiran, ali su RCZ i HCPI-IS nakon analize odlučili kako bi prema iskustvima nakon potresa u Hrvatskoj i trenutno raspoložim kapacitetima isti mogao biti formiran i operativan u slučaju potrebe za međunarodnom pomoći. Turska nije zatražila međunarodnu pomoć tima strukturnih inženjera i isti nije bio upućen u pogođenu zemlju.

Realizirana međunarodna misija MUSAR tima je imala značajan utjecaj na RCZ, ali i cjelokupan sustav civilne zaštite u Hrvatskoj. Prije svega je dodatno u fokus stavila važnost međunarodnog djelovanja koje je bilo blago zanemareno u posljednjih nekoliko godina zbog kriznih situacija na području Hrvatske izazvanih COVID-19 i potresima.

Pod utjecajem međunarodne misije, RCZ je pokrenuo sveobuhvatnu analizu i ažuriranje postojećih kapaciteta za međunarodne misije. Tijekom analize RCZ je prepoznao nekoliko potencijalnih timova koji mogu biti formirani i nominirani za certifikaciju u ERCC, a jedan od njih je i tim strukturnih inženjera.

RCZ je u komunikaciji s HCPI-IS odlučio je kako će se krenuti u pripremu nacрта čvrsto strukturiranog tima strukturnih inženjera koji bi mogao biti certificiran prema kriterijima za standardizaciju prema postojećem vrlo slobodnom i neformalnom timu koji je djelovao nakon potresa u 2020. godini. Odlučeno je kako će u pripremi nacрта nositelj biti upravo HCPI-IS dok će RCZ biti potpora, a u slučaju potrebe uključit će se i drugi dionici sustava.

HCPI-IS je uz pomoć savjeta RCZ i vanjskih konzultanata izradio nekoliko dokumenta koji su dio sveobuhvatnog nacрта i stvoren je planski okvir za formiranje tima. Zaključeno je kako bi HCPI-IS sa svojim stručnjacima mogao pokriti većinu potreba tima, dok će za dio stručnjaka, kao i za materijalna logistička sredstva, morati dobiti potporu RCZ i manjim dijelom drugih dionika sustava.

Ipak, obzirom da se HCPI-IS nalazi na samom početku stvaranja nacionalnog sustava za uključivanje inženjera u sustav civilne zaštite i interventna inženjerska djelovanja, u komunikaciji s RCZ zaključeno je kako trenutno ne može definirati osobe koje bi mogle biti dio stalnog sastava čvrstog strukturiranog tima strukturnih inženjera za međunarodna djelovanja.

Paralelno je na koordinacijskim sastancima svih dionika sustava na temu analize i ažuriranja postojećih kapaciteta za međunarodna djelovanja odlučeno je kako

će se strateški i postepeno postupiti s razine RCZ u planiranju, formiranju i nominiranju timova u EERC-a kako ne bi došlo do preopterećenja RCZ i sustava civilne zaštite u cjelini.

Obzirom na spomenute okolnosti odlučeno je kako tim strukturnih inženjera ne bi trebao biti u prioritetima, ali i kako će HCPI-IS krenuti s poduzimanjem svih potrebnih radnji da za njegovo formiranje. Isto je započeto i preostaje vidjeti kako će se razvijati u budućnosti i kad će se ostvariti svi preduvjeti da tim strukturalnih inženjera bude u potpunosti spreman za formiranje u čvrstu strukturu i normiranje, a naknadno i certificiranje u EERC-a.

## **5. ZAKLJUČAK**

Sve ukazuje kako se u bliskoj budućnosti zasigurno očekuje povećanje važnost inženjera u upravljanju u kriznim situacijama i dokazuje se potreba za formiranjem timova strukturalnih inženjera. Pozitivno je što su pojedine države su već poduzele korake u spomenutim pravcima, ali i što pojedine države prepoznaju važnost i potrebu i počinju poduzimati prve korake.

Od spomenutih država se očekuje da preuzmu inicijativu i u međunarodnim djelovanjima pa samim time i u formiranju timova strukturalnih inženjera koji će biti na raspolaganju za međunarodne aktivnosti, uzimajući u obzir certifikaciju prema jasnim kriterijima kako bi se osigurala standardizacija kapaciteta.

