KAKO SMANJITI RIZIK U PROCESU DOKAZIVANJA KVALITETA GRAĐEVINSKIH PROIZVODA

STRENGTHENING OF TIMBER BEAMS USING FRP BARS

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STRUČNI RAD
PROFESSIONAL PAPER
UDK:691:658.56(497.7)
doi: 10.5937/grmk1701065C

1 UVOD

U inženjerstvu rizik se koristi za opisivanje prirodnih/slučajnih pojava, odnosno neizvesnosti od njihove pojave. Rizik se definiše kao rezultat verovatnosti i ugroženosti od neke pojave, zajedno s posledicama. Rizik je interakcija intenziteta opasnosti, izloženosti i otpornosti.

Zemljotresi, poplave ili uragani (koji su postojali u antičkom dobu) postaju sve ozbiljniji, budući da se civilizacija sve više razvija. Sve veća šteta, kako ljudska tako i materijalna, pokazuje koliko je ozbiljan ovaj problem, a cilj jeste da se izbegnu sve izražene katastrofe u svetu.

Tehnički standardi definišu i nalažu stepen sigurnosti objekata, koji zavisi od njihove kategorije. Uobičajeno, te vrednosti su više za objekte javnog karaktera, a niže za individualne objekte. Međutim, tehnički standardi takođe definišu kriterijume koje građevinski proizvodi treba da ispunjavaju da bi odgovorili svojoj nameni, da omoguće objektima da zadovolje osnovne zahteve koji su dati u Regulativi - Construction Products Regulation CPR.

Svi proizvodi pojedinačno drugačije doprinose bezbednosti objekta – neki su važniji (na primer, noseći elementi, krov, vrata za zaštitu od požara...), dok ostali nisu toliko važni (unutrašnja vrata, obloženi paneli...). CPR predviđa pet različitih sistema za ocenu i potvrdu postojanosti svojstava građevinskih proizvoda (Assessment and Verification of Constancy of Performance

1 INTRODUCTION

In engineering, risk is used to describe natural/accidental events or uncertainty of their occurrence. Risk is defined as the result of the probability and vulnerability of some phenomena, together with the consequences. Risk is the interaction of intensity of danger, exposure and resistance.

Earthquakes, floods or hurricanes (which existed in ancient times) are becoming more serious, since civilization has developed. The increasing damage, both human and material, shows the importance of the seriousness of this problem, in order to avoid ever more present disasters in the world.

Technical standards define and dictate the level of safety of the facilities, which depends on their category. Typically, these values are higher for public facilities, and lower for individual buildings. However, technical standards also define the criteria that building products should meet in order to be suitable for their purpose, to ensure that the facilities meet the basic requirements that are set out in the Regulation - Construction Products Regulation - CPR.

All products individually in a different manner contribute to the safety of the facility - some are more important (for example, supporting elements, roof, fire protection doors...), while others are not so important (interior doors, covered panels ...). CPR includes five different systems for assessment and verification of

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AVCP). Svi sistemi su kombinacija zadataka koje obavljaju proizvođači i treća lica ili tela za ocenjivanje usaglašenosti.

Infrastruktura kvaliteta je od suštinskog značaja i predstavlja sastavni deo ekonomije i jedan je od temelja nacionalne, regionalne i međunarodne trgovine. Sistem infrastrukture kvaliteta podrazumeva: standardizaciju, metrologiju, akreditaciju, ocenjivanje usaglašenosti i nadzor tržišta.

Ocenjivanje usaglašenosti pomaže da se obezbedi sigurnost da proizvodi i usluge ispunjavaju očekivanja, što će reći: ocenjivanje usaglašenosti gradi poverenje. Ocenjivanjem usaglašenosti potrošačima se obezbeđuje da proizvode biraju na osnovu izveštaja sa ispitivanja i sertifikata izdatih od specijalizovanih laboratorija i sertifikacionih tela. Tipične aktivnosti ocenjivanja usaglašenosti jesu: uzimanje primeraka, laboratorijska ispitivanja, inspekcije, ocenjivanje, verifikacija i obezbeđivanje deklaracije, sertifikacija, kao i njihove kombinacije.

2 TELA ZA OCENJIVANJE USAGLAŠENOSTI SAGLASNO REGULATIVI - CPR

Evropski parlament i Evropski savet su 9. maja 2011. godine usvojili Regulativu 305/2011 za građevinske proizvode (Construction Products Regulation CPR), koja je u potpunosti obavezujuća i direktno primenjiva u svim zemljama članicama, od 1. jula 2013. godine, dok je Direktiva (Construction Products Directive) br. 89/106/EEC – ukinuta.

Regulativa sadrži odredbe za ocenjivanje usaglašenosti koje su uključene u proces usaglašenosti, a koje će biti ovlašćene za izvršavanje zadataka za treće strane u procesu ocene i potvrde postojanosti svojstava (AVCP) prema ovoj regulativi.

2.1 Tela za laboratorijska ispitivanja – ISO/IEC 17025

Laboratorijsko ispitivanje je jedna od aktivnosti ocenjivanja usaglašenosti. Obezbeđivanje kvaliteta laboratorijskih rezultata omogućuje se akreditacijom laboratorija u skladu sa standardom MKC EN ISO/IEC 17025 – Opšti zahtevi za kompetentnost laboratorija za testiranje i kalibraciju. Tela za akreditaciju laboratorija koriste standard MKC EN ISO/IEC 17025, s ciljem da ocene specifične faktore koji utiču na tehničku kompetentnost laboratorija i to: (1) tehnička kompetentnost zaposlenih; (2) validnost i adekvatnost metoda za ispitivanje; (3) preglednost merenja i kalibracija u saglasnosti sa nacionalnim standardima; (4) adekvatnost, kalibracija i održavanje opreme; (5) uzimanje, rukovanje i transport primeraka za ispitivanje; i (6) obezbeđivanje kvaliteta rezultata ispitivanja i kalibracije. Ovaj standard se sastoji od dva modula: (1) zahtevi za upravljanje laboratorijom (poglavlje 4); (2) tehnički zahtevi za kompetentnost laboratorija (poglavlje 5). Saglasno klauzuli 5.9, važan način ispunjavanja zahteva u oblasti obezbeđivanja kvaliteta laboratorijskih rezultata jeste testiranje sposobnosti laboratorija.