Važno je istaknuti kako uz već identificirane timove strukturalnih inženjera unutar EERC-a postoji prostor, ali i potreba za daljnji razvoj, odnosno identifikaciju i standardiziranje inženjerskih timova. Postoje brojne interventne inženjerske aktivnosti koje mogu biti predmet međunarodne pomoći, a ne odnose se na specifične strukturalne inženjere.

Sa spomenutim interventnim inženjerskim aktivnostima iskustva ima i Hrvatska koja je jedna od država koje su počele poduzimati prve korake prema formiranju i certificiranju tima strukturalnih inženjera. Unatoč iskustvu i HCPI-IS kao središnjoj organizaciji u sustavu za interventna inženjerska djelovanja, proces usporava činjenica kako se u Hrvatskoj tek uspostavlja nacionalni sustav interventnih inženjerskih aktivnosti, ali i kako Hrvatska još uvijek nema dovoljno informacija o postojećem talijanskom timu strukturalnih inženjera prema kojem se treba uskladiti.

Samim time je jasno kako Hrvatska zasigurno ima potencijal za formiranje tima strukturalnih inženjera unutar EERC-a, ali trenutno još uvijek nema mogućnosti za realizaciju potencijala. Ključno je da se spomenuti procesi uspostavljanja nacionalnog sustava interventnih inženjerskih aktivnosti i formiranja tima strukturalnih inženjera za međunarodna djelovanja nastave u Hrvatskoj i u budućnosti jer će njihova korist biti iznimna za sustav upravljanja u kriznim situacijama, ne samo u Hrvatskoj, već i u svim zemljama koje će u budućnosti zaprimiti međunarodnu pomoć.

Poseban naglasak je na regiju koja zasigurno može imati najveću korist od razvoja u Hrvatskoj. Osim u kriznim situacijama, sustavi u državama regije moraju nastojati iskoristiti razvoj u Hrvatskoj i tijekom mirnodopskog razdoblja za prijenos znanja i vlastiti razvoj.

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## **POSSIBILITY OF FORMING A CROATIAN STRUCTURAL ENGINEERING TEAM INSIDE EUROPEAN EMERGENCY RESPONSE CAPACITY (EERC)**

*Expert article*

*Alen Kadic\**

### ***Abstract***

*Trends show that engineers will certainly continue to gain importance within the system of modern crisis management systems. When it comes to the response phase, international cooperation, or international assistance, is inevitable, in which there is no long and meaningful history of engineering participation. However, positive developments have been taking place recently and attempts have begun to standardize the role and methods of operation of engineering teams, primarily structural ones.*

*The foundations for the formation of standardized teams of structural engineers by their identification as one of the teams within the European capacity to respond to emergency situations were also laid by the European Union as a leader in the field of standardization of international aid in crisis situations. However, the achievement of numbers and standardization depends on the initiatives of individual countries, which must take responsibility and form teams of structural engineers, but also work on harmonizing the structure and handling with teams from other countries.*

*One of the countries that can potentially form a team of structural engineers is Croatia, as it has experience with numerous and diverse emergency engineering activities after the earthquake in 2020. The problem is that the aforementioned activities were carried out without systematic preparation, which began only after the earthquake.*

*In parallel, Croatia also started the process of forming a team of structural engineers due to the potential need for international action in the near future, which was additionally stimulated by the earthquake in Turkey at the beginning*

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*of 2023, but also by the fact that there are no developed similar capacities in the region.*

***Keywords*** : *structural engineering teams, crisis management, engineering, international assistance, European Emergency Response Capacity*

## **1. INTRODUCTION**

Security and security sciences cover many areas and require a comprehensive, yet multidisciplinary approach due to the diversity of these areas. This fact is especially evident in the 21st century, when the focus in the field of security is increasingly moving away from traditional understandings and war activities.