Za poboljšanje kvaliteta rezultata testiranja i kalibra-

constancy of the properties of building products (Assessment and Verification of Constancy of Performance - AVCP). All systems are a combination of tasks that are performed by manufacturer and by third parties or conformity assessment bodies.

Quality infrastructure is of vital importance and represents an integral part of economy and is one of the foundations of national, regional and international trade. The infrastructure quality system includes: standardization, metrology, accreditation, conformity assessment and market inspection.

Conformity assessment helps ensure that products and services deliver on their promises, in other words, conformity assessment builds trust. Conformity assessment ensures that the consumers select products on the basis of reports from the tests and certificates issued by specialized laboratories and certification bodies. Typical activities of conformity assessment are: taking samples, laboratory testing, inspection, assessment, verification and provision of declaration, certification, and combinations thereof.

2 CONFORMITY ASSESSMENT BODIES REGARDING CONSTRUCTION PRODUCTS REGULATION CPR

The European parliament and the Council on 9 March 2011 adopted REGULATION No 305/2011-(Construction Products Regulation CPR), laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106 EEC-CPD. The Regulation 305/2011 applied from 1 July 2013.

The Regulation includes provisions for conformity assessment that are included in the process of conformity, and which will be authorized to carry out tasks for third parties in the process of assessment and verification of constancy of properties (AVCP) under this Regulation.

2.1 Body for laboratory testing -ISO/IEC 17025

Laboratory testing is one of the conformity assessment activities. Quality assurance of laboratory results is accomplished by accreditation of the laboratories according to the standard ISO/IEC 17025:2005 - General requirement for the competence of testing and calibration laboratories. Laboratory accreditation bodies use ISO/IEC 17025, specifically to assess factors relevant to the laboratory technical competence, including the: (1) technical competency of staff; (2) validity and suitability of test methods; (3) traceability of measurements and calibrations to national standards; (4) suitability, calibration and maintenance of testing equipment; (5) sampling, handling and transportation of test items, and (6) quality assurance of test and calibration data. This standard consists of two modules: (1) laboratory management requirements (clause 4 from the standard); (2) technical requirements for competence of laboratories (clause 5 from the standard). Regarding of ISO/IEC 17025 (clause 5.9) in the area of quality assurance of laboratory results, important way of meeting the requirements is Proficiency testing (comparative testing).

Officially, by the end of 2010, for the improvement of

cije do kraja 2010. godine, zvanično su korišćena dva tipa međunarodnih dokumenata i to: za interno obezbeđivanje kvaliteta (IQA) – ISO / IEC 17025 i za eksterno obezbeđivanje kvaliteta (EQA) – ISO / IEC Uputstvo 43 i ILAC G13. Od početka 2011. godine, za eksterno obezbeđivanje kvaliteta laboratorijskih rezultata primenjuje se međunarodni standard MKC EN ISO/IEC 17043 – ocenjivanje usaglašenosti – Opšti zahtevi za testiranje osposobljenosti. Testiranje osposobljenosti (uporedno ispitivanje) bitan je način ispunjavanja zahteva ISO / IEC 17025 (klauzula 5.9) u oblasti obezbeđivanja kvaliteta laboratorijskih rezultata. Takođe, tela za akreditaciju obavezuju laboratorije da učestvuju u testiranju osposobljenosti u odgovarajućim programima za sve vrste analiza koje se vrše u toj laboratoriji. Testiranje osposobljenosti uključuje grupu laboratorija ili analitičare koji rade iste analize na istim primercima i dobijaju uporedne rezultate. Ključni zahtevi ovih poređenja su da primerci budu homogeni i stabilni, a grupa primeraka koja se analizira treba da bude odgovarajuća za ispitivanje i prikazivanje sličnosti i razlika u rezultatima.

2.2 Sertifikaciona tela za proizvode – ISO/IEC 17065:2012

Sertifikacija proizvoda je sredstvo koje obezbeđuje sigurnost da je proizvod usaglašen sa specifičnim zahtevima, navedenim u standardima i standardizacijskim dokumentima. Iako se ovaj standard odnosi na tela koja rade kao treća strana, mnoge od ovih odredaba mogu da se koriste i kod tela koja rade kao prva i druga strana, u njihovim unutrašnjim procedurama za ocenu usklađenosti proizvoda.

Donedavno su ISO/IEC Uputstvo 65:1996 i Opšti zahtevi tela za sertifikaciju proizvoda omogućavali da se ovi sertifikati sprovode na kompetentan i fer način. Sada novi standard obećava da će se ovaj proces podići na viši nivo. Tekst Uputstva je u potpunosti revidiran, dokazani delovi su zadržani i poboljšani tamo gde je bilo potrebno i kao rezultat revizije objavljen je novi standard ISO/IEC 17065:2012, Ocenjivanje usaglašenosti – Zahtevi za tela koja sertifikuju proizvode, procese i usluge. Novi standard jasno ukazuje na to da sertifikacija proizvoda može da se primeni i na procese i na usluge. Novi informativni aneks (Annex A) pokazuje kako standard može da bude specifično interpretiran samo za procese i usluge. Novi aneks identifikuje principe kojima se rukovode tela za sertifikaciju proizvoda kao i njihove aktivnosti. Ti principi inspirišu poverenje u proces sertifikacije. Ključne reči su nepristrasnost, kompetentnost, poverljivost i otvorenost, odgovaranje prema prigovorima i žalbama, i odgovornost. Mnogi od zahteva ISO/IEC 17065 razjašnjeni su i bazirani na povratnim informacijama iz dugogodišnjeg iskustava i formalnih tumačenja ISO/IEC Uputstva 65. Koncept koji se često spominje u ISO/IEC 17065 jesu sertifikacione šeme. Njima se obuhvataju svi specifični zahtevi, pravila i procedure koje se odnose na proizvod (ili grupu proizvoda) da bi oni bili sertifikovani.