The focus is beginning to be directed towards crisis situations, including those resulting from the occurrence of anthropogenic threats, and especially those resulting from the occurrence of natural threats. The reason for this is the increasingly frequent and increasingly harmful crisis situations caused by natural hazards, and climate change, whose impact will continue in the future, also contributes to this.

Security will also continue to focus increasingly on preventive activities and increasing resilience in the future due to the undeniable impact that can be achieved through timely action. However, due to the very core of security and the circumstances that influence it, operational action, with an emphasis on the response phase, will always remain its importance.

Due to this fact, in the response phase, ways of further development and optimization of future activities continue to be found. One of the directions is international cooperation, or assistance, because in disasters, states cannot respond to the crisis situation alone and need the help of other states that are capable and willing to help.

The practice of international assistance in response has been proven many times throughout history, but problems related to the provision of international assistance have also appeared, especially in the part related to the understanding of assistance and coordination in action. For this reason, it has been proven that the standardization of capacities that are the subject of international aid is necessary, as this is the only way to maximize efficiency (Giles et al., 2019).

## **2. OVERVIEW OF THE CURRENT SITUATION**

Due to the increased focus on international aid and its development, there has been an increasing number of activities aimed precisely at standardizing capacities in international aid. Primarily, these are practical efforts by states to create capacities and procedures for international aid and to use their own, but also the experience and knowledge of other states (Łaźniewska, 2011). However, it should be noted that there is also an increasing number of scientific research, although their number still lags behind the number of practical activities in the area of transfer of knowledge and experience related to international cooperation.

### **European emergency response capacity**

The transfer of knowledge and experience takes place through direct cooperation, with emphasis on cooperation between neighboring countries or countries that are in similar situations when it comes to risks, but it also takes place through the mediation of international organizations that specialize in coordinating international aid, of which the European Union, namely its civil protection mechanism, can be highlighted (Zwęgliński, 2015).

The role of the European Union Civil Protection Mechanism is not only to connect individual countries, primarily through the organization of civil protection exercises and the financing of joint projects from their own funds, nor the coordination of their international activities during crisis situations through the Coordination Center for Response to Emergency Situations (hereinafter: ERCC). The European Union's civil protection mechanism also works to identify the needs for the formation and identification of international aid capacities that can be activated through the ERCC.

For this purpose, the European Emergency Response Capacity (hereinafter: EERC) was created as a kind of pool of capacities to which states are nominated for potential international assistance, *Figure 1*. The types of capacities are identified in advance by the Civil Protection Mechanism and are divided into modules, teams, experts and equipment (DG ECHO, 2015).

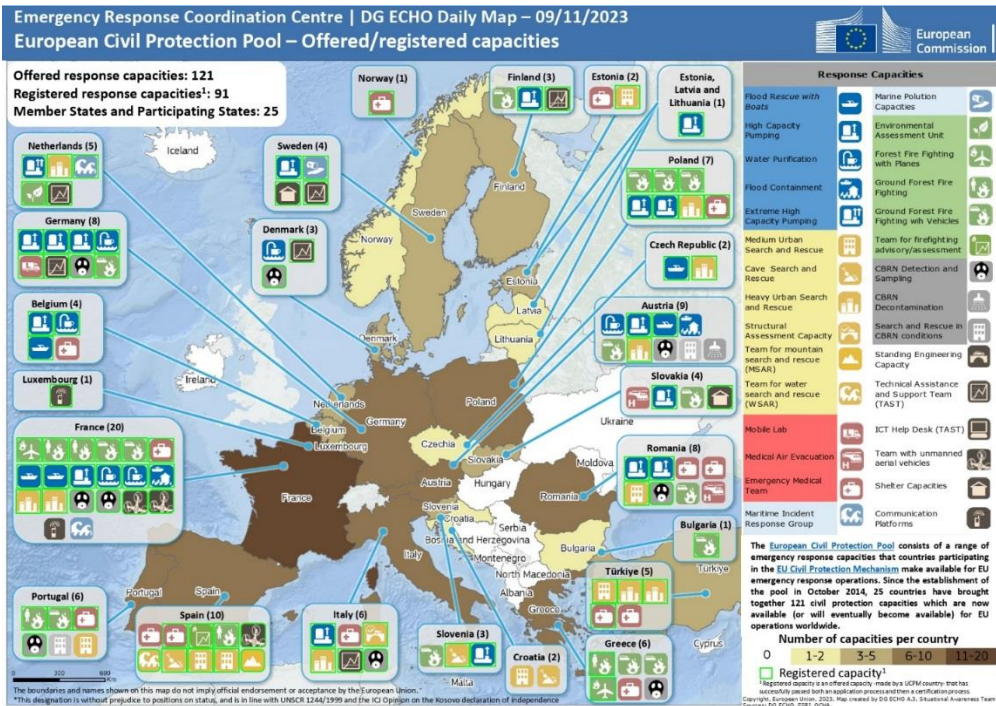


Figure 1 European capacity for crisis response Source: <https://reliefweb.int/map/turkiye/european-civil-protection-pool-offeredregistered-capacities-dg-echo-daily-map-09112023>

The key fact is that there is a very strong emphasis on the standardization of capacities in order to ensure their understanding, but also efficiency and interoperability in the operational activity itself. In order to achieve standardization, the European Union prescribes very strict criteria and certifies all capacities (1313/2013/EU).

In addition to understanding individual capacities when requesting and accepting assistance during crisis situations, strict criteria significantly facilitate understanding the necessary form of capacities during the process of their formation and nomination to the EERC, especially when it comes to modules and teams.

However, the strictness of the criteria differs depending on whether it is about teams or modules (1313/2013/EU). According to the certification process and criteria, modules are more demanding than teams. The modules and their criteria are very strictly defined due to their importance and frequency of activation for international aid. The criteria and certification procedure for teams are however more flexibly defined within the EERC.

The reason for this is the fact that the European Union itself, namely the ERCC and EERC, is still trying to find new teams and their optimal forms. For this

reason, there are greater opportunities to form teams and adapt their forms according to specific capabilities or preferences. This facilitates the process of formation teams, but also represents an opportunity to improve the general standard for the criteria of these teams in the future.

### **Structural engineering teams in the European Union**

One of the teams recently recognized at EERC is the structural engineering team. Engineers are one of the areas that are gaining more and more importance within the management system in crisis situations, especially when it comes to their potential role in the response phase, i.e. the implementation of intervention engineering activities, and therefore also in the field of international aid.

Engineers can contribute to a multitude of different interventional engineering activities and threats, and structural engineers stand out in particular. They can contribute the most in the part of the crisis management system that refers to buildings and their condition, where crisis situations caused by earthquakes can be highlighted (Dolce, 2023).

In addition to all of the above, the European Union itself had previous experience with the need and sending of structural engineers as international aid during crisis situations, both as part of the European Union Civil Protection Teams (hereinafter: EUCPT) and as part of the teams of specialized assessment teams (Goretti, 2017 ). The best example is the earthquake in Albania in 2019 when, at the request of Albania, through the ERCC, as part of the ECUPT, about 185 structural engineers from 18 countries were sent to assist local engineers in inspecting the damage and serviceability of buildings , Figure 2 (Macabuag, 2022 ).



*Figure 2 EUCPT after the earthquake in Albania*

Source: <https://th.bing.com/th/id/OIP.z8OkZwpXfpFruXhMT6ReTQHaE8?rs=1&pid=ImgDetMain>

In order not to depend on the invitation of structural engineers as individual experts or spontaneously formed and offered specialized teams through the ERCC, the European Union took further measures and identified a team of structural engineers as one of the capacities within the EERC. In this way, ensuring easier finding and organization when sending structural engineers as international aid, but at the same time ensuring easier implementation in the teams, activities and system of the country receiving the aid.

As mentioned earlier, teams contribute to understanding and efficiency, but still do not represent complete strictness in the criteria as is the case with modules. Structural engineering teams are also quite flexible as a capacity, that is, they have yet to be developed and formed according to optimal needs and capabilities, after harmonization and proof of form, a more strict definition of criteria will begin in order to ensure standardization according to the optimal form.