the quality of test and calibration results, two sets of international documents were used: for internal quality assurance (IQA) - ISO/IEC 17025; for external quality assurance (EQA) -ISO/IEC Guide 43 and ILAC G13. Since the end of 2010, for the purpose of external quality assurance, the international standard ISO / IEC 17043:2010 - Conformity assessment, General requirements for proficiency testing - has been used. Proficiency testing (comparative testing) is an important way of meeting the requirements of ISO/IEC 17025 (clause 5.9) in the area of quality assurance of laboratory results. It is also mandated by accreditation bodies that laboratories participate in proficiency testing and, when they exist, suitable programs for all types of analyses undertaken in that laboratory. Proficiency testing involves a group of laboratories or analysts performing the same analyses on the same samples and comparing results. The key requirements of such comparisons are that the samples are homogenous and stable, and also that the set of samples analyzed are appropriate to test and display similarities and differences in results.

2.2 Certification body for product - ISO/IEC 17065:2012

Product certification is a tool that provides assurance that the product conforms to the specific requirements set out in standards and standardization documents. Although this standard applies to the bodies operating as a third party, many of these provisions can be used also with bodies operating as first and second sides, in their internal procedures for assessing the conformity of products.

Until recently, the ISO/IEC Guide 65:1996 and the General requirements for product certification bodies allowed these certificates to be conducted in a competent and fair manner. General requirements for product certification allowed these certificates to be implemented in a competent and fair manner. Now a new standard promises to take this process to the next level. The text of the Guide has been completely revised, proven parts are retained and improved where needed and as a result the revision was released a new standard ISO/IEC 17065:2012, Conformity assessment - Requirements for bodies certifying products, processes and services. The new standard clearly indicates that the certification of products can be applied both to processes and services. The new informative annex (Annex A) shows how the standard can be specifically interpreted only for processes and services. The new annex identifies the principles that govern the product certification bodies as well as their activities. These principles inspire confidence in the certification process. Keywords are impartiality, competence, confidentiality and openness, responding to complaints and appeals, and responsibility. Many of the requirements of ISO/IEC 17065 are clarified and based on feedback from many years of experience and formal interpretation of ISO/IEC Guide 65. The concept that is often mentioned in the ISO/IEC 17065 is certification schemes. They include all specific requirements, rules and procedures relating to a product (or a group of products) in order to be certified.

3 METODOLOŠKO ISTRAŽIVANJE

Sprovedeno je empirijsko istraživanje stavova rukovodstva i zaposlenih u laboratorijama. Istraživanje je sprovedeno na 21 primerku, dok je u radu data samo analiza akreditovanih laboratorija za testiranje iz sektora građevinarstva. Istraživanje je sprovedeno jedino u akreditovanim laboratorijama zato što su u ovom trenutku akreditovana samo dva sertifikaciona tela za građevinske proizvode i to jedno u junu, a drugo telo u decembru 2016. godine.

Cilj istraživanja je: (1) da se dobije jasan uvid u celokupno stanje laboratorija u odnosu na njihovu akreditaciju i njihovo učešće u međulaboratorijskim poređenjima; (2) definisanje benefita od njihove akreditacije i međulaboratorijskih poređenja; (3) lociranje problema i prepreka s kojima se suočavaju laboratorije pri implementaciji zahteva specificiranih u standardu MKC EN ISO/IEC 17025; (4) ocena ekonomske opravdanosti akreditacije. Implementacija standarda nije jednostavan proces, međutim njihovom primenom se postiže efektivno i efikasno funkcionisanje laboratorije, kao i postizanje željenih rezultata.

3.1 Prikaz elemenata upitnika

Anketa je projektovana tako da obuhvata pitanja primene standarda MKC EN ISO/IEC 17025 i MKC EN ISO/IEC 17043. Istovremeno, anketa obuhvata pitanja o upravljanju i organizaciji rada (implementiran MKC EN ISO 9001), finansijskoj opravdanosti, sugestijama i preporukama za unapređivanje rada organizacija u savremenim tržišnim uslovima. Istraživanje stavova predstavnika rukovodstva laboratorija izvršeno je u periodu od novembra 2012. do marta 2015. godine, na teritoriji Republike Makedonije, kako bi se dobila mišljenja rukovodilaca i zaposlenih koji se bave laboratorijskim ispitivanjima.

Upotrebom statističkih metoda u analizi odgovora i kreiranjem dijagrama i tabela, dobijen je određeni niz stavova koji oslikavaju realno stanje u zemlji u odnosu na akreditovane laboratorije i njihovo učešće u međulaboratorijskim poređenjima.

Prvi deo upitnika je usmeren na tačku 4 standarda MKC EN ISO/IEC 17025. Odnosi se na merenje stepena poboljšanja u procesu elemenata povezanih s menadžmentom u laboratoriji: (1) upravljanje dokumentima; (2) zadovoljstvo klijenata; (3) upravljanje ljudskim resursima i (4) upravljanje procesima.

Drugi deo upitnika je usmeren na tačku 5 standarda MKC EN ISO/IEC 17025 kompetencija laboratorije. Odnosi se na merenje stepena: (1) učešća u međulaboratorijskim ispitivanjima; (2) učešća u RT šemama; (3) uspostavljanja i razvijanja PT šema i (4) akreditovanih PT šema.

3 METHODOLOGICAL RESEARCH

Empirical survey of the views of management and employees in laboratories was carried out. The survey was carried out on 21 samples, and the paper presents only the analysis of accredited testing laboratories in the construction sector.

The survey was carried out only in accredited laboratories for the reasons that at the moment only two certification bodies are accredited for construction products; one in June and the other body in December 2016.

The purpose of this research is to: (1) gain a clear understanding of the overall state of laboratories in terms of their accreditation and participation in inter-laboratory comparisons; (2) define the benefits of their accreditation and participation in inter-laboratory comparisons, and (3) locate the problems and obstacles they are facing in implementation of relevant requirements specified in the standard ISO/IEC 17025 (4) assessment of economic justification of the accreditation. The implementation of the standards is not an easy process, although it contributes to the effective and efficient functioning of laboratories and achievement of desired results.

3.1 Representation of the questionnaire elements

The questionnaire was designed in a way to cover issues of implementation of the standard ISO/IEC 17025 and ISO/IEC 17043. At the same time, the questionnaire includes questions about management and organization of work (implemented ISO 9001), as well as financial viability, and suggestions and recommendations for improvement in the organization of work in modern market conditions. A survey of the views of the representatives of the management of laboratories is conducted in order to get the opinion of managers and employees who are engaged in laboratory testing. This survey was carried out during the period from November 2012 to March 2015 in the territory of the Republic of Macedonia.

Using statistical methods in the analysis of responses and creating diagrams and charts, a range of views were received, which reflect the real situation in the country in terms of accredited laboratories and their participation in interlaboratory comparisons.

The first part of the questionnaire is directed towards point 4 of the standard ISO/IEC 17025. It refers to the measurement of the improvement level in the process related to the management of the laboratory: (1) document management; (2) customer satisfaction; (3) human resource management; (4) management processes.

The second part of the questionnaire is directed towards point 5 of the standard ISO/IEC 17025:2005, the competence of the laboratory. It refers to the measurement of the degree of: (1) participation in interlaboratory comparisons; (2) participation in PT schemes; (3) the establishment and development of PT schemes; (4) accredited PT schemes.

4 ANALIZA REZULTATA

Prema zvaničnim podacima Instituta za akreditaciju Republike Makedonije (IARM), u Republici Makedoniji postoje 142* akreditovana tela za ocenu usklađenosti iz 110* organizacija. Pregled akreditovanih tela za ocenu usklađenosti dat je u tabeli 1.

Tabela 1. Pregled akreditovanih tela za ocenjivanje usaglašenosti

Table 2. Overview of accredited bodies for conformity assessment

Tela za ocenjivanje usaglašenosti / Conformity assessment bodies		N	Ukupno Total
Laboratorije / Body for laboratory testing (MKC EN ISO/IEC 17025/ MKC ISO 15189)	za ispitivanje / for testing	66	75
	etaloniranje / calibration	8	
	medicinske laboratorije medical laboratories	1	
Tela za sertifikaciju / Certification body (MKC EN ISO/IEC 17021/ MKC EN ISO/IEC 17065)	sistema menadžmenta kvalitetom quality management systems	1	3
	proizvoda / products	2	
Inspeksijska tela / Inspection body (MKC EN ISO/IEC 17020)		64	64

Od ukupno 66 laboratorija za testiranje, najzastupljenije su laboratorije u oblasti hemije (43,9%), dok su prema vrsti proizvoda/materijala za testiranje najzastupljenije u životnoj sredini i primerci iz životne sredine (30,3%). Od ukupnog broja laboratorija za testiranje, šest laboratorija je iz oblasti građevinskog sektora, što predstavlja zastupljenost od 9,1% prema vrsti proizvoda/materijala – građevinskog proizvoda, materijala i konstrukcije. Prema navedenom, građevinski proizvodi, materijali i konstrukcije rangiraju se kao treća najzastupljenija vrsta proizvoda/materijala za testiranje.

Pregled procentualne zastupljenosti laboratorija prema vrsti proizvoda dat je u tabeli 2, dok je zastupljenost akreditovanih laboratorija prema vrsti proizvoda iz oblasti građevinarstva prezentovana u tabeli 3.

According to the official data of the Institute for Accreditation of the Republic of Macedonia (IARM), in the Republic of Macedonia there are 142* accredited bodies for conformity assessment of 110* organizations. Overview of accredited bodies for conformity assessment is given in Table 1.

From a total of 66 testing laboratories the most common are laboratories in the field of chemistry (43.9%), while according to the type of testing products/materials the greatest number of laboratories are in the environment sector and samples from the environment (30.3%). Of the total number of testing laboratories, 6 laboratories are operating in the areas of the construction sector, which is a representation of 9.1% according to the type of product/material - building products, materials and structures. According to the previously mentioned, building products, materials and structures are ranked as the third most common type of products/materials for testing.

Overview of the percentage share of laboratories according to the type of product is given in Table 2, while the representation of accredited laboratories according to the type of product in the construction sector is presented in Table 3.

Tabela 2. Zastupljenost laboratorija prema vrsti proizvoda/materijala za testiranje

Table 2. Representation of laboratories according to types of products/materials for testing

Vrsta proizvoda materijala za testiranje Types of products/materials for testing	Biološki primeri Biological samples	Građevinski proizvodi, materijali i konstrukcije Construction products, materials and structures	Električni proizvodi i oprema Electrical products and equipment	Ind. materijali i proizvodi Industrial materials and products	Životna sredina i primerci iz životne sredine Environment and samples from the environment	Hrana / Foodstuffs	Goriva, sredstva za podma- zivanje i industrijska ulja Fuels, lubricants and industrial oils	Nameštaj / Furniture	Tekstil i koža Textile and leather	Predmeti za opštu upotrebu Objects of general use	Medicinski proizvodi Medical products	Poljoprivredni proizvodi Agricultural products	Ostalo / Others
N	4	6	1	2	20	14	2	1	1	1	2	5	3
% Zastuplj. represent.	6,1	9,1	1,5	3,0	30,3	21,2	3,0	1,5	1,5	1,5	3,0	7,5	4,5

* Stanje zaključno u junu 2015.

* Condition end June 2015.

Tabela 3. Zastupljenost laboratorija prema vrsti proizvoda/materijala za testiranje u građevinskom sektoru
Table 3. Representation of laboratories according to types of products/materials for testing in construction sector

Vrsta proizvoda/ materijala za testiranje Types of products / materials for testing	Cement / Cement	Beton / Concrete	Kamen i agregati Stone and aggregate	Stene i zemlja Stone and soil	Cigle / Masonry unit	Keramika / Ceramics	Vatrootalni materijali i proizvodi Refractory materials and products	Asfalt bitumeni Bituminous mixtures	Toplotnoizolacioni materijali Thermal insulation materials	Konstrukcije / Structures	Građevinski proizvodi Construction Products	Građevinska stolarija i proizvodi od drveta Wood products
N	2	3	2	4	1	1	0	2	0	3	1	1

Pregled broja akreditovanih laboratorija po određenim metodama za ispitivanje građevinskih proizvoda u skladu s makedonskim standardima dat je u tabelama 4, 5 i 6. Prema navedenom, najzastupljenije su metode za ispitivanje cementa, betona, agregata i tla.