Italy took the initiative in the entire process, which was expected, as they have had a long-standing systematic involvement of engineers in the crisis management system (Dolce 2023). They also already had significant experience with involving engineers in crisis situations in their area, and their engineers have also provided international assistance, including as part of the team sent by the ERCC to Albania in 2019 (Macabuag, 2022).

In addition, in the past years, Italy has organized the training of engineers from other countries for the implementation of interventional engineering activities. It is necessary to highlight the project MultinATional module on Damage Assessment and countermeasures (hereinafter: MATILDA). MATILDA was implemented from 2014 to 2017 as a continuation of the previous project Dr. House, which was within the national framework, while in MATILDA it expanded to include engineers from Slovenia and Croatia (DG ECHO, 2014).

Precisely because of all of the above, Italy took the initiative and was the first to register a team of structural engineers in the EERC, and to this day it remains the only registered team of structural engineers. It is problematic that there is no information available about the Italian team of structural engineers and its structure and capabilities, but only information about its existence and certification within the EERC.

There is no doubt that more established and certified teams of structural engineers are needed within the EERC. This is evidenced by what can be seen during many large-scale crisis events (also outside the European Union), especially when it comes to those caused by earthquakes, the best example being the earthquake in Turkey in 2023.

Certainly, the Italian team of structural engineers should serve as a reference when forming other teams of structural engineers, especially if they intend to be nominated for certification in the EERC. However, the form itself proposed by Italy is flexible and can be adapted to the capabilities of other countries or teams, and it is possible to find improvements for all future teams of structural engineers, which will be especially evident by increasing the number of teams and their coordination and training, and potentially also by cooperation during crisis events.

Joining the initiative of forming teams of structural engineers and nominating them for certification in EERC by other countries should be based on countries that already have experience and existing prerequisites for creating teams of structural engineers.

### **3. POTENTIAL FOR FORMING A CROATIAN TEAM OF STRUCTURAL ENGINEERS IN CROATIA**

Croatia has exceptional recent experience with emergency engineering activities within the civil protection system. The experience was gained after the earthquakes in Croatia in 2020, specifically in March in Zagreb, and then in December in Petrinja.

Previously, there was no organized and prepared system for involving engineers in the response phase during crisis situations, but due to a significant need, a system (structure, procedures, methodologies, etc.) , with a significant level of improvisation, was created in a very short time under the name Croatian Center for Earthquake Engineering.

Although the Croatian Earthquake Engineering Center did not formally exist as an organization, but only as an informal platform that operated as part of the Emergency Situations Office of the City of Zagreb and later the Civil Protection Directorate of the Republic of Croatia (hereinafter: RCZ), it was crucial because it became the central body that enabled the involvement of engineers, and thus the implementation of emergency engineering activities.

Numerous engineers, totaling around two thousand, were organized into teams with the aim of carrying out individual intervention engineering activities, Figure 3. The specializations of individual engineers were diverse, and the most important role was played by structural engineers.



*Figure 3 Engineers after the 2020 Petrinja earthquake*

Source: HCPI-IS Collection

The reason is that the most important and extensive activities required the knowledge of structural engineers, and these activities include: inspections of damage and usability of structures (critical infrastructure, buildings, roads), inspections related to emergency procedures (safety corridors, emergency removals, emergency technical protection measures), participation in rubble rescue teams as professional support (asset rescue).

In addition to the above, other interventional engineering activities were carried out that did not include structural engineers, namely inspections of geotechnical hazards and the establishment of emergency buildings/infrastructure. It is important to point out that most of the activities were carried out using modern technologies and tools, above all ArcGIS, which was especially important when inspecting the damage and usability of buildings.

Given that the earthquakes have proven the undoubted need for emergency engineering activities, and all activities and the entire built system were initially the result of improvisation and the operation of an informal platform, an initiative has emerged within the civil protection system to formalize a platform that will continue its operations after the crisis.

The initiative subsequently, at the end of 2021, resulted in the formation of the association Croatian Center for Earthquake Engineering - Intervention Service (hereinafter: HCPI-IS). HCPI-IS took over the implementation of all interventional engineering activities and started implementing them into the Croatian civil protection system.