Overview of the number of accredited laboratories according to certain methods of testing of construction products in accordance with Macedonian standards is given in Tables 4, 5 and 6. According to this, the most common are the methods for testing of cement, concrete, aggregates and soil.

Tabela 4. Prikaz broja akreditovanih laboratorija u sektoru: beton, čelik, cement i građevinska hemija
Table 4. Overview of the number of accredited laboratories in the sectors: concrete, steel, cement and building chemicals

SEKTOR-BETON, ČELIK, CEMENT I GRAĐEVINSKA HEMIJA SECTOR-CONCRETE, STEEL, CEMENT AND BUILDING CHEMICALS									
METODE (po seriji standarda) Methods for series of standards	MKC EN 12350 ispitivanja svežeg betona Testing fresh concrete	MKC EN 12390 ispitivanja očvrlog betona Testing hardened concrete	MKC EN 12504 ispitivanje betonskih konstrukcija Testing concrete in structures	MKC EN 196 ispitivanje cementa Methods of testing cement	MKC EN 413 zidarski cement Masonry cement	MKC EN 480 -aditivi za beton Admixtures for concrete	MKC EN 1008 voda za pripremu betona Mixing water for concrete	MKC EN 451 ispitivanje letećeg pepela Method of testing fly ash	MKC EN 15630 betonski čelik i čelik za prethodno naprezanje betona Steel for the reinforcement and prestressing of concrete
Br. labor. No. lab.	3	3	3	3	1	2	2	1	3

Tabela 5. Prikaz broja akreditovanih laboratorija u sektoru: agregat, kamen i keramika
Table 5. Overview of the number of accredited laboratories in the sectors: aggregates

SEKTOR-AGREGAT, KAMEN I KERAMIKA / SECTOR- AGGREGATES					
METODE (po seriji standarda) Methods for series of standards	MKC EN 932 agregat Methods for aggregates	MKC EN 933 agregat Methods for aggregates	MKC EN 1097 agregat Methods for aggregates	MKC EN 1367 agregat Methods for aggregates	MKC EN 772 zidarske jedin. Methods of test for masonry units
Br. labor. No. lab.	2	2	2	1	1

Tabela 6. Prikaz broja akreditovanih laboratorija u sektoru: geomehanika, asfalt, bitumen i izolacioni materijali
Table 6. Overview of the number of accredited laboratories in the sectors: geomechanics, asphalt, bitumen and insulating materials

SEKTOR ZA GEOMEHANIKU, ASFALT I IZOLACIONI MATERIJALI SECTOR - GEOMECHANICS, ASPHALT, BITUMEN AND INSULATING MATERIALS			
METODE (po seriji standarda) <i>Methods for series of standards</i>	MKC EN 12697 asfaltne mešavine <i>Bituminous mixtures</i>	MKC EN 13286 nevezane i hidrauličkim vezivom vezane mešavine <i>Unbound and hydraulically bound mixtures</i>	MKC CEN ISO TS 17892 geotehničko istraživanje <i>Geotechnical investigation and testing</i>
Br. labor. <i>No. lab.</i>	2	4	2

Svi ovi standardi predstavljaju indirektnu podršku zakonskoj regulativi, odnosno Zakonu za građevinske proizvode. Harmonizovani standardi na koje se poziva Zakon, obezbeđuju metode i kriterijume za procenu funkcionalnosti građevinskog proizvoda u vezi s njegovim osnovnim karakteristikama. Za primer ćemo uzeti cement kao najzastupljeniji, krucijalni proizvod u građevinarstvu, koji kao takav, saglasno sistemu za ocenu usklađenosti, nosi sistem „1+”. Makedonski standard MKC EN 197-1:2012 – Cement – Deo 1: Sastav, specifikacije i kriterijumi usklađenosti za obične cemente, jeste harmonizovan standard. Standard MKC EN 197-1 definiše i daje specifikacije za 27 posebnih običnih proizvoda od cementa i njihove sastavne elemente. Definicija za svaki cement uključuje saodnose u kojima sastavni elementi (sastojci) treba da se kombinuju da bi se dobili ovi posebni proizvodi i to u okviru šest klasa jačine. Standard, takođe, uključuje zahteve koje treba da ispunjavaju sastavni elementi kao i mehaničke, fizičke i hemijske zahteve, uključujući, gde je moguće, i zahteve za toplinu hidratacije. Standard, zatim, iznosi i utvrđuje kriterijume za usaglašenost kao i pravila povezana s njima. Usaglašenost 27 proizvoda prema MKC EN 197-1 treba kontinuirano da se evaluira na osnovu ispitivanja pojedinačnih primeraka (uzetih s lica mesta). Svojstva, metode ispitivanja i minimalna učestalost ispitivanja za autokontrolno ispitivanje od strane proizvođača dati su upravo u referiranim standardima (tabela 7). Saglasno tim standardima, radi se laboratorijsko ispitivanje i saglasno istim standardima, laboratorije su akreditovane za odgovarajuće metode. U tabeli koja sledi dat je niz standarda iz serije MKC EN 196, na koje se upravo harmonizovani standard MKC EN 197-1 poziva.

All these standards represent indirect support to the legal regulations, i.e. the Law on construction products. The harmonized standards, to which the law refers, provide methods and criteria for assessing functionality of the construction product in relation to its basic characteristics. For example, we can consider cement as the most common and crucial product in the construction industry which, as such, in accordance with the system of conformity assessment, bears system "1+". Macedonian standards MKS EN 197-1: 2012 - Cement - Part 1: Composition, specifications and conformity criteria for common cements, is a harmonized standard. Standard MKS EN 197-1 defines and provides specifications of 27 special common cement products and their constituent elements. The definition of each cement includes the proportions in which its constituents (ingredients) should be combined in order to achieve these special products within six classes of strength. The standard also includes requirements to be met by constituents as well as mechanical, physical and chemical requirements including, where applicable, the requirements for the heat of hydration. The standard, then, presents and determines the criteria for conformity as well as the rules associated with them. Conformity of 27 products to MKS EN 197-1 should continuously be evaluated on the basis of tests of individual samples (taken from the site). The properties, test methods and minimum testing frequency for auto controlled testing by the manufacturer are given exactly in the referred standards (Table 7). In accordance with these standards laboratory testing is conducted and in accordance with the same standards laboratories are accredited for the appropriate methods. The following table provides a set of standards from the series MKS EN 196, to which the harmonized standard EN 197-1 ICC actually refers.

Tabela 7. Prikaz standarda za ispitivanje cementa
Table 7. Overview of standards for cement

Svojstva Performance	Početa čvrstoća Initial strength	Vremena vezivanja i stalnosti zapremine Determination of setting times and soundness	Tvrdoća / Hardens	Gubitak pri paljenju Loss on ignition	Nerastvorljivi ostatak Insoluble residue	Sadržaj sulfata Sulphate content	Sadržaj hlorida Chloride content	Pucolanski Pozzolan	Topolota hidratacije Thermal hydration
Cementi Cement	Svi / all	Svi / all	Svi / all	CEM I, CEM III	CEM I, CEM III	Svi / all	Svi / all	CEM IV	Obični cement s niskom toplotom hidratacije Common cement with low heat of hydration
Metode za ispitivanje Methods for testing	MKC EN 196-1	MKC EN 196-3	MKC EN 196-3	MKC EN 196-2	MKC EN 196-2	MKC EN 196-2	MKC EN 196-2	MKC EN 196-5	MKC EN 196-8/9

Ovim primerom autori žele da potvrde da implementacija standarda nije jednostavan proces. Evidentno je da laboratorije definišu oblast i metode koje će akreditovati u zavisnosti od postojanja zakonskih okvira. Dakle, ukoliko legislativa definiše određene karakteristike proizvoda koje treba da budu ispitane prema standardnim metodama, onda laboratorije u opsegu akreditacije uključuju samo ove metode. Stiče se utisak da je link zakonodavac-proizvođač determinacioni faktor u definisanju opsega akreditacije, dok su zahtevi klijent/poslovni saradnik-proizvođač u drugom planu.

Međutim, radi obezbeđivanja kvalitetnog proizvoda, obezbeđivanja poverljivih rezultata ispitivanja, zadovoljenja zahteva klijenata, kao i jačanja pozicije na tržištu, laboratorije se upuštaju u proces akreditacije. Ovaj proces nosi određene koristi koje laboratorije iz građevinskog sektora identifikuju kao što je prikazano na slici 3.

Najviše laboratorija izjasnilo se da su primećena vidljiva poboljšanja pri upravljanju dokumentima (17%), te bolja kompetentnost personala (16%), kao što je dato na slici 1.

Akreditacijom laboratorija, u klauzuli 5.9 standarda MKC EN ISO/IEC 17025 postavljeni su zahtevi za učešće u međulaboratorijskim poređenjima. Saglasno sprovedenom istraživanju, laboratorije u građevinskom sektoru 100% ispunjavaju ove zahteve. U građevinskom sektoru, četiri laboratorije (80%) učestvuju u ukupno 21 PT šemi. Važno je istaći da su tri laboratorije iz građevinskog sektora (60%) uspostavile i razvile ukupno deset neakreditovanih PT šema.

With this example the authors wish to acknowledge that implementation of standards is not an easy process. It is evident that laboratories define the area and the methods to be accredited according to the existence of relevant legal framework. Therefore, if legislation defines certain features of the product that should be tested according to standard methods, then the laboratories include only these methods in the scope of accreditation. One gets the impression that the link legislator-manufacturer is the determining factor in the defining of the scope of accreditation, while the demands of client/business associate-manufacturer are pushed into the background.

However, in order to ensure a quality product, reliable test results, satisfaction of customer requirements, as well as strengthen the market position, laboratories are engaged in the process of accreditation. This process carries certain benefits as identified by the laboratories from the construction sector and as shown in Figure 3.

Most laboratories (17%) said they have noticed visible improvements in the management of documents (16%) which improved personnel competence, as shown in Figure 1.

Accreditation of laboratories, in clause 5.9 of the standard MKS EN ISO/IEC 17025, sets out the requirements for participation in inter-laboratory comparisons. In accordance with the conducted research, laboratories in the construction sector 100% meet these requirements. In the construction sector 4 (80%) laboratories participate in a total of 21 PT schemes. It is important to point out that 3 laboratories in the construction sector (60%) have established and developed a total of 10 non-accredited PT schemes.

Slika 1. Poboljšanja s procesom akreditacije
Figure 1. Improvements in the laboratories after accreditation

5 NOVINE U STANDARDIZACIJI CEMENTA

Evropski komitet za standardizaciju radi na proširenju palete običnih cementa u okviru palete EN 197-1. Ono što je karakteristično za ove kompozitne cemente jeste veća koncentracija mešavine dveju glavnih komponenti bez klinkera u svom sastavu. Takva vezivna sredstva su izražena u trojnim kombinacijama K-S-L/LL, K-S-V i K-V-L/LL (K – klinker, S – granulirana šljaka iz peći za topljenje materijala, V – silicijumov lebedeći pepeo, L/LL – kreč). Zbog toga će tekući cementni sastavi biti prošireni za dopunsku podgrupu CEM II/C sa uvećanim udelom mineralnih aditiva do 50% i za celu novu grupu kompozitnih cementa CEM IV, u kojima sadržaj portland klinkera neće prevazilaziti 50%. Sadržaj glavnih komponenti bez klinkera u okviru ove grupe biće između 50 i 65%. Posle toga bi grupa CEM V promenila svoje ime od kompozitnih cementa u pucolanske – šljaka cemente.

5 NEW DEVELOPMENTS IN CEMENT STANDARDIZATION

European Standardization Committee is working on widening the range of common cements within the scope of EN 197-1. A characteristic feature of these composite cements is a higher concentration of a mixture of the two non-clinker main components in their composition. Such binders are present in ternary combinations K-S-L/LL, K-S-V and K-V-L/LL (K – clinker, S – granulated blast furnace slag, V – siliceous fly ash, L/LL – lime). Current cement compositions will therefore be extended by an additional subgroup of CEM II/C, with increased share of mineral additives up to 50% and by a whole new group of composite cements CEM IV, of which the content of Portland clinker will not exceed 50%. The content of the main non-clinker components will constitute within this group from 50 to 65 %. Hitherto group of CEM V will then change its name from composite cements into pozzolanic – slag cements.

Tabela 8: Novi tipovi običnih cementa prema pr EN 197-1 (2014) Izvor: (pr EN 197-1, 2014)
Table 8: New types of common cements acc. to pr EN 197-1 (2014)

Tip cementa <i>Cement type</i>	Oznaka <i>Designation</i>		Učešće komponentata u cementu, % po masi <i>Component share in cement, % by mass</i>				
			Klinker K <i>Clinker K</i>	Zgura peći S <i>Blast furnaceslag S</i>	Prirodni pucolan P <i>Natural Pozzolan P</i>	Leteći pepeo V <i>Fly ash V</i>	Kreč L i LL <i>Lime L u LL</i>
CEM II	Portland kompozitni cement <i>Portland composite cement</i>	CEM II/C-M (S-L)	50-64	16-44	-	-	6-20
		CEM II/C-M (S-LL)		16-44	-	-	6-20
		CEM II/C-M (P-L)		-	16-44	-	6-20
		CEM II/C-M (P-LL)		-	16-44	-	6-20
		CEM II/C-M (V-L)		-	-	16-44	6-20
		CEM II/C-M (V-LL)		-	-	16-44	6-20
		CEM II/C-M (S-V)		16-44	-	6-20	-
CEM VI	Kompozitni cement <i>Composite cement</i>	CEM VI (S-L)	35-49	31-59	-	-	6-20
		CEM VI (S-LL)		31-59	-	-	6-20
		CEM VI (S-V)		31-59	-	6-20	-

Proširenje asortimana kompozitnih cementa opravdava se činjenicom da je nastalo formiranjem njihovih svojstava upotrebom sinergetskog uticaja na primenjene mineralne aditive. Poznato je da efekat individualnih glavnih komponenti bez klinkera na cementna svojstva može da bude različit. Takav jednostavan primer imamo pri uticaju na dodavanje lebdećeg pepela i mlevenog kreča za razvoj čvrstine. Silicijumov lebdeći pepeo usporava razvoj čvrstine na početku stezanja (povezivanja), ali ne smanjuje čvrstinu na duže periode. Kombinacijom različitih mineralnih aditiva u kompozitnim cementima mogu da se koriste njihove povoljne karakteristike, a zatim optimalnim iskorišćavanjem sastava cementne mešavine, efektivno može da se potisne njihov negativan uticaj.

Novembra 2016. godine, izglasana je važna Rezolucija BT N 10528. Predmet ove rezolucije je priprema radnog nacrt – Amandmana na Mandat M/114 na CEN – SRAHG 'CEMENT'. Rok za izglasavanje bio je 22. novembar i trenutno očekujemo rezultate. Cilj ovog radnog nacrt-a-mandmana jeste da se proširi postojeći mandat M/114 koji obuhvata harmonizovane standarde za proizvod, tako da bi mogli da se uključe noviji događaji u istoj proizvodnoj oblasti (na primer, da se uključe dopunski tipovi cementa).

Za dalje postupanje s „Radnim nacrtom-amandmanom na M/114“, Centar za upravljanje CEN – CENELEC (CCMC) imenuje ad-hok grupu (SRAHG 'CEMENT') da bi koordinisao output članova tehničkog odbora (BT) i drugih relevantnih strana i da bi obezbedio blagovremene povratne informacije za vreme pripreme i odobrenja ovog zahteva. SRAHG 'CEMENT' će biti referentna grupa za praćenje priprema i davanje saveta u slučaju problematičnih pitanja s kojima će se suočavati Centar za upravljanje CEN – CENELEC (CCMC) i pogođene strane za vreme procesa pripreme i odobrenja (primerice, sadržina, rokovi, resursi koji nedostaju, itd.) tako da blagovremeno može da se podnese relevantan predlog tehničkom odboru (BT).

6 ZAKLJUČAK

Proces akreditacije u Republici Makedoniji počeo je 2006. godine, dok je prva laboratorija iz oblasti građevinarstva akreditovana 2008. godine. Nazvanični podaci pokazuju da je u Republici Makedoniji ukupan broj laboratorija daleko veći od broja akreditovanih laboratorija i otuda proizlazi pitanje zašto je to tako.

Proces akreditacije podrazumeva troškove angažovanja konsultanata i ocenjivača, više vremena za izradu akreditacije, limitirane ljudske resurse, i kada se na to doda trošak za održavanje akreditacije, korišćenje referentnih materijala kao i kalibraciju instrumenata, očigledno je da je akreditacija skup proces. Laboratorije treba da pronađu optimalni način da simultano ispune sve ove zahteve. Cene usluga su niske, a broj klijenata je mali i ne povećava se. Zato je velik broj akreditovanih laboratorija iz javnog sektora koji je finansijski podržan od vlade, dok je industrija predstavljena samo sa 13%. Na tržištu još uvek postoji nelojalna konkurencija tako da je cene usluga akreditovanih laboratorija nemoguće povećati. Istraživanje je pokazalo da laboratorije svojim opsegom akreditacije uključuju uglavnom metode koje su podrška Regulativi što ide u prilog činjenici da proizvođači ciljaju na ispunjavanje osnovnih minimalnih

The expansion of composite cements assortment is justified primarily by the fact that one came, form their properties using the synergy influence effect of the mineral additives applied. It is a common knowledge that the effect of individual non-clinker main components on cement properties, can vary. A simple example of such is the influence of the fly ash and ground limestone addition on strength development. Siliceous fly ash retards the development of strength in early setting times, but do not reduce the strength in longer periods. In contrast, lime accelerates the development of early strength, but reduces the strength in the longer periods of setting. With a combination of various mineral additives in composite cements, it is possible to use their favourable characteristics, furthermore, by optimizing the composition of cement mixture, their adverse impact can be effectively suppressed.

In November 2016 year, very important Resolution BT N 10528 was voted. The Subject of this Resolution is preparing working draft Amendment to the Mandate M/114 to CEN - SRAHG 'CEMENT'. The deadline for vote was 22 of November and now we are waiting for the results. The objective of this working draft amendment is to extend the existing mandate M/114 that cover, harmonized product standards, so recent developments in the same product area could be included (e.g. to include additional types of cement).

To further deal with the "Working draft amendment to M/114", CCMC is setting up an ad-hoc group (SRAHG 'CEMENT') to coordinate input from BT members and other relevant parties and to provide timely feedback, during the drafting and approval of this request. The SRAHG 'CEMENT' will be the reference-group to follow-up the preparatory work and advise in case of problematic issues encountered by CCMC and by the concerned parties during the drafting or approval process (e.g. content, deadlines, missing resources, etc.) so that a relevant proposal can be submitted to the BTs in due time.

6 CONCLUSION

The accreditation process in the Republic of Macedonia began in 2006, while the first laboratory in the field of civil engineering was accredited in 2008. Unofficial data shows that in the RM the total number of laboratories by far exceeds the number of accredited laboratories and hence raises the question of why this is the case?

The accreditation process includes the costs of hiring consultants and evaluators, more time for preparation of accreditation, limited human resources, the cost of maintaining accreditation, use of reference materials and calibration of instruments; thus, it is clear that accreditation is an expensive process. Laboratories should find the optimal way to simultaneously meet all these requirements. Service prices are low and number of clients is small and it is unlikely to increase. Therefore, there is a large number of accredited laboratories from the public sector, which are financially supported by the government, while industry is represented by only 13%. On the market there is still unfair competition so that it is impossible to increase the prices of services of accredited laboratories. Research has shown that laboratories in their scope of

zakonskih zahteva za kvalitet i bezbednost proizvoda. Više nego očigledno je da se metode za ispitivanje karakteristika proizvoda koje ne podržavaju ovu regulativu, akredituju u minimalnom broju.

Iz gorenavedenog možemo da zaključimo da cena usluga, nelojalna konkurencija, niska svesnost o standardima, visoki troškovi akreditacije predstavljaju ograničavajući faktor upuštanja laboratorija u proces akreditacije.

I pored svih problema, postoje laboratorije i sertifikaciona tela koja su napravila prve korake i pokazala visoke performanse i dobre rezultate.

Zemlje u razvoju treba da stvore ambijent za uspešnu integraciju svoje ekonomije na evropskom i međunarodnom tržištu. U toku je usaglašavanje makedonskog zakonodavstva sa zakonodavstvom Evropske unije. Zemlje u razvoju treba da imaju u vidu da će bez akreditovanih laboratorija, bez sertifikacionih tela, bez učešća u međulaboratorijskim poređenjima, samo povećati rizik u vezi s plasmanom proizvoda na evropskom tržištu.

accreditation include mainly the methods that support the Regulation, which supports the fact that manufacturers are aiming at meeting the basic minimum legal requirements for product quality and safety. It is more than obvious that the methods for testing the characteristics of products that fail to support this regulation, are accredited to the minimum number.

From the above said it can be concluded that the price of services, unfair competition, low awareness of the standards, the high cost of accreditation, all represent a limiting factor for laboratories to initiate the accreditation process.

Despite all the problems, there are laboratories and certification bodies which had made the first steps and showed high performance and good results.

Developing countries should create an environment for successful integration of their economies in the European and international markets. The process of harmonization of Macedonian legislation with legislation of the European Union is currently underway. Developing countries should bear in mind that without accredited laboratories, certification bodies, and participation in inter-laboratory comparisons, the risk involved in the placement of products on the European market can be only increased.

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REZIME

KAKO SMANJITI RIZIK U PROCESU DOKAZIVANJA KVALITETA GRAĐEVINSKIH PROIZVODA

Sonja ČEREPNALKOVSKA
Ljubica VLADIČESKA

Infrastruktura kvaliteta sa svojim komponentama obezbeđuje usklađivanje proizvoda i usluga sa obaveznim zahtevima interesa potrošača i biznisa i doprinosi održavanju kvaliteta proizvoda i usluga. Infrastruktura kvaliteta promoviše izvoz, konkurentnost i inovativnost. Ocenjivanje usaglašenosti pomaže da se obezbedi sigurnost da proizvodi i usluge ispunjavaju očekivanja, drugim rečima: ocenjivanje usaglašenosti gradi poverenje.

U ovom radu, koji je baziran na upitniku, prikazuje se realno stanje, odnosno broj akreditovanih laboratorija u Republici Makedoniji za ispitivanja iz oblasti građevinarstva, kao i učešće u PT šemama, sa akcentom na cement kao ključni proizvod u građevinarstvu.

Ključne reči: akreditacija, ocenjivanje usaglašenosti, međulaboratorijska poređenja, PT šeme.

SUMMARY

HOW TO REDUCE THE RISK IN THE PROVING PROCESS FOR QUALITY CONSTRUCTION PRODUCTS

Sonja CEREPNALKOVSKA
Ljubica VLADICESKA

Quality infrastructure with its components ensures compliance of products and services with the mandatory requirements, interests of consumers and businesses, and contributes to the maintaining of the quality of products and services. Quality infrastructure promotes export, competitiveness and innovation. Conformity assessment helps ensure certainty that products and services deliver on their promises. In other words, conformity assessment builds trust.

This paper, which is based on the questionnaire, presents the real situation or the number of accredited laboratories in the Republic of Macedonia for testing in the field of construction as well as the participation in PT schemes, with an emphasis on the cement as a crucial product in the construction industry.

Key words: accreditation, conformity assessment, inter-laboratory comparison, PT schemes