The implementation and establishment of regular and systematic functioning of the HCPI-IS create the prerequisites for the strategic and systematic organization of the participation of engineers in the civil protection system, including intervention engineering activities. A systematic organization would enable the formation of national, tightly structured teams of engineers that could be easily activated and coordinated in future crisis situations, achieving systematicity and reducing improvisation.

After the formation of national teams of engineers, HCPI-IS, with the support of the rest of the civil protection system in Croatia, will have the prerequisites for the systematic formation of teams of engineers for international operations, harmonizing national teams with the standards prescribed for international operations. Currently, in the field of engineering teams in international operations, the aforementioned teams of structural engineers within the EERC certainly stand out.

In addition to creating national teams of engineers, HCPI-IS and Croatia already have another prerequisite for creating international teams. This is the fact that individual engineers already have experience with international activities, especially courses, missions and exercises of the European Union, which is responsible for certification within the EERC.

The engineers underwent technical expert training courses, and participated in missions in Albania and Turkey, as well as exercises in Slovenia and Portugal. It is also important to note that some engineers underwent training in Italy as part

of the aforementioned MATILDA project, in which Croatian engineers participated in all parts of the training (Atalić et al., 2019).

In addition to engineers, Croatia has significant international experience in the field of crisis management. In addition to having requested international assistance several times due to crises on its territory, it has also deployed its capacities through the ERCC to assist other countries.

A recent example is the MUSAR team, which is the only formed and certified Croatian capacity in the EERC, and which was deployed through the ERCC and operated operationally after the earthquake in Turkey in 2023. It is important to point out that the MUSAR team, in addition to certification in the EERC, regularly participates in European exercises.

Although only MUSAR is currently nominated, Croatia is currently in the process of preparing and nominating other teams for certification in the EERC that have also previously undergone European exercises, but have also been sent as international assistance to other countries in the past, including firefighting using aircraft and water rescue using vessels.

In addition to international assistance in the crisis response phase, Croatia, and above all the RCZ as the central body responsible for crisis management, has significant experience with European Union procedures and projects, which significantly facilitates all activities that are part of the European Union system, specifically the European Union Civil Protection Mechanism.

It is also necessary to emphasize that the RCZ, as well as the rest of the civil protection system, are very active in the region through joint projects, as well as exercises and international cooperation in crisis situations, Figure 4. It is precisely the region that can benefit the most from the Croatian team of structural engineers within the EERC, because a very organized and capable team will be formed that will be able to activate and assist very quickly through the ERCC, but also bilaterally. Also, for the same reason, the region can also benefit from other parts of the HCPI-IS emergency engineering activities.



*Figure 4 EU CZ BiH Field Exercise – BANJA LUKA 2021*

Source: <https://civilna-zastita.gov.hr/userdocsimages//CIVILNA%20ZA%C5%A0TITA/Vijesti/Terenska%20vje%C5%BEba%20EU%20CZ%20BiH%20naslovna.jpg?width=750&height=500>

HCPI-IS and Croatia can have an exceptionally positive impact on the region even in the time between crises because with their development and the development of the aforementioned capacities they can serve as an example and a center of excellence, or a knowledge transferor in the region, as was the case, for example, with the aforementioned MATILDA project for knowledge transfer by Italy. This is especially emphasized because the fact is that similar capacities are largely not developed in the region.

An additional advantage is the fact that the countries in the region are in a very similar position, not only due to geographical prerequisites related to the existence and spread of certain threats and geographical features, but also to very similar characteristics of buildings, but also a very similar language, which can have a great influence in international cooperation, especially in the part that refers to teams of structural engineers.

#### **4. INITIAL STEPS IN FORMING A CROATIAN TEAM OF STRUCTURAL ENGINEERS**

In February 2023, a powerful earthquake occurred in Turkey, resulting in a disaster, and international assistance was requested, including through the EERC. Croatia offered a MUSAR team through the ERCC, which Turkey accepted and was sent to Turkey, where it operated for several days. The MUSAR team also included two HCPI-IS engineers as professional support.

During the stay of the MUSAR team, a team of structural engineers was offered to Turkey bilaterally by Croatia, although it was not formally nominated in the ERCC and was not certified, but RCZ and HCPI-IS decided after analysis that according to the experiences after the earthquake in Croatia and the currently available capacities, it could be formed and operational in case of need for international assistance. Turkey did not request international assistance from a team of structural engineers and it was not dispatched to the affected country.

The implemented international mission of the MUSAR team had a significant impact on the RCZ, but also on the entire civil protection system in Croatia. First of all, it further focused on the importance of international action, which had been slightly neglected in the last few years due to the crisis situations in Croatia caused by COVID-19 and earthquakes.

Under the influence of the international mission, RCZ initiated a comprehensive analysis and update of existing capacities for international missions. During the analysis, RCZ identified several potential teams that could be formed and nominated for certification in the ERCC, one of which is a team of structural engineers.

RCZ, in communication with HCPI-IS, decided to start preparing a draft of a tightly structured team of structural engineers that could be certified according to the criteria for standardization according to the existing very loose and informal team that operated after the earthquake in 2020. It was decided that HCPI-IS would be the lead in preparing the draft, while RCZ would provide support, and if necessary, other stakeholders in the system would be involved.

HCPI-IS, with the help of advice from RCZ and external consultants, has developed several documents that are part of the comprehensive draft and a planning framework for the formation of the team has been created. It was concluded that HCPI-IS with its experts could cover most of the needs of the team, while for some of the experts, as well as for material logistical resources, it will have to receive support from RCZ and a smaller number of other stakeholders of the system.

However, given that HCPI-IS is at the very beginning of creating a national system for including engineers in the civil protection system and emergency engineering activities, in communication with RCZ it was concluded that it cannot currently define persons who could be part of the permanent composition of a solid structured team of structural engineers for international activities.

In parallel, at coordination meetings of all system stakeholders on the topic of analyzing and updating existing capacities for international operations, it was decided that the RCZ level would proceed strategically and gradually in planning, forming and nominating teams in the EERC in order to avoid overloading the RCZ and the civil protection system as a whole.

Considering the mentioned circumstances, it was decided that the team of structural engineers should not be in the priorities, but also that HCPI-IS will start taking all the necessary actions for its formation. The same has been started and it remains to be seen how it will develop in the future and when all the prerequisites will be met for the team of structural engineers to be fully ready for formation in a solid structure and standardization, and subsequent certification in the EERC.

## **5. CONCLUSION**

Everything indicates that in the near future the importance of engineers in managing crisis situations is certainly expected to increase and the need to form teams of structural engineers is proven. It is positive that some countries have already taken steps in the mentioned directions, but also that some countries recognize the importance and need and are starting to take the first steps.

The mentioned countries are expected to take the initiative in international activities and therefore also in the formation of teams of structural engineers that will be available for international activities, taking into account certification according to clear criteria to ensure the standardization of capacities.

It is important to point out that in addition to the already identified teams of structural engineers within the EERC, there is room, but also the need for further development, that is, the identification and standardization of engineering teams. There are numerous interventional engineering activities that can be the subject of international assistance, which do not refer to specific structural engineers.

Croatia also has experience with the aforementioned emergency engineering activities, and is one of the countries that has begun to take the first steps towards forming and certifying a team of structural engineers. Despite the experience and the HCPI-IS as the central organization in the emergency engineering system, the process is slowed down by the fact that a national system of emergency engineering activities is only just being established in Croatia, and that Croatia still does not have enough information about the existing Italian team of structural engineers to which it needs to be aligned.

It is therefore clear that Croatia certainly has the potential to form a team of structural engineers within the EERC, but currently there is still no possibility to realize the potential. It is crucial that the aforementioned processes of establishing a national system of intervention engineering activities and forming a team of structural engineers for international operations continue in Croatia in the future, as their benefit will be exceptional for the crisis management system, not only in Croatia, but also in all countries that will receive international assistance in the future.

Special emphasis is placed on the region, which can certainly benefit the most from developments in Croatia. Apart from crisis situations, systems in the countries of the region must strive to use developments in Croatia even during peacetime for knowledge transfer and their own development.

